SBIR/STTR REAUTHORIZATION: A REVIEW OF TECHNOLOGY TRANSFER

HEARING

BEFORE THE

SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

June 16, 2016

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SBIR/STTR REAUTHORIZATION: A REVIEW OF TECHNOLOGY TRANSFER

THURSDAY, JUNE 16, 2016

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to call, at 9:41 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Barbara Comstock [Chairwoman of the Subcommittee] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

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SBIR/STTR Reauthorization: A Review of Technology Transfer

Thursday, June 16, 2016
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

Witnesses

Dr. Pramod Khargonekar, Assistant Director, National Science Foundation

Dr. Michael Lauer, Deputy Director, National Institutes of Health

Dr. Patricia Dehmer, Deputy Director for Science Programs, Office of Science, Department of Energy

Dr. Jilda D. Garton, Vice President for Research and General Manager, Georgia Tech Research Corporation

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Thursday, June 16, 2016

TO: Members, Committee on Science, Space, and Technology

FROM: Majority Staff, Committee on Science, Space, and Technology

SUBJECT: Research and Technology Subcommittee hearing
"SBIR/STTR Reauthorization: A Review of Technology Transfer"

The Subcommittee on Research and Technology of the Committee on Science, Space, and Technology will hold a hearing titled *SBIR/STTR Reauthorization: A Review of Technology Transfer,"* on Thursday, June 16, 2016 at 9:30 a.m. in Room 2318 of the Rayburn House Office Building.

Hearing Purpose:

The purpose of the hearing is to examine the role of the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) Programs in promoting innovation. Witnesses will discuss their organizations' experience with the SBIR and STTR Programs and will provide advice on areas of potential improvement as the Committee considers reauthorization of these programs.

Witness List

- Dr. Pramod Khargonekar, Assistant Director, National Science Foundation
- Dr. Michael Lauer, Deputy Director, National Institutes of Health
- Dr. Patricia Dehmer, Deputy Director for Science Programs, Office of Science, Department of Energy
- Dr. Jilda D. Garton, Vice President for Research and General Manager, Georgia Tech Research Corporation (Minority)

Staff Contact

For questions related to the hearing, please contact Cliff Shannon or Jenn Wickre of the Majority Staff at 202-225-6371.

Chairwoman COMSTOCK. Good afternoon. The Committee on Science, Space, and Technology will come to order.

Without objection, the Chair is authorized to declare recesses of the Committee at any time.

Good morning, and welcome to today's hearing titled "SBIR/STTR Reauthorization: A Review of Technology Transfer." I now recognize myself for five minutes for an opening statement.

The foundation of America's future economic success is and will continue to be our global leadership in science and technology.

Taxpayer-funded basic research conducted through the National Science Foundation, NASA, NIH, DOD, and other federal agencies underwrites the breakthrough science and the key discoveries that have created today's world: the internet, wireless communications, lifesaving medicines, lasers, artificial intelligence, and so much more.

Converting scientific breakthroughs into innovations creates new industries, new businesses, and new jobs. Such innovation transforms commerce, everyday life and our entire society.

Risk-taking entrepreneurs and small businesses are the catalysts for innovation. They are the catalysts for economic growth, for generating the family and community-sustaining jobs that we need so badly.

Congress enacted the Small Business Innovation Research, or SBIR, program in 1982, followed by the Small Business Technology Transfer, or STTR, program in 1992. These two programs accelerate technological innovation and commercialization of new products and services by small businesses. They also help the Department of Defense and other federal agencies meet their research and development needs.

Federal agencies with large extramural research budgets—more than $100 million a year for the SBIR program and $1 billion for STTR—award competitive grants to small businesses for technology development and commercialization.

Eleven agencies hit the $100 million research budget threshold for SBIR. They are required to set aside three percent of their extramural research budgets to support SBIR, and that will rise to 3.2 percent in fiscal year 2017.

Five agencies, including NSF, NASA and DOE, surpass the $1 billion threshold for STTR. These five agencies also account for about 98 percent of SBIR. These five agencies are required to set aside 0.45 percent of their extramural research budgets for STTR grants.

Since its inception, participating federal agencies have awarded SBIR and STTR contracts and grants to small businesses totaling more than $40 billion. A number of companies that use SBIR are located in my Congressional district, and I hear often about people who are both working in this program, have issues on how it can better be utilized, and so I really do look forward to that discussion. Just some of the companies I know in my district are three Phoenix, Inc., Aurora Flight Sciences in Manassas, and Mosaic ATM in Leesburg, Progeny Systems of Manassas, Virginia and there are a number of others.

I do look forward to hearing from our panel of expert witnesses this morning, including individuals who lead the administration

and management of three of the largest SBIR and STTR programs and the Vice President of Research from one our Nation's most prominent academic research universities.

[The prepared statement of Chairwoman Comstock follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
June 16, 2016

Media Contacts: Alicia Criscuolo, Thea McDonald
(202) 225-6371

Statement of Research & Technology Subcommittee Chairwoman Barbara Comstock (R-Va.)
SBIR / STTR Reauthorization: A Review of Technology Transfer

Chairwoman Comstock: The foundation of America's future economic success is and will continue to be our global leadership in science and technology.

Taxpayer-funded basic research conducted through the National Science Foundation, NASA, NIH, DOD, and other federal agencies underwrites the breakthrough science and the key discoveries that have created today's world: the internet, wireless communications, life-saving medicines, lasers, artificial intelligence, and much more.

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These two programs accelerate technological innovation and commercialization of new products and services by small businesses. They also help the Department of Defense and other federal agencies meet their research and development needs.

Federal agencies with large extramural research budgets – more than $100 million/year for the SBIR program and $1 billion/year for STTR – award competitive grants to small businesses for technology development and commercialization.

Eleven agencies hit the $100 million research budget threshold for SBIR. They are required to set aside 3 percent of their extramural research budgets to support SBIR (rising to 3.2 percent in FY17).

Five agencies, including NSF, NASA and DOE, surpass the $1 billion threshold for STTR. (These five agencies also account for about 98 percent of SBIR.) These five agencies are required to set aside 0.45% of their extramural research budgets for STTR grants.

Since inception, participating Federal agencies have awarded SBIR and STTR contracts and grants to small businesses totaling more than $40 billion. A number of companies that use SBIR are located in my Congressional district/Northern Virginia.

- 3 Phoenix, Inc. is an engineering small business in Chantilly, Virginia that provides innovative electronic technology solutions to the Department of Defense and the US Navy, as well as private industry. (USN, submarines)
- Headquartered in Manassas, Aurora Flight Sciences is a global leader in the development and manufacturing of advanced unmanned systems and aerospace vehicles for NASA and other private and government customers.
- Mosaic ATM is a Leesburg small business focused on air transportation efficiency and safety and pushing the envelope on unmanned aircraft systems. Mosaic serves a wide range of Government and industry customers.
- Progeny Systems of Manassas, Virginia has leveraged both SBIR and STTR assistance to develop for its military and civilian customers specialized software and hardware system integration capabilities, computer-vision solutions, and cutting-edge research and development for advanced manufacturing.

I look forward to hearing from our panel of expert witnesses this morning, including individuals who lead the administration and management of three of the largest SBIR and STTR programs and the vice president of research from one our nation's most prominent academic research universities.

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Chairwoman COMSTOCK. I now recognize the Ranking Member, the gentleman from Illinois, Mr. Lipinski, for his opening statement.

Mr. LIPINSKI. Thank you, Chairwoman Comstock, for holding this hearing to review the SBIR and STTR programs, as well as to examine national efforts to support commercialization of federally funded research and development.

Those of you who follow this Committee know that I am always focused on finding better ways to promote commercialization of research, especially the great research funded by the American taxpayers at our universities and national labs.

This hearing is an important step in the reauthorization of the SBIR and STTR commercialization programs, which our subcommittee has jurisdiction over.

In the United States, where small businesses create 55 percent of all jobs, the success of the small business enterprise is key to economic growth.

For almost 40 years, the SBIR program has been funding small business innovation across all sectors of our economy. There are many prominent success stories from SBIR grants. A recent Air Force review of Phase II winners between 2000 and 2013 found that 58 percent of them had sales in excess of $1 million.

Importantly, many of the innovators who create these small businesses are educated and trained in our Nation's great research institutions, with support from federal research dollars. And some even directly commercialize research funded by federal dollars. The Federal R&D enterprise is truly an ecosystem from basic research to commercialization.

Unlike any other program that I'm aware of, SBIR and STTR are funded using a percentage of participating agencies' extramural research and development budgets. That percentage has increased by 30 percent since 2011, even as the larger budgets have remained flat.

While the SBIR program has great value, we must look at it in the context of overall agency budgets and missions. Increasing the set-aside for SBIR and STTR as much as has been proposed by some could come at the expense of support for other critical research programs.

Perhaps my biggest concern is harm done to the pipeline of STEM talent and innovators by increasingly lower research funding levels. This is a difficult choice in tough budget times because both research and commercialization activities are highly valuable investments.

We must also look hard at assessments of the SBIR program and consider ways to make it more efficient and help the program better achieve its goals, and this hearing is a good opportunity to talk about other ways to improve the commercialization of federally funded research, including the very successful Innovation Corps program started at NSF in 2011 and now expanding to other agencies, as well as the NIH's Proof of Concept pilot program. I–Corps is essentially an entrepreneurial education program. The I–Corps Node program provides this education and other support for innovators at our research universities, creating a true interconnected, national innovation network.

I am pleased that Ms. Garton is joining us today, and I look forward to her testimony regarding Georgia Tech's I–Corps Node program and the challenges innovators face in seeking early stage funding.

In the five years since the I–Corps program has been running, it has clearly demonstrated its value in improving tech transfer and commercialization, and we are beginning to see that it makes the SBIR program more efficient as well. Although it takes time to fully realize success in commercialization, the early returns show I–Corps-trained teams having more success than comparable teams without this training. I think the time has come to talk about having some kind of I–Corps program at every agency with an SBIR program, as the two truly go hand in hand.

Finally, I want to mention language that I put in the 2011 SBIR Reauthorization bill which allowed for an NIH Proof of Concept pilot program, utilizing a small portion of the funds from the STTR set-aside, to give grants to researchers at a pre-SBIR stage. This could be called SBIR phase zero.

Many university researchers are hesitant to start a company, which often means leaving their university, so they're hesitant without having confidence that the idea can work out. The Proof of Concept pilot has led to programs at NIH such as the NIH Centers for Accelerated Innovations and the Research Evaluation and Commercialization Hubs, or REACH, programs. I believe programs like these can be an important part of the innovation ecosystem and I look forward to an update on the pilot from Dr. Lauer.

I know the agencies here today are exploring many other aspects of early stage commercialization, including how to coordinate these efforts better with the SBIR program. I look forward to this broader discussion about commercializing federally funded research. I also look forward to your testimony about how you've implemented new requirements and flexibilities in the SBIR program since the 2011 reauthorization, and what our Committee should consider as we take up the next reauthorization.

I would like to ask unanimous consent to enter into the record the Administration's Principles for SBIR/STTR Reauthorization and the letter dated May 10, 2016, from a coalition of science organizations and universities.

Chairwoman COMSTOCK. Thank you——

Mr. LIPINSKI. Can I get unanimous consent to put those in the record?

Chairwoman COMSTOCK. Without objection.

[The information was not available at the time of publishing.]

Mr. LIPINSKI. Thank you, and with that, I will yield back. Thank you.

[The prepared statement of Mr. Lipinski follows:]

OPENING STATEMENT

Ranking Member Dan Lipinski (D-IL)
of the Subcommittee on Research and Technology

House Committee on Science, Space, and Technology
Subcommittee on Research and Technology
"SBIR/STTR Reauthorization: A Review of Technology Transfer"
June 16, 2016

Thank you Chairwoman Comstock for holding this hearing to review the SBIR and STTR programs, as well as to examine national efforts to support commercialization of federally funded research and development. Those of you who follow this committee know that I am always focused on finding better ways to promote commercialization of research, especially the great research funded by American taxpayers. This hearing is an important step in the reauthorization of the SBIR and STTR commercialization programs which our subcommittee has jurisdiction over.

In the U.S., where small businesses create 55 percent of all jobs, the success of the small business enterprise is key to economic growth. For almost 40 years, the SBIR program has been funding small business innovation across all sectors of our economy. There are many prominent success stories from SBIR grants. A recent Air Force review of Phase II winners between 2000 and 2013 found that 58 percent of those contracts had sales in excess of $1 million. Importantly, many of the innovators who create these small businesses are educated and trained in our nation's great research institutions, with support from federal research dollars. And some even directly commercialize research funded by federal dollars. The Federal R&D enterprise is truly an ecosystem from basic research to commercialization

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I would like to ask unanimous consent to enter into the record the Administration's Principles for SBIR/STTR Reauthorization and the letter dated May 10, 2016 from a coalition of science organizations and universities.

Thank you and I yield back the balance of my time.

Chairwoman COMSTOCK. Thank you, Mr. Lipinski, and I now recognize the Chairman of the full Committee, Mr. Smith.

Chairman SMITH. Thank you, Madam Chairwoman, and I appreciate both your comments and the comments by the Ranking Member.

The Small Business Innovation Research Act, or SBIR, was signed into law by President Reagan in 1982 to help spur innovation and increase small business participation in federal research and development activity.

Since then, more than 100,000 small businesses in the United States have received SBIR grants to convert taxpayer-supported basic research discoveries into commercial technological innovation.

The Small Business Technology Transfer program, or STTR, was approved by Congress in 1992. STTR's unique feature is its requirement for a small business to collaborate with a nonprofit research institution in order to bridge the gap between basic science and commercialization of resulting innovations.

Both SBIR and STTR are funded through a tax on federal agencies' research budgets. The SBIR tax on research began at 0.2 percent; that tax is now three percent, or 15 times higher. Twelve federal agencies—those with annual external research budgets of $100 million or more—are currently subject to the SBIR tax.

The five federal departments and agencies with annual external research budgets of more than $1 billion are also taxed to provide funding for the STTR program. That tax is an additional .45 percent on the three research agencies represented here today: DOE, NSF, and NIH. These basic research taxes currently amount to approximately $2.5 billion each year for commercialization grants to small businesses.

Grant recipients run the gamut. Although about one-quarter of the companies are first-time recipients, most participating small businesses have received multiple SBIR grants.

Some former recipients of SBIR assistance have even become very large international corporations, such as Qualcomm, Sonicare, and Symantec.

SBIR and STTR companies have created parts for NASA's Mars Rover, equipped our military men and women with key war-fighting innovations, and generated a long list of lifesaving medicines and health care treatments.

SBIR and STTR recipients have thousands of new patents and created thousands of new jobs, many in new areas of technology.

In the leading-edge field of nanoscience, we're learning that tiny particles can have very big effects. SBIR support enabled Applied Nanotech of Austin, TX, to become a world leader in nanotechnology breakthroughs: inventing cheaper, more efficient solar energy cells, new materials for blast-resistant structures and equipment, and low-cost, high-performance metallic inks and pastes for ink-jet-printed electronics.

Xeris Pharmaceuticals, also Austin-based, has used SBIR grants to develop new delivery systems for injectable medicines that are not soluble with water. This includes a system for injectable glucagon to treat congenital hyperinsulinism that affects thousands of infants and young children.

The current legislative authorization for the SBIR and STTR programs doesn't expire until September of next year. The Science Committee is holding its first hearing today in order to start the process of timely oversight and reauthorization consideration.

There are still ways to improve SBIR and STTR and assure taxpayers are getting the greatest return for the investments of their hard-earned dollars. Instances of fraud and abuse continue to be problematic.

Objective measurement of results across all participating federal agencies is needed. It is also important to examine if the current funding level—the taxes on basic research—are hurting fundamental scientific research. Any increases would necessarily reduce our Nation's primary investments in basic research at a time when U.S. global leadership is threatened. As the members of this Committee know, China is set to overtake the U.S. in R&D spending as soon as 2020.

Madam Chairwoman, I look forward to hearing from our panel of witnesses today, who are all experts in their own right, and who represent federal agencies and research universities, about these and other issues.

Thank you, and yield back.

[The prepared statement of Chairman Smith follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
June 16, 2016

Media Contacts: Alicia Criscuolo, Thea McDonald
(202) 225-6371

Statement of Chairman Lamar Smith (R-Texas)
SBIR/STTR Reauthorization: A Review of Technology Transfer

Chairman Smith: Thank you, Mr. Chairman. The *Small Business Innovation Research Act*, or SBIR, was signed into law by President Reagan in 1982 to help spur innovation and increase small business participation in federal research and development activity.

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Objective measurement of results across all participating federal agencies is needed. It is also important to examine if the current funding levels – the taxes on basic research -- are hurting fundamental scientific research.

Any increases would necessarily reduce our nation's primary investments in basic research at a time when U.S. global leadership is threatened. As the members of this Committee know, China is set to overtake the U.S. in R&D spending as soon as 2020.

I look forward to hearing from our panel of witnesses, representing federal agencies and research universities, about these and other SBIR/STTR issues.

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Chairwoman COMSTOCK. Thank you, Mr. Smith, and I now recognize the Ranking Member of the full Committee for a statement, Ms. Johnson.

Ms. JOHNSON. Thank you very much, and good morning. I'd like to thank you, Madam Chair, for holding this hearing today to examine the Small Business Innovation Research program and the Small Business Technology Transfer programs and related technology transfer issues, and I'd like also to thank the Chairman of the full Committee for ensuring that Science Committee members have the opportunity to weigh in on reauthorization of these important programs.

The United States has long been a nation that nurtures innovation. The number of small businesses has grown by 49 percent since 1982, and today's 28 million small businesses make up 54 percent of all U.S. sales. The invigorating startup culture we have seen for the last decade and a half has contributed to this growth and has given us extraordinary economic and social benefits.

The first SBIR program was at the National Science Foundation and was started in the mid-1970s to support small high-tech firms' ability to compete for federal R&D grants. This program grew to a government-wide program in 1982. Today the program receives approximately $2.2 billion from funds set-aside from the federal research and development budget. The SBIR and STTR programs are funded from a set-aside from agencies' extramural R&D budgets. They are the only R&D programs that are funded in this market. While stability and continuity in the programs are important goals, the SBIR and STTR programs are just one tool in a much larger R&D toolbox that agencies draw from to meet their missions.

The SBIR and STTR programs were last authorized from fiscal years 2012 through 2017. During that time, the programs grew by 30 percent. In addition, the 2011 reauthorization introduced many new requirements and flexibilities for the agencies.

Before we reauthorize the programs, it is the responsibility of this Committee to review how the new policies introduced in the last reauthorization have been implemented, how well the programs are achieving their goals and how they might continue to improve, and how the programs fit into the larger federal research and development enterprise. Our job on the Science Committee is to help ensure the health and sustainability of this entire enterprise.

One particular issue I hope our witnesses can address is women and minority participation. According to the National Academies, agencies are doing well in all of the main goals of the SBIR and STTR programs except for participation in innovation by economically and socially disadvantaged groups. I have spent my entire political career working on increasing female and minority participation in STEM starting in the early 1970s, I might add. I'm glad to say that we are not doing much better—I'm sad to say that we are not doing much better today than when I started.

SBIR cannot solve disparities created earlier in the pipeline. However, we know that women and minorities receive less encouragement and support to become entrepreneurs. I'd like to hear from our witnesses today how agencies can help address this disparity through the SBIR and STTR programs.

I thank the witnesses for being here today and I look forward to their comments and recommendations for future legislation.

Thank you, Madam Chair, and I yield back the balance of my time.

[The prepared statement of Ms. Johnson follows:]

OPENING STATEMENT
Ranking Member Eddie Bernice Johnson (D-TX)

House Committee on Science, Space, and Technology
Subcommittee on Research and Technology
"SBIR/STTR Reauthorization: A Review of Technology Transfer"
June 16, 2016

Good morning, I would like to thank the Chair for holding today's hearing to examine the Small Business Innovation Research Program and the Small Business Technology Transfer Programs and related technology transfer issues. I would also like to thank the Chairman of the full committee for ensuring that Science Committee Members have the opportunity to weigh in on reauthorization of these important programs.

The United States has long been a nation that nurtures innovation. The number of small businesses has grown by 49% since 1982, and today's 28 million small businesses make up 54% of all U.S. sales. The invigorating startup culture we have seen for the last decade and a half has contributed to this growth and has given us extraordinary economic and social benefits. The first SBIR program was at the National Science Foundation and was started in the mid-1970s to support small high tech firms' ability to compete for federal R&D grants. This program grew to a government-wide program in 1982. Today the program receives approximately $2.2 billion from funds set-aside from the federal research and development budget.

The SBIR and STTR Programs are funded from a set-aside from agencies' extramural R&D budgets. They are the only R&D programs that are funded in this manner. While stability and continuity in the programs are important goals, the SBIR and STTR programs are just one tool in a much larger R&D toolbox that agencies draw from to meet their missions.

The SBIR and STTR programs were last authorized from fiscal years 2012 through 2017. During that time, the programs grew by 30%. In addition, the 2011 reauthorization introduced many new requirements and flexibilities for the agencies. Before we reauthorize the programs, it is the responsibility of this Committee to review how the new policies introduced in the last reauthorization have been implemented, how well the programs are achieving their goals and how they might continue to improve, and how the programs fit into the larger federal research and development enterprise. Our job on the Science Committee is to help ensure the health and sustainability of this entire enterprise.

One particular issue I hope our witnesses can address is women and minority participation. According to the National Academies, agencies are doing well in all of the main goals of the SBIR and STTR Programs except for participation in innovation by economically and socially disadvantaged groups. I have spent my entire political career working on increasing female and minority participation in STEM. I'm sad to say that we are not doing much better today than when I started. SBIR cannot solve disparities created earlier in the pipeline. However, we know that women and minorities receive less encouragement and support to become entrepreneurs. I'd like to hear from the witnesses today how agencies can help address this disparity through the SBIR and STTR Programs.

I thank the witnesses for being here today and look forward to their comments and recommendations for future legislation.

Thank you Madam Chairwoman. I yield back the balance of my time.

Chairwoman COMSTOCK. Thank you.

And now let me introduce our witnesses. Our first witness today is Dr. Pramod Khargonekar, Assistant Director for the Directorate of Engineering at the National Science Foundation. He was appointed to serve as Assistant Director in March 2013. In this role, he leads the Engineering Directorate with an annual budget of more than $900 million, which funds engineering research and development and education, cultivates an innovation ecosystem, and develops next-generation engineers. He previously served as Deputy Director of Technology at ARPA–E at the U.S. Department of Energy and served as the Dean of the College of Engineering at the University of Florida. He received his bachelor's degree at the Indian Institute of Technology-Bombay and a master's in mathematics and a doctorate in electrical engineering from the University of Florida-Gainesville.

Our second witness today is Dr. Michael Lauer, Deputy Director of Extramural Research at the National Institutes of Health. In this role, Dr. Lauer serves as the principal scientific leader and advisor to the Director of the NIH on all matters relating to the substance, quality and effectiveness of the NIH Extramural Research program and administration. Prior to joining NIH, he served as a Division Director at the National Heart, Lung and Blood Institute as a Board-Certified Cardiologist. He received education and training at Albany Medical College, Harvard Medical School, and Harvard School of Public Health.

Our third witness today is Dr. Patricia Dehmer, Deputy Director for Science Programs in the Office of Science at the Department of Energy. The Office of Science supports research at 300 colleges and universities nationwide, at DOE laboratories, and at other private institutions. She has served in a number of positions at DOE where she began her scientific career as a postdoctoral fellow at Argonne National Laboratory. She received a bachelor of science degree in chemistry from the University of Illinois and a Ph.D. in chemical physics from the University of Chicago in 1972.

Our final witness today is Ms. Jilda Garton, Vice President for Research and General Manager at Georgia Tech Research Corporation at Georgia Institute of Technology. She is responsible for financial and business affairs including licensing of intellectual property created at Georgia Tech. She directs the activities of the Office of Sponsored Programs, the Office of Research Integrity Assurance, and the Office of Industry Engagement. Ms. Garton currently serves on the Board of the University-Industry Demonstration Partnership and co-chairs the UIDP's Contracts Accords Working Group. She has a B.A. in biology from Vanderbilt University and an M.S. in zoology from Louisiana State University.

I now recognize Dr. Khargonekar for five minutes to present his testimony.

TESTIMONY OF DR. PRAMOD KHARGONEKAR,
ASSISTANT DIRECTOR,
NATIONAL SCIENCE FOUNDATION

Mr. KHARGONEKAR. Good morning, Chairwoman Comstock, Ranking Member Lipinski, Chairman Smith, Ranking Member Johnson, Committee members. Thank you for this opportunity to

testify regarding the Small Business Innovation Research and Small Business Technology Transfer programs at the National Science Foundation. My name is Pramod Khargonekar. I am the Assistant Director for Engineering at National Science Foundation. The SBIR/STTR program at NSF is managed within the Division of Industrial Innovation and Partnerships and the Directorate for Engineering.

While NSF's primary mission is to advance the frontiers of science and engineering through basic research, the SBIR/STTR program is an integral part of the NSF strategy to stimulate innovation and address societal needs. This is achieved through the commercialization of results of fundamental research. We fund small businesses at very early stages when the technology risk is high and before the private sector is normally willing to invest.

Since the NSF is not the ultimate customer of resulting innovations, the NSF SBIR/STTR research topics are designed to address existing and emerging needs of the U.S. marketplace and the Nation as a whole. For example, NSF SBIR research brought about Symantec, which is now a global leader in cybersecurity. It was founded in 1982 by Gary Hendrix, who was funded by an NSF SBIR grant. Qualcomm, a world leader in wireless communications and computing technologies, also received NSF SBIR funding during the 1980s in its early years as a small business. Its co-founder, Irwin Jacobs, recently stated, and I quote, "With one of the grants, we developed some of the first chips we did at Qualcomm, if not the first. Of course, making chips for cell phones is now about 2/3 of our revenue today, and that was the base."

In the last four decades, NSF has been continuously innovating and exploring new approaches to stimulating small business-based technological innovations and commercialization. In 1998, NSF SBIR introduced a new supplemental program called Phase IIB. It is a platform to stimulate NSF-funded active Phase II grantees to attract additional private-sector funding for further technology commercialization.

In addition to providing funding in varying stages, we also assist awardees by providing them with experiential entrepreneurial education based in part on the NSF Innovation Corps, or I–Corps program. I–Corps helps entrepreneurs and their small businesses understand market needs and customers, thus increasing their chances of successful commercialization of new technologies.

Another program closely related to I–Corps is the Accelerating Innovation Research, or AIR. We frequently find that NSF-funded researchers apply for AIR grants first before pursuing I–Corps training. We are seeing strong interactions between these programs and our SBIR/STTR program where researchers with NSF-funded fundamental research advance to AIR first, then go through I–Corps, and then pursue SBIR/STTR funding. This pathway is getting strong and working extremely well.

We also many other translational research programs which complement our significant investments in fundamental scientific and engineering research.

SBIR and STTR are vital components of NSF's agenda to enable commercialization of technology stemming from basic research. We

at NSF take great pride in having pioneered the SBIR program concept and continue to innovate to expand its impact.

Recently, there have been proposals to increase the set-aside percentages for SBIR/STTR whose ultimate effect will be to apportion a greater amount of the NSF research budget to the SBIR/STTR program.

NSF is the lead agency for the support of basic research at our Nation's universities. Our budget for basic research has been flat during this decade, and any further diminution will reduce the very discoveries that our country needs to remain an economic powerhouse and a global leader. We do support future growth in SBIR/STTR programs but urge that such growth be enabled through an overall budget increase for NSF.

NSF strongly supports a permanent reauthorization of SBIR/STTR and recommends that the annual set-aside percentages for the programs be maintained at fiscal year 2017 levels.

Lastly, I should note that NSF participated in interagency process to detail principles all the SBIR/STTR agencies can support for reauthorization, which include permanent reauthorization, growth in program through overall extramural research growth, and maintaining flexibility.

Madam Chairwoman, this concludes my testimony. On behalf of the National Science Foundation, the SBIR/STTR program, and our awardees, I want to thank you for this opportunity to highlight a program that provides small businesses with the means to keep America on the forefront of innovation and stimulate U.S. economic growth. We greatly appreciate the opportunity to work with you on reauthorizing SBIR and STTR. Thank you.

[The prepared statement of Mr. Khargonekar follows:]

Testimony of Dr. Pramod Khargonekar
Assistant Director
Directorate for Engineering
National Science Foundation
Before the
Committee on Science, Space and Technology
Subcommittee on Research and Technology
United States House of Representatives
SBIR/STTR Reauthorization: A Review of Technology Transfer

June 16th, 2016

Chairwoman Comstock and Ranking Member Lipinski, thank you for this opportunity to testify regarding the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the National Science Foundation (NSF). My name is Pramod Khargonekar, and I am the Assistant Director (AD) for Engineering at NSF.

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. NSF is the funding source for approximately 24 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics and computer science, NSF is the major source of federal support. Many NSF-funded discoveries and technological advances have been truly revolutionary including 217 of our researchers who have received Nobel Prizes over the past few decades. Our grantees are the winners in this process, so too are the taxpayers who have invested in this research through the NSF.

The Engineering directorate provides about 40 percent of the federal funding for fundamental research in engineering at academic institutions in the United States. Research funded by the NSF's Directorate for Engineering has enabled major advances in manufacturing, electronics, communications, and chemical processes.[1] It has created new knowledge that has helped to fortify the nation's infrastructure. It has invested in programs to educate the next generation of engineers. Engineering is also home to many of NSF's activities that foster innovation and technology transfer and commercialization. The SBIR program at NSF is managed within the Division of Industrial Innovation and Partnerships in the Directorate for Engineering

While NSF's primary mission is to advance the frontiers of science and engineering through basic research, 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. We fund small businesses at very early stages, when the technology risk is high and before the

[1] http://www.nsf.gov/dir/index.jsp?org=ENG

private sector is normally willing to invest. Since NSF is not the ultimate customer of the innovation stimulated by the SBIR program, the NSF SBIR research topics are oriented to the needs of the marketplace and the nation as a whole.For example, NSF SBIR research brought about Symantec, which is now a global leader in cybersecurity. It was founded in 1982 by Gary Hendrix who was funded by an NSF SBIR grant. Qualcomm, a world leader in wireless communications and computing technologies, also received NSF SBIR funding during the 1980's in its early years as a small business.

In 1998, NSF SBIR introduced a new supplemental program called Phase IIB as a platform to stimulate NSF-funded active Phase II grantees to attract private sector funding for further technology commercialization. The Phase IIB proposal is submitted while the company is conducting the Phase II research. With Phase II research underway, the small business is better positioned to attract investors because most of the early stage technology risk has already been addressed with NSF funding.

In addition to providing funding in varying stages, we also assist our awardees by providing them with experiential entrepreneurial education based in part on the NSF Innovation Corps (I-Corps) program that helps entrepreneurs and their small businesses understand market needs and customers, thus increasing their chances of successfully commercializing new technologies. I-Corps was designed to foster entrepreneurship that will lead to the commercialization of basic research. I-Corps uses customer discovery and business model development to validate commercialization opportunities, and successful I-Corps projects will be prepared for business formation.

Another program, closely related to I-Corps, is the Partnerships For Innovation (PFI): Accelerating Innovation Research (AIR) program. 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. It also fosters connections between existing NSF innovation research alliances.

In addition to the SBIR program, the Engineering division manages several university-industry partnership programs: Small Business Technology Transfer (STTR), Industry/University Cooperative Research Centers (I/UCRC), and Partnerships for Innovation (PFI) and Grant Opportunities for Academic Liaison with Industry (GOALI). NSF's SBIR and STTR programs enable companies to undertake research and development with high technical risk and high potential commercial reward. In fiscal year (FY) 2015, SBIR awards were made to small technology-based firms across 39 states, including 27 awards made in the Experimental Program to Stimulate Competitive Research (EPSCoR) states and territories. Existing NSF innovation research alliances such as Engineering Research Centers (ERC), I/UCRC, PFI, Science and Technology Centers (STC), Nanoscale Science and Engineering Centers (NSEC) and Materials Research Science and Engineering Centers (MRSEC), complement our other significant investments in fundamental scientific and engineering research. They do so by offering multiple pathways for moving from discovery to innovation to technology.

We frequently find that NSF-funded researchers will pursue and receive grants from many of these eight programs in parallel, in sequence, or on a combined path. For example, PFI-AIR

grants first before pursuing I-Corps training. We are seeing strong interactions between these programs as well as with our SBIR/STTR program where researchers start with NSF-funded fundamental research, advance to PFI: AIR, then go through I-Corps and then pursue SBIR and STTR funding.

SBIR and STTR are vital components of NSF's agenda to enable commercialization of technologies stemming from basic research. We strongly support a permanent reauthorization of this program. NSF also strongly recommends that the yearly set-aside percentages for SBIR/STTR be maintained at FY17 levels.

Since FY11, the SBIR program has expanded by 5 percent a year, or almost 30 percent overall. This is almost three times as much as the rest of the agency during the same time period. The House proposal, H.R. 4783, would continue a similar path, increasing program funding by 40 percent over 6 years for SBIR and 33 percent over 6 years for STTR. The proposed increases would come at the expense of reducing funding in existing highly meritorious fundamental research programs at NSF as well as other non-SBIR/STTR innovation programs I have highlighted today. We believe any future growth in NSF SBIR and STTR programs should be realized through overall extramural R&D budget increases for NSF. In the current budget environment, increases in these programs mean real cuts to the remainder of the extramural budget. We do not see annual increases in the set-asides for these programs as justified, especially at the cost of others, when the overall budget of the agency is flat.

We appreciate the flexibilities provided by the current program which allow NSF to support activities to strengthen the nation's innovation ecosystem. Specifically, agency flexibility on award size and sequencing, consistent with the diverse needs of small businesses in different industries and technology arenas, is critical. The NSF SBIR program funds grants in diverse technology topic areas including: Smart Health (SH) and Biomedical (BM) Technologies; Biological Technologies (BT); Chemical and Environmental Technologies (CT); Educational Technologies and Applications (EA); Electronic Hardware, Robotics and Wireless Technologies (EW); the Internet of Things (I); Information Technologies (IT); Semiconductors (S) and Photonic (PH) Devices and Materials; Advanced Materials and Instrumentation (MI); and Advanced Manufacturing and Nanotechnology (MN).

Lastly, I should note that NSF participated in an interagency process to detail principles all the SBIR/STTR agencies can support for reauthorization, which include permanent reauthorization, growth in the program through overall extramural research growth, and maintaining flexibility.

Madame Chairwoman, this concludes my testimony. On behalf of the National Science Foundation, the SBIR program and our awardees, I want to thank you for this opportunity to highlight a program that provides small businesses with the means to keep America on the forefront of innovation. I would be pleased to provide any additional information that would be useful to you.

Pramod P. Khargonekar
Biographical Sketch

Dr. Pramod P. Khargonekar was appointed by the National Science Foundation (NSF) to serve as Assistant Director for the Directorate of Engineering (ENG) in March 2013. In this position, Khargonekar leads the ENG Directorate with an annual budget of more than $900 million. He is also a member of the NSF senior leadership team that sets policies and priorities for the Foundation. The ENG Directorate invests in frontier engineering research and education, cultivates an innovation ecosystem, and develops the next-generation of engineers.

Khargonekar was Chairman of the Department of Electrical Engineering and Computer Science from 1997 to 2001 and also held the position of Claude E. Shannon Professor of Engineering Science at The University of Michigan. From 2001 to 2009, he was Dean of the College of Engineering and is currently Eckis Professor of Electrical and Computer Engineering there. He also served briefly as Deputy Director of Technology at ARPA-E, U. S. Department of Energy in 2012-13.

Khargonekar's current interests include systems and control theory, machine learning, and applications to smart electric grid and neural engineering. He has authored more than 300 journal and conference publications. He is a recipient of the NSF Presidential Young Investigator Award, the American Automatic Control Council's Donald Eckman Award, the Japan Society for Promotion of Science fellowships, the IEEE W. R. G. Baker Prize Award, the IEEE George Axelby Award, the American Automatic Control Council's Hugo Schuck Award, and the Distinguished Alumnus and Distinguished Service Awards from the Indian Institute of Technology, Bombay. He is a Fellow of IEEE and IFAC. At the University of Michigan, he received the Arthur F. Thurnau Professorship. He has been recognized as a Web of Science *Highly Cited Researcher.*

Chairwoman COMSTOCK. Thank you.
Now we'll hear from Dr. Lauer.

TESTIMONY OF DR. MICHAEL LAUER,
DEPUTY DIRECTOR,
NATIONAL INSTITUTES OF HEALTH

Dr. LAUER. Good morning. Chairwoman Comstock, Ranking Member Lipinski, and members of the Subcommittee, it is an honor to appear before you today to talk about how the SBIR and STTR programs fit within the overall context of the NIH research portfolio.

NIH has been advancing our understanding of health and disease for more than a century. Scientific and technological breakthroughs generated by NIH-supported research are behind many of the improvements our country has enjoyed in public health. Many recent breakthroughs stem from our Nation's commitment from investing in basic research, which lays the foundation for advances in disease diagnosis, and prevention and is generally not supported by the private sector.

NIH supports a broad research portfolio that includes basic science, translational science, clinical research, and population-based research at universities, academic health centers, and small businesses. Like any other investment portfolio, the key to success is diversity, which maximizes the likelihood that we will come up with transformative cures.

It is important to remember that many years and financial resources are necessary to bring medical innovations into the practice of medicine. It has been estimated that it takes 11 to 14 years and approximately $2.6 billion to bring a new drug to market.

While basic science lays the foundation for advancing our knowledge about the nature and behavior of living systems, this knowledge must then be applied and translated and later approved through the regulatory system before patients can benefit. The small business community benefits form all of the formative research supported by NIH.

Among the 11 federal departments and agencies that participate in the SBIR and STTR programs, the NIH is the second largest funder. Examples of the types of research that we support include but are not limited to drug discovery, medical devices, biosensors, nanotechnology, imaging, and bioengineering. A successful example of a technology developed through our programs is Lift Labs' Liftware, which creates stabilizing technologies to help people with essential tremor and Parkinson's disease.

Our programs have grown significantly with the increases provided by the 2011 Reauthorization. Between fiscal years 2011 and 2016, the NIH budget increased by about 4.5 percent, while our SBIR and STTR budgets increased approximately 30 percent, or six times as much.

We are grateful for the financial and human resources support provided through the administrative fund pilot authority. We have used this authority to bolster and diversify our program outreach efforts, reaching more than 24,000 individuals from all states in the past several years, including 940 women-owned and 650 socially and economically disadvantaged small businesses. Through

these and other efforts, we anticipated increased applications from these groups in the future, further diversifying the programs.

The NIH strongly supports the SBIR and STTR programs. For decades, these programs have served as vital sources of federal funding for innovative American small businesses. The program should be permanently reauthorized to provide us all with much-needed long-term certainty.

However, future growth in SBIR and STTR programs should be realized through overall extramural budget increases for each agency. For example, the Congress provided NIH with a $2 billion increase this past year, which meant that our SBIR and STTR budget increased by 12.4 percent from the previous year, nearly twice the agency's increase.

Scholars have noted that the biomedical research enterprise now suffers from hypercompetitiveness with increasing numbers of researchers competing against each other for relatively fewer available dollars. Historically, NIH success rates have been about one in three, and they are now down to less than one in five. We are concerned that dedicating an ever-increasing proportion of NIH's extramural research dollars to these two specific programs would threaten the diversity of the research portfolio, a portfolio that succeeds precisely because it is so diverse. In our judgment, it would be more effective for overall R&D budgets to increase so all programs benefit.

Furthermore, it is imperative that NIH and other federal agencies participating in the program be provided with the resources necessary for effective administration, oversight and outreach as well as reasonable flexibility on award size and sequencing consistent with the diverse needs of small businesses in different industries and technology areas.

This concludes my statement. Thank you for your attention, and I look forward to answering any questions you may have.

[The prepared statement of Dr. Lauer follows:]

DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH

SBIR/STTR Reauthorization: A Review of Technology Transfer

Testimony before the
House Committee on Science, Space, and Technology
Subcommittee on Research & Technology

Michael S. Lauer, M.D.

Deputy Director for Extramural Research
National Institutes of Health

June 16, 2016

Good morning, Chairwoman Comstock, Ranking Member Lipinski, and distinguished members of the Committee. My name is Dr. Michael Lauer and I am the Deputy Director for Extramural Research at the National Institutes of Health (NIH). Thank you for the opportunity to discuss the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs at the NIH in the context of NIH's research and development (R&D) portfolio. This morning, I will discuss NIH's R&D portfolio, the NIH SBIR/STTR portfolio, and principles for reauthorization for consideration by this Committee to ensure that the SBIR/STTR programs best meet the needs of the biomedical research ecosystem.

OVERVIEW OF THE NIH PORTFOLIO

As the nation's premier biomedical research agency, NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems, and to apply that knowledge to enhance human health, lengthen life, and reduce illness and disability.

NIH has been advancing our understanding of health and disease for more than a century. Scientific and technological breakthroughs generated by NIH-supported research are behind many of the improvements our country has enjoyed in public health. For example, our Nation has gained about one year of longevity every six years since 1990.[1] A child born today can look forward to an average lifespan of about 78 years – nearly three decades longer than a baby born in 1900. Deaths from heart attack and stroke have been reduced by more than 70 percent in the past 60 years. Thanks to NIH-developed anti-viral therapies, HIV-infected people in their 20s today can expect to live into their 70s. This compares to a life expectancy measured in months when the disease first appeared in the 1980s. Cancer death rates have been dropping about one percent annually for the past 15 years.

[1] http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf

Many recent breakthroughs stem from our nation's commitment to investing in basic science research. Basic science lays the foundation for advances in disease diagnosis, treatment, and prevention by providing the building blocks for clinical applications. Basic science is generally not supported in the private sector, and NIH's focus on understanding fundamental biological processes not only has led to 148 Nobel Prizes to our grantees, but fosters innovation and ultimately leads to effective ways to treat complex medical conditions.

In fiscal year (FY) 2016, NIH's $32.3 billion budget will support biomedical research in every state and nearly every Congressional district. The NIH portfolio is split into two broad categories. First, our extramural program supports scientists throughout the country at universities, hospitals, academic medical centers, and small businesses and represents about 83 percent of the budget. Second, our intramural program supports research conducted by NIH scientists within our own laboratories and represents about 11 percent of the budget. For the extramural program, NIH provides support through grants, cooperative agreements, and contracts; and we have an array of different funding mechanisms to match the variety of types of science we support. Researcher-initiated ideas are the cornerstone of the NIH research portfolio, including projects supported by the SBIR/STTR program. NIH supports the foundation of the entire biomedical research enterprise.

Studies have shown that NIH grants lead to novel inventions and patents. From 2000 to 2013, NIH-funded researchers produced 20,441 unique patents. NIH research funding directly yields approximately 6 new patents for every $100 million of grant and contract funding.[2]

[2] "Patents as Proxies Revisited: NIH Innovation 2000 to 2013" Batelle Technology Partnership Practice, prepared for The Academy of Radiology Research, 2015.
http://www.battelle.org/docs/tpp/battelle_2015_patents_as_proxies.pdf

Furthermore, each year's new round of funding can be expected to generate at least 100 to 120 new inventions.[3]

NIH investment also spurs private-sector patents, because the biotechnology and pharmaceutical industries build on knowledge generated by NIH funding. Every $10 million increase in NIH funding generates 3.26 additional private sector patents, which translates to one private-sector patent for every two NIH grants.[4]

It is important to remember that many years and financial resources are necessary to bring medical innovations into the practice of medicine. It's been estimated that it takes 11-14 years and approximately $2.6 billion to bring a new drug to market.[5,6] While basic science lays the foundation for advancing our knowledge about the nature and behavior of living systems, this knowledge must then be applied and translated and later approved through the regulatory system before patients can benefit. NIH, as well as universities, created technology transfer offices to aid researchers to commercialize their discoveries. The small business community benefits from all of these opportunities resulting from the formative research supported by NIH.

THE NIH SBIR/STTR PROGRAMS

Among the 11 Federal departments and agencies that participate in the SBIR/STTR programs, the NIH is the second largest funder, and the largest Federal supporter of biomedical research. The NIH SBIR/STTR programs continue to be critical to feeding the innovation pipeline that promises to deliver the medical advances of tomorrow and have complemented NIH's mission to advance science while bringing new health care solutions to the public.

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[3] Kalutkiewicz, Michael J. and Ehman, Richard L., Patents as proxies: NIH hubs of innovation, *Nature Biotechnology*, June 2014.
[4] Pierre Azoulay et al. "Public R&D Investments and Private-sector Patenting: Evidence from NIH Funding Rules" NBER working paper, 2015. http://www.nber.org/papers/w20889
[5] DiMasi, Joseph A., Ronald W. Hansen, and Henry G. Grabowski. 2003. The Price of Innovation: New Estimates of Drug Development Costs. Journal of Health Economics 22: 151–85.
[6] DiMasi JA, Grabowski HG, Hansen RA. Innovation in the pharmaceutical industry: new estimates of R&D costs. Journal of Health Economics 2016; 47:20-33.

The NIH SBIR/STTR programs are ideally suited for creating research opportunities for U.S. small businesses to stimulate technological innovation. Part of a complex innovation ecosystem, these programs provide dedicated funding for U.S. small businesses to conduct early-stage R&D to explore the feasibility of innovative ideas that may eventually result in products or services that will lead to better health for everyone. The NIH SBIR/STTR programs are one means by which NIH Institutes and Centers accomplish their R&D objectives. A key feature that sets SBIR/STTR apart from other NIH programs is a focus on commercialization of the results of research. Thus, the programs serve to supplement the basic and applied research programs of NIH.

Examples of the types of research that NIH supports through the SBIR/STTR programs include, but are not limited to: drug discovery, drug and pharmaceutical development, medical devices, biosensors, nanotechnologies, proteomics, imaging, bioengineering, behavioral research, health services, and other technologies that enhance health, lengthen life, and reduce illness and disability. Successful NIH SBIR-funded technology include the Lift Labs' Liftware,™ which creates stabilizing technologies to help people with Essential Tremors and Parkinson's disease and Senestech, which has technology to manage rodent populations using a non-toxic approach that limits reproduction.

NIH's SBIR and STTR programs have grown significantly with the increases provided in the 2011 reauthorization. Between FY 2011 and FY 2016, the NIH budget increased about 4.5 percent while the NIH SBIR and STTR funding increased approximately 30 percent, more than six times the NIH budget increase.

NIH is grateful for the financial and human resources support provided through the administrative fund pilot authority to enhance our management of the SBIR/STTR programs in

new and better ways. One example of how we have used this authority is that we have bolstered and diversified our SBIR/STTR outreach efforts the past several years, with a major focus on women-owned and socially- and economically-disadvantaged businesses. During FYs 2013-2015, we have reached over 24,400 individuals from all 50 states and the District of Columbia and Puerto Rico, including more than 940 women-owned small businesses and 650 socially and economically disadvantaged small businesses. Through these and other efforts, we anticipate increased applications from these groups, further diversifying the SBIR/STTR Programs.

The NIH attributes the success and effectiveness of its programs to several factors, the most significant of which is a flexible and proactive approach that adapts to the changing nature of biomedical and behavioral research while maintaining a highly competitive and effective program.

Examples of program flexibility include the ability to propose research projects in fields that have the most biomedical potential; the ability for an applicant to resubmit an unfunded application; and the ability to fund Phase I and Phase II awards at appropriate budgets that may exceed the established guidelines if the science proposed warrants such an exception to ensure successful outcomes. Biomedical research presents a unique set of challenges that require appropriate resources to commercialize the next set of discoveries.

REAUTHORIZATION PRINCIPLES

The NIH and Obama Administration strongly support the SBIR and STTR programs. For decades, these programs have served as vital sources of Federal funding for innovative American small businesses, including startups, which make outsized contributions to technology commercialization and job creation across the country. The programs should be permanently

reauthorized to provide American's small businesses and participating Federal agencies with much-needed long-term certainty.

Future growth in SBIR/STTR programs should be realized through overall extramural R&D budget increases for each SBIR/STTR funding agency. For example, Congress provided NIH a $2 billion increase in FY 2016, which meant that our SBIR/STTR programs increased by 12.4 percent from the previous fiscal year (4.5 percentage points of that growth attributed to the statutory increase in the set aside with the remainder due to the overall budget increase) compared to a 6.6 percent increase for NIH. The annual set-aside amounts for agency SBIR/STTR programs should be maintained at the FY 2017 levels (3.2 percent/0.45 percent), which represent greater than 30 percent increase over the FY 2011 levels (2.5 percent/0.3 percent). The biomedical research enterprise now suffers from hyper competitiveness with researchers competing against each other for available research dollars. Historically, NIH success rates have been about one in three (32 percent in FYs 1999 - 2001) while now they are down to less than one in five (18 percent in FY15). Dedicating a larger proportion of NIH's extramural research dollars to these two specific programs would threaten the diversity of the research portfolio when the portfolio's diversity is one of the major keys to its success. It would be more effective to increase overall R&D budgets so all programs benefit.

Furthermore, it is imperative that NIH and other Federal agencies participating in the program dedicate resources for effective administration, oversight, and outreach as well as reasonable flexibility on award size and sequencing, consistent with the diverse needs of small businesses in different industries and technology areas.

Conclusion

In conclusion, I want to emphasize that flexibility is critical at a time when science is changing rapidly, becoming more complex, more interdisciplinary, and more resource intensive. NIH plays a foundational role in the biomedical research enterprise, supporting all stages of research. Also, as a responsible steward of taxpayers' dollars, we strive to leverage NIH's portfolio across the biomedical enterprise. This concludes my statement. Thank you for your attention and I look forward to answering any questions you may have.

Biography

Michael Lauer, M.D., is the Deputy Director for Extramural Research at the National Institutes of Health (NIH), where he serves as the principal scientific leader and advisor to the Director of the NIH on all matters relating to the substance, quality, and effectiveness of the NIH extramural research program and administration. He received education and training at Rensselaer Polytechnic Institute, Albany Medical College, Harvard Medical School, Harvard School of Public Health, and the NHLBI's Framingham Heart Study. He spent 14 years at Cleveland Clinic as Professor of Medicine, Epidemiology, and Biostatistics. During his tenure at the Clinic, he led a federally funded internationally renowned clinical epidemiology program that applied big data from large-scale electronic health platforms to questions regarding the diagnosis and management of cardiovascular disease. From 2007 to 2015 he served as a Division Director at the National Heart, Lung, and Blood Institute (NHLBI), where promoted efforts to leverage big data infrastructure to enable high-efficiency population and clinical research and efforts to adopt a research funding culture that reflected data-driven policy. He has received numerous awards including the NIH Equal Employment Opportunity Award of the Year and the Arthur S. Flemming Award for Exceptional Federal Service in recognition of his efforts to grow a culture of learning and accountability.

Chairwoman COMSTOCK. Thank you, and we'll now hear from Dr. Dehmer.

TESTIMONY OF DR. PATRICIA DEHMER,
DEPUTY DIRECTOR FOR SCIENCE PROGRAMS,
OFFICE OF SCIENCE, DEPARTMENT OF ENERGY

Dr. DEHMER. Thank you, Chairman Comstock, Ranking Member Lipinski, Chairman Smith and Ranking Member Johnson from the full Committee, and members of the subcommittee. My name is Pat Dehmer, and I am the Deputy Director of the Department of Energy's Office of Science, where I oversee all of the science programs. The DOE SBIR/STTR Program Office is one of nine reporting to me.

The Office of Science has managed the Department's SBIR/STTR programs since the formation of SBIR in 1982. We work with the six science outlay programs in the Office of Science with four applied energy technology offices, with the Office of Environmental Management, and with the Office of Defense Nuclear Nonproliferation with in the National Nuclear Security Administration. These 12 offices together contribute about $200 million annually to SBIR/STTR, and the Office of Science is about 2/3 of this funding.

Since its establishment as a separate agency within the Department of Energy, the Advanced Research Projects Agency-Energy, or ARPA–E, has managed its own small SBIR program, about $8 million annually, with initial awards in 2012.

During the past few years, we have experimented with some new approaches, some resulting directly from the Reauthorization Act of 2011, which I'll talk about in a moment. But first I want to mention one other program. In 2013, we began something called the Technology Transfer Opportunities, or TTOs, as part of our funding opportunity announcements. TTOs enable small business to use technology that has been developed using DOE funding at our national laboratories or at universities. TTOs awardees are assigned rights by the institution owning the technology to perform R&D on the technology during Phase I or Phase II grants. In addition, the research institute provides the awardee with a no-cost, six-month option to license the technology.

In 2015, 10 Phase I and two Phase II TTO awards were made, representing technologies from Michigan State University and from four of our Department of Energy National Laboratories. When the 2013 cohort, the first cohort completes, we will begin an assessment of the outcomes of this particular experiment.

I'd like to turn now to some important features of the 2011 Reauthorization Act, particularly as they might relate to your consideration of the forthcoming reauthorization. The 2011 Reauthorization Act created a pilot program that allowed agencies to use up to three percent of SBIR program funds to improve the administration of these programs. DOE used from .6 to .9 percent of program funds annually for some very important improvements.

First is the improvement in our award timelines. By adding small amounts of funding to accelerate the development of our new Office of Science-wide web-based grants management system and introducing a few process changes, we were able to reduce the time from the close of a solicitation to Phase I actual awards by a factor

of two from eight months to four months. That's a very substantial improvement, and the opportunity to have this flexibility was critical to us.

A second thing that we did with this authorization was an important outreach activity. We created a Phase 0 assistance program to help under represented small businesses apply for SBIR/STTR funding. In this program, we target applications from states with historically low SBIR/STTR submissions and from women and minority-owned businesses across the Nation. The Phase 0 assistance program helps awardees with letter-of-intent writing, Phase I proposal preparation, review and submission, training and mentoring, communications and market research, technology advice, and consulting on areas of intellectual property. In just three funding opportunity announcements, we received more than 500 applications for the Phase 0 assistance program and we provided services to 165 participants. Again, we plan to assess the effectiveness of this after a year or so of this program being in operation.

The Reauthorization Act of 2011 also permitted us to make sequential Phase II awards. These awards permit us to fund additional R&D to complete Phase II research if necessary and to assist with transition to commercialization. In 2015, 17 percent of our Phase II awards were sequential Phase II awards.

As you think about the reauthorization in 2017, we'd like to take this opportunity to present our thoughts. We strongly support permanent reauthorization to provide federal agencies with long-term certainty and stability. We strongly support the existing flexibilities provided on award size and sequencing and, for example, that helped us innovate and begin the Phase II assistance pilot program and, finally, like my colleagues, we support maintaining the SBIR/STTR set-asides at the 2017 levels, which represent more than a 30 percent increase over the fiscal year 2011 level.

Thank you very much for the opportunity to talk to you. I appreciate the Committee's interest in this important topic, and I will be happy to answer your questions.

[The prepared statement of Dr. Dehmer follows:]

Testimony of Dr. Patricia Dehmer
Deputy Director of the Office of Science for Science Programs
U.S. Department of Energy
Before the
Committee on Science, Space, and Technology
Subcommittee on Research and Technology
United States House of Representatives
SBIR/STTR Reauthorization: A Review of Technology Transfer

June 16, 2016

Thank you Chairwoman Comstock, Ranking Member Lipinski, and Members of the Subcommittee. I am pleased to come before you today to discuss the Department of Energy's (DOE's) programs for Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR). For decades, these programs have served as key sources of Federal funding for innovative American small businesses, including startups, which make important contributions to technology commercialization and job creation.

I would like to begin by highlighting the scientific and commercial achievements of three of our past SBIR/STTR awardees. These examples illustrate how federally-funded scientific advancements made at small businesses can have public benefit as well as commercial success.

- Niowave, Inc., based in Lansing, Michigan, received three DOE SBIR Phase I and II awards in the past decade to enable superconducting linear accelerators to be reduced in size and cost. These innovations have allowed Niowave to address a number of commercial applications including medical radioisotope production, free electron lasers, intense X-ray sources, and fast neutron sources. In September 2015, Niowave achieved an important milestone: it produced Molybdenum-99, an important medical radioisotope, by fissioning uranium using one of its superconducting linear accelerators. The decay product of Molybdenum-99, Technetium-99m, is used in approximately 80% of all nuclear diagnostic imaging procedures in the world, with over 30 million procedures annually. The U.S. consumes about half of the world's annual production of Molybdenum-99, but we currently have no domestic production capabilities for this critical isotope. Niowave's innovations in accelerator technology will bring this important industry to the U.S., with commercial-scale production scheduled to begin in 2017.
- Aerodyne Research Inc., of Billerica, Massachusetts, received DOE SBIR awards to miniaturize laboratory scientific instruments that characterize aerosols so that the instruments could be used in aircraft. This has been a key enabler for advancing climate research. Today Aerodyne provides research and development services and advanced

sensor and software products to industrial, academic, and government customers for monitoring and enhancing regional and global environmental quality; developing clean and efficient energy and propulsion technologies; and advancing remote sensing, surveillance, and image processing capabilities for the national defense. Aerodyne has delivered over 70 instruments and realized revenue in excess of $25M from their innovations.

- Finally, the first large commercial production of nanomaterials, specifically fullerenes (a form of carbon in which the molecule is hollow with a spherical or soccer-ball shape), was enabled by two SBIR awards from DOE and two from the National Science Foundation (NSF) to TDA Research of Wheat Ridge, CO. Formed in 1987 by two staff from what is now the National Renewal Energy Laboratory, TDA Research has grown to a staff of 80 with annual revenues of approximately $14 million. TDA remains a privately held R&D company that develops catalytic- and sorbent-based materials and processes, new materials (polymers and carbons), and military and aerospace components.

The DOE Office of Science (SC) has managed the DOE SBIR/STTR Programs since the SBIR program was formed in 1982 and the STTR program was formed in 1992. With a budget of $5,347 million in FY 2016, SC is the Nation's largest Federal sponsor of basic research in the physical sciences and the lead Federal agency supporting fundamental scientific research for the Nation's energy future. Approximately 42 percent of the budget is devoted to the support of research at the frontiers of science—from the study of fundamental subatomic particles, atoms, and molecules that are the building blocks of the materials of our universe and everything in it to the DNA, proteins, and cells that are the building blocks of life. Another 38 percent is devoted to the operation of the 27 state-of-the-art national scientific user facilities, the most advanced tools of modern science, which together propel the U.S. to the forefront of science and technology development. SC user facilities provide tools and capabilities to more than 31,000 researchers annually from universities, national laboratories, and industry. Of the remaining funding, most is devoted to major facility construction projects. SBIR/STTR set-aside percentages are applied to all SC operating expense research funding including facility operations, but excluding capital equipment and construction.

The DOE SBIR/STTR Programs work collaboratively with 12 program offices throughout DOE. These include the six basic science research programs in the Office of Science (Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, and Nuclear Physics); four applied energy technology programs (Energy Efficiency and Renewable Energy, Electricity Delivery and Energy Reliability, Fossil Energy, and Nuclear Energy); the Office of Environmental Management; and the Office of Defense Nuclear Nonproliferation within the National Nuclear Security Administration

Each program office makes awards commensurate with its budget allocation, sometimes in collaboration with other offices on topics of mutual interest. SC provides about 65 percent of the total DOE SBIR/STTR funding. Since its establishment as a separate program element, the Advanced Research Projects Agency-Energy (ARPA-E) has managed its own small SBIR/STTR program with initial awards in 2012. The results of the ARPA-E awards are included in the DOE SBIR/STTR annual report to the SBA. In FY 2015, the DOE SBIR Program issued 255 Phase I awards and 146 Phase II awards totaling $191.7M and the DOE STTR Program issued 39 Phase I awards and 19 Phase II awards totaling $25.5M. Additionally, the Office of Science works with the new Office of Technology Transitions on strategies on how to leverage lab technology transfer programs and other technology commercialization activities to facilitate the transition of federally-funded R&D to the market.

The DOE SBIR/STTR Programs Office is responsible for issuing topics and solicitations, managing the review and selection process, working with the SC Office of Acquisition and Assistance to award SBIR/STTR Phase I and Phase II grants, issuing annual reports to the U. S. Small Business Administration, performing outreach, and setting overall policy for the Department's SBIR and STTR programs. The 12 participating programs are responsible for topic development, reviewer assignment, award selection, and project oversight. In the FY 2016 Phase I solicitations issued in August and November 2015, 57 technical topics and 264 subtopics were included, spanning research areas in Energy Production (fossil, nuclear, renewable, and fusion energy), Energy Use (in vehicles, buildings, and industry), and Fundamental Energy Sciences (materials, chemical, biological, environmental, and computational sciences among others).

The SBIR/STTR Reauthorization Act of 2011 created a pilot program that allowed agencies to use up to 3% of SBIR program funds to improve the administration of these programs. I would like to highlight two initiatives that were enabled by this pilot program: improvements in our timelines and our Phase 0 Assistance Program. By accelerating investment in our web-based grants management system and introducing process changes, we have reduced the time required to process applications and to issue awards. In FY 2011, it took approximately 8 months between the close of a solicitation and the release of funds for Phase I awards; today it takes only about 4 months.

The Phase 0 Assistance Program was instituted to help eligible underrepresented small businesses successfully apply for DOE SBIR/STTR funding. DOE is the first Federal agency to develop such a program for SBIR/STTR applicants. The Phase 0 Assistance Program seeks to increase the number of responsive, high-quality proposals submitted to DOE from targeted states with historically low SBIR/STTR submissions to DOE, and from women- and minority-owned businesses nationally. The Phase 0 Assistance Program includes Letter of Intent writing assistance; Phase I proposal preparation, review, and submission assistance; small business development training and mentoring; communication and market research assistance; technology advice and consultation; indirect rate and financial information; and Intellectual Property

consultation. The DOE Phase 0 Assistance Program is modelled after state programs that assist small businesses in applying to Federal SBIR/STTR programs and that provide state funding to assist in generating high-quality applications.

In states that have these programs, the DOE program complements those services and has successfully partnered with state organizations in each of DOE's underrepresented states for SBIR/STTR applications and awards. Over the course of three Funding Opportunity Announcements, the DOE Phase 0 Assistance Program has received more than 500 applications for assistance and has provided services to 165 participants. Feedback from a recent participant shows the value of the Phase 0 program to those new to engaging with government programs: "We have had a very positive experience with the DOE Phase 0 Assistance Program. It was very helpful to us, our Phase 0 coach was great, and we were well supported throughout the process. Finally, we'd like to thank DOE for launching and supporting this program — it is a critical resource to help startups & innovative small businesses navigate the government grant space, engage with the DOE successfully, and accelerate energy innovation."

The SBIR/STTR Reauthorization Act of 2011 also permitted agencies to make Sequential Phase II awards. These awards permit agencies to fund additional R&D to assist with transition to commercialization. In Fiscal Year (FY) 2015, 17% of the Phase II awards were Sequential Phase II awards.

In order to further enhance transition of DOE-funded innovations developed at DOE National Labs and universities, the DOE SBIR/STTR Programs Office began including technology transfer opportunities in its solicitations in FY 2013. DOE works with partnering research institutions so that awardees receive a six month, no-cost option to license the innovation in conjunction with their SBIR/STTR award. In FY 2015, 10 Phase I and 2 Phase II awards were made representing technologies from Michigan State University, Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory, Oak Ridge National Laboratory, and Savannah River National Laboratory.

As Congress considers reauthorization of the SBIR/STTR program in advance of its expiration in FY 2017, the Department of Energy supports permanent reauthorization to provide Federal agencies with long-term certainty and stability.

The annual set-aside amounts for agency SBIR/STTR programs should be maintained at FY 2017 levels (3.2%/0.45%), which represent more than a 30% increase over FY11 levels (2.5%/0.3%). Future growth in SBIR/STTR programs should be realized through overall extramural R&D budget increases for each SBIR/STTR funding agency.

The motivation for this position is that the very significant increases for the SBIR/STTR programs over the past few years are in sharp contrast to the small growth in the underlying programs. We note that during the period FY 2011 to FY 2016, the SBIR/STTR set asides grew

by 23%. During this same period, the DOE Office of Science research funding grew by 3.9% *over the entire five years*, and the facility operations funding grew by 12.3%. Additional increases in the set-aside would further reduce the available basic research funding.

Finally, we are grateful for our existing flexibility provided on award size and sequencing, consistent with the diverse needs of small businesses in different industries and technology arenas and for the ability to innovate in program management, for example, through the Phase 0 pilot program.

Thank you for this opportunity to come before you today to discuss the DOE SBIR/STTR Programs and the Office of Science. I appreciate the Committee's interest in this topic and look forward to answering your questions.

Dr. Patricia M. Dehmer

Acting Director, Office of Science
U.S. Department of Energy

Patricia M. Dehmer has been the Acting Director for the Office of Science since April 2013. She is the Deputy Director for Science Programs in the Office of Science at the U.S. Department of Energy (DOE). In this capacity, Dr. Dehmer is the senior career science official in the Office of Science, which is third largest Federal sponsor of basic research in the United States, the primary supporter of the physical sciences in the U.S., and one of the premier science organizations in the world.

As Deputy Director for Science Programs, Dr. Dehmer provides scientific and management oversight for the six science programs of the Office of Science (basic energy sciences, biological and environmental research, fusion energy sciences, advanced scientific computing research, high energy physics, and nuclear physics), for workforce development for teachers and scientists, and for construction project assessment. The Office of Science supports research at 300 colleges and universities nationwide, at DOE laboratories, and at other private institutions.

From 1995 to 2007, Dr. Dehmer served as the Director of the Office of Basic Energy Sciences (BES) in the Office of Science. Under her leadership, the BES budget more than doubled in size to $1.2B annually. She built a world-leading portfolio of work in condensed matter and materials physics, chemistry, and biosciences. A five-year effort to relate fundamental research in these disciplines to real-world problems in energy – including problems in fossil energy and carbon dioxide sequestration, nuclear energy, renewable energy, energy efficiency, energy transmission and storage, and the mitigation of environmental impacts of energy use – facilitated greater integration of basic and applied research across DOE.

During this period, Dr. Dehmer also was responsible for the planning, design, and construction phases of more than a dozen major construction projects totaling $3 billion. Notable among these were the $1.4 B Spallation Neutron Source at Oak Ridge National Laboratory, five Nanoscale Science Research Centers totaling more than $300M, the total reconstruction of the Stanford Synchrotron Radiation Lightsource at the SLAC National Accelerator Laboratory (SLAC), and the start of two new facilities for x-ray scattering – the Linac Coherent Light Source at SLAC, which is the world's first hard x-ray free electron laser, and the National Synchrotron Light Source II at Brookhaven National Laboratory, which will provide the highest spatial resolution of any synchrotron light source in the world.

Dr. Dehmer began her scientific career as a postdoctoral fellow at Argonne National Laboratory in 1972. She joined the staff of the Laboratory as an Assistant Scientist in 1975 and became a Senior Scientist in 1985. In 1992, the Laboratory established a new scientific rank that recognizes sustained outstanding scientific and engineering research, and Dr. Dehmer was among the 1% of the Laboratory's technical staff promoted to that rank, now called Argonne Distinguished Fellow, in that first year.

Dr. Dehmer's research in atomic, molecular, optical, and chemical physics resulted in more than 125 peer-reviewed scientific articles. Her studies of the interactions of electronic and atomic motion in molecules provided fundamental understanding of energy transfer, molecular rearrangement, and chemical reactivity.

Dr. Dehmer is a fellow of the American Physical Society and the American Association for the Advancement of Science. For the 15 years prior to assuming her position as Director of BES, she served in dozens of elected and appointed positions in scientific and professional societies and on review boards. Dr. Dehmer was awarded the Meritorious Presidential Rank Award in 2000 and 2008 and the Distinguished Presidential Rank Award in 2003.

Dr. Dehmer received the Bachelor of Science degree in Chemistry from the University of Illinois in 1967 and the Ph.D. degree in Chemical Physics from the University of Chicago in 1972.

Chairwoman COMSTOCK. Thank you, and I now recognize Ms. Garton.

TESTIMONY OF DR. JILDA D. GARTON,
VICE PRESIDENT FOR RESEARCH
AND GENERAL MANAGER,
GEORGIA TECH RESEARCH CORPORATION

Ms. GARTON. Good morning, Chairwoman Comstock, Ranking Member Lipinski, Chairman Smith, and members of the Subcommittee. My name is Jilda Diehl Garton, and I serve as the Vice President for Research and General Manager of Georgia Technology Research Corporation at Georgia Tech.

Georgia Tech is a comprehensive public university with more than 25,000 undergraduate and graduate students. We reported more than $765 million in research expenditures in 2015 with research funding from a variety of federal and non-federal sponsors. Private industry sponsors about 13 percent of the total research activity at Georgia Technology, and includes several dozen SBIR and STTR subcontracts. And we do a little tech transfer at Georgia Tech. Georgia Tech is among the top 25 universities in the number of U.S. patents granted in 2014, and over the past five years, 81 companies have been formed based on Georgia Tech technologies.

SBIR and STTR programs are important to universities because these are important to our technology transfer ecosystems. America's universities create amazing new inventions every day. My own institution will receive about 350 invention disclosures this year alone. As creators and stewards of these inventions, we have an obligation to make them available to the public in the form of new products, new drugs, new assistive technologies and new services. University technology transfer works with the private sector to move technologies from the laboratory into companies that can develop them, invest in them, and commercialize them. It's this ecosystem that we want to develop.

Universities value the SBIR and STTR programs, and we generally support their permanent reauthorization at their current set-aside levels, and that's because these are important parts of that ecosystem.

In thinking about how to discuss our experiences with the SBIR and STTR programs, I thought it might be helpful to offer an example that illustrates how the SBIR program in particular interacts with other parts of the innovation ecosystem on my campus to support new ventures that are trying to bring new technologies onto market. I've given you a couple of examples also in my written testimony including one woman-owned company.

Pindrop is an Atlanta-based company that markets a way to combat telecommunications fraud through something they call acoustic fingerprinting. The technology resulted from Department of Defense-funded research that was conducted by a professor in the College of Computing and to students. The invention was closed to GTRC in 2010 and licensed to a new company in 2011. Pindrop's management participated in and was mentored by Georgia Tech's NSF I–Corps program. We're very proud to have been one of those original three nodes.

The company went on to work with our SBIR assistance office, which helps companies that are formed in our environment reach out and identify opportunities in SBIR and STTR programs at various agencies and prepare proposals and submit them in a way that will help them get funded. Pindrop won one of those SBIR awards, and went on to develop their technology, and in January 2016, Pindrop received Series C investment from Google Finance. They're on their way to being a major company in this space.

Pindrop's story shows how development inside the university readied the technology for the marketplace and de-risked it. SBIR funds increased the likelihood that the company would become successful. As it developed its technology, it became more attractive for private-sector investment. Pindrop's story also demonstrates how long it takes and how much investment is actually needed.

You've asked us for advice in areas of potential improvement as you consider the reauthorization of these programs, and I would be remiss if I did not point out that Pindrop would not have been possible without basic research. As the federal investment in research and development conducted at U.S. universities is constrained, it's important to acknowledge that funding basic science and engineering has to be a priority because that's what fills the pipeline of discoveries that feed the innovation ecosystem.

Universities are interested in seeking balance. If I have one thing to offer for your consideration, it would be to focus on the overall fiscal budgets for the research funding agencies and ensure robust investment in basic and applied research to support the highest quality peer-reviewed research.

It remains the case that there's a funding gap that sometimes prevents universities from moving new discoveries and technology into the marketplace. Accordingly, members of the higher education community have recommended creating the SBIR program that would focus on commercialization that we often call Phase zero. These awards could be used by universities to engage in prototyping, mentoring, and supporting market readiness initiatives.

Finally, I would like to suggest that we could all benefit from additional information about the federal SBIR and STTR funding. Dr. Lauer and Dr. Dehmer have talked about a number of efforts at their agencies to analyze the success rates of the programs and how the companies perform after award. These objective measures of performance and indicators of performance would be very welcome.

I'd like to thank the Subcommittee for the opportunity to provide our insights from the university perspective on the important question of reauthorization of the programs, and I look forward to answering your questions.

[The prepared statement of Ms. Garton follows:]

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.

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[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.

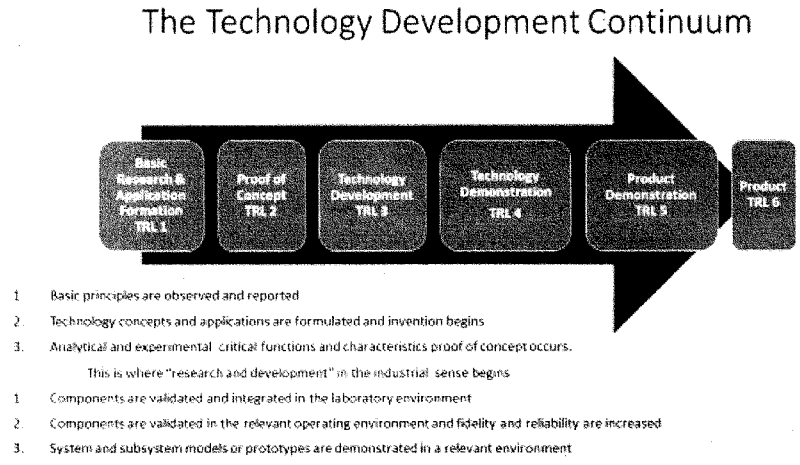
Zyrobotics was launched in September 2013 by Ayanna Howard, the Linda J. and Mark C. Smith Chair professor in Georgia Tech's School of Electrical and Computer Engineering. Zyrobotics is commercializing assistive technology that enables children with limited mobility to operate tablet computers, smartphones, 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.

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[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.

JILDA DIEHL GARTON

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Ms. Garton serves as the Vice President for Research and General Manager of the Georgia Tech Research Corporation (GTRC) and Georgia Tech Applied Research Corporation (GTARC) at Georgia Institute of Technology, a comprehensive university which reported over $765 million in research expenditures in 2015. Ms. Garton is responsible for the financial and business affairs of GTRC and GTARC, including licensing of intellectual property created at Georgia Tech. She directs the activities of the Office of Sponsored Programs, the Office of Research Integrity Assurance and the Office of Industry Engagement.

Ms. Garton is also active nationally in research policy matters. She served on the Board of Directors of the Council on Governmental Relations (1999-2004) including two years as chair of the Contracts and Intellectual Property Committee. She currently serves on the Board of the University-Industry Demonstration Partnership (UIDP) and co-chairs the UIDP's Contracts Accords Working Group. She has also served as a member of the faculty of the National Council of University Research Administrators' professional education programs.

Chairwoman COMSTOCK. Thank you.

I now recognize myself for five minutes for questions.

I guess this is a question to all of you. How do we measure success with the SBIR and STTR programs? Is it things like job growth, employment growth, patents? How do you judge it and what are you looking at?

Dr. KHARGONEKAR. I mean, that's an excellent question, and the National Academies study does talk quite a bit about metrics for success of the SBIR/STTR programs. We look at it as a program as a whole, which is really aimed at taking discovery in the lab to the real world, and we also think about I–Corps and other innovation programs as part of the overall ecosystem.

So in that regard, it's Phase II, Phase IIB funding which really makes it possible for the company's technology to become a real-world company with employment and revenues, and there the numbers are quiet encouraging. The vast majority of Phase IIB companies go on to become very successful companies and have revenues many years out into the future. We also look at intellectual property generated by these companies, and probably most importantly, it's the people because the people who go through these experiences then go on and start new companies throughout their careers. So I think one has to look at the whole system and look at the metrics from that point of view.

Chairwoman COMSTOCK. And I know a lot of you had used the word "ecosystem" which I think is very important, how we create that innovative ecosystems so with our universities, with our businesses, and how do we get that ecosystem, you know, getting the input from the private sector too so as we're investing in these things, there's sort of a leveraging factor that gives it that extra oomph to start doing things. You know, how do you all see that playing out in what you're doing?

Dr. LAUER. So for NIH-funded research, there are some additional components of the ecosystem that are important for success metrics, and those would include moving products on to clinical trials, getting them through the regulatory system, working with CMS and other payers to see whether or not a product once eventually successful will be reimbursed in clinical practice, and then also working with professional societies to realize the incorporation of new technologies into standard clinical practice.

Chairwoman COMSTOCK. Good point. Thank you.

Dr. DEHMER. Well, we've had quite a bit of experience over the last five to ten years of looking at success of non-traditional research programs. We started something many years ago called the Energy Frontier Research programs, and how do we measure their success? We do it in part by the standard metrics of counting publications, licenses, things like tech transfer and how many small businesses and industries are involved. In reality, it's an extremely topic to measure success of non-traditional research and development programs. Not only have I been involved with that, but for the past five years I've been involved with measuring success of programs that do STEM workforce development training, very difficult.

So one of the things that we've done actually in the last year is bring a new person into the SBIR/STTR program, a Ph.D. re-

searcher, whose function is going to be to look at how we measure success and to follow on with some of the programs that we've started and that the traditional SBIR or STTR programs do.

Chairwoman COMSTOCK. Thank you.

Ms. GARTON. One of the ways that we look at measuring the success of our technology transfer efforts is to look at whether or not our patents or our licensed intellectual properties are being utilized at various points after they've either been protected by patent or licensed under other circumstances and ensuring that those technologies are still being used at three, five and seven years after the license, and I think that's one of the measures rather than counting the numbers of patents per se but looking at whether or not those technologies are being used by the private sector and being used to either do additional research or being used and incorporated into new products and services, so looking at whether or not the intellectual property we're creating is being used is one of the important metrics for success both of the university technology transfer but also of the SBIR receiving company because it will itself begin generating intellectual property and we want to see if that's being used as well.

Chairwoman COMSTOCK. So I'm running a little over my time but I did want to give a shout out to my local technological community, the Northern Virginia Technology Council. It's very good at working with all of our technology companies but they also highlight emerging companies and doing things like that and they're very good at publicizing it within communities, and that in turn kind of helps get more support there. Are we seeing that utilized too, having the kind of leverage there that—or maybe since my time is up I'll just ask, is there any way that we can have others such as, you know, NVTC in my community that is very good at it but maybe I'd recommend, you know, others to use that as a model because I think they're particularly helpful in highlighting the whole ecosystem, and that's what they're all about is that ecosystem and supporting it. They support STEM education. They support the emerging companies. They exist by virtue of a lot of support from the big companies but really, everyone in it is driving the ecosystem, and I know they work a lot with their universities too, so looking at that as a model, I just throw that out because they're a great group for us to work with.

I'm recognizing Ms. Johnson. We're going out of order here so Ms. Johnson can have her questioning, and thank you.

Ms. JOHNSON. Thank you very much.

I'd like each of you to respond to the forth statutory purpose of SBIR and STTR programs is to foster participation in innovation and entrepreneurship with socially and economically disadvantaged persons. The National Academies have consistently found that agencies are struggling to achieve this. My concern over the years has been integrating these populations. It's now become of more concern because that's our growing population in this country, and I'm concerned that a lot of our brain power is not being utilized.

So could you comment on what you're doing or whether it's difficult or what we could do to attract that population more?

Dr. KHARGONEKAR. So I think that's a really excellent and difficult question. We at NSF are very focused on this topic. Our lat-

est initiative, NSF Includes, which is a Foundation-wide initiative, is aimed exactly at attracting women, underrepresented minorities, people with disabilities, people from low socioeconomic status, into science and engineering fields. In addition, in the SBIR program, this has been a really major area of focus and concern. As you correctly noted, the progress has been quite slow.

There are several things we are doing. One of the ways in which we use our administrative fee is for very strong outreach programs with our program officers and there is a group of program officers whose full-time job it is to run our SBIR/STTR, go out to these communities in terms of outreach. The Phase 0 program at NSF, it has two objectives, one of which is explicitly to reach out to women and underrepresented minorities in terms of forming companies.

So this remains a major priority for the Foundation, for the SBIR program, and we would love to see faster and more—and stronger progress, and we will continue to work on this problem until we achieve success. Thank you.

Ms. JOHNSON. Thank you.

Dr. LAUER. Thank you, Congresswoman. This is a very high priority for NIH. On an NIH-wide level, we've set up an Office of Workforce Diversity, which his specifically focused on this. The National Institutes of Minority Health has—is expanding its RO–1 program. The—some of the institutes like the NHLBI have actually set up specific units that are devoted to increasing our profile in disparities research, and then within SBIR, we also are engaged in using administrative funds for extensive outreach efforts. The Phase 0 programs are also an opportunity to bring in previously disadvantaged groups into the fold and increase the likelihood of their success.

Ms. JOHNSON. Thank you.

Dr. DEHMER. Well, thank you for that question. In the Department of Energy, we have a particular challenge with women and underrepresented minorities because the work that we do is primarily physical sciences, and the pipeline for bringing those folks into physical sciences has never been cracked to the extent that I would like to see it. And by the way, my own personal time with this goes back to yours in the 1970s.

Within the SBIR/STTR program, we're doing several things. We're definitely increasing our outreach to everyone as my colleagues have mentioned, and one of the reasons we've started the Phase 0 assistance program, which is somewhat different than the other Phase 0 programs described, is specifically to target women and socially and economically disadvantaged persons. It's a huge challenge in the physical sciences. You know, I've observed in my own career, which dates back to the early 1970s, thanks to my bio, which didn't expunge the date of my Ph.D., I can remember when I was a student and my colleagues, who were women and minorities, talked of quotas for medical school and other kinds of professional schools, very small quotas, in the few percents, not double digits. Today, medical schools graduate 50 percent women. Veterinary schools graduate nearly 100 percent women. But the physical sciences have not kept pace at all with that. So that's one of the things the Department of Energy is particularly keen to crack, and

we've done so both in the core research programs and our workforce development programs and in our SBIR/STTR programs.

Ms. JOHNSON. Thank you.

Ms. GARTON. Georgia Tech as a public institution really takes its mission in economic development in Georgia very seriously. We have what we call the Enterprise Innovation Institute, which has a number of offices. The Advanced Technology Development Center is one of the oldest university-based incubators in the country, and it is open to companies from our entire area. Within EII, we also have the SBIR assistance office, which helps small businesses identify SBIR and STTR opportunities, learn about the programs, and learn how to apply to those programs, so that is an office that's available to support all companies that are created in the environment access SBIR and STTR funding. We also operating the Manufacturer Extension Partnership, which helps businesses in Georgia become more competitive and sustainable.

Ms. JOHNSON. Thank you very much. My time's expired.

Chairwoman COMSTOCK. Thank you, and I now recognize Mr. Westerman for five minutes.

Mr. WESTERMAN. Thank you, Madam Chair, and thank you to the witnesses for sharing with us today.

Ms. Garton, you shared the success story of Pindrop, and I appreciate your testimony because it gives us a real-life example that makes it easier to understand the importance of research.

Bill Gates once said—who is obviously one of the great innovators of our time. He said that governments will always play a big part in solving big problems. They set public policy and are uniquely able to provide the resources to make sure solutions reach everyone who needs them. They also fund basic research, which is a crucial component of the innovation that improves life for everyone.

Having an engineering background and sitting on this Committee, I've really enjoyed getting to go see where this research is being done. I made a trip out to the Berkeley National Research Lab and I saw some very exciting research there in biofuels and creating economical methods to use our bioresources to make all kinds of fuels and chemicals. I saw some innovative research with nanotechnology with a material that it's envisioned that if you could create a filter out of this material, you could essentially clean the entire stack emissions from a coal-fired plant, very exciting stuff.

In my home state, the institutions of higher learning are doing some neat research. The University of Arkansas Institute for Nanoscience and Engineering Technology, just amazing some of the things that they are doing.

What I would like to ask you, we've talked about some success stories but could you share with us maybe one exciting new innovation that's on the horizon that's taking place at your organizations and how close are we to seeing those become reality, and I'll start with you, Dr. Khargonekar.

Dr. KHARGONEKAR. I think one of the areas that we are very excited about in the Engineering Directorate is our focus on advanced manufacturing. First of all, historically, NSF has made pioneering contributions in that area. The whole 3D printing industry came

out of NSF-funded research in the 1980s. In recent years, last two or three years, we've been investing in cyber manufacturing that will shape the factories of the future by leveraging cyber technologies, communications, computation, networks and things of that nature. We are investing in cellular biomanufacturing, so as cells become therapies, how do we manufacture those? So we are sort of creating basic research in manufacturing of cells.

And a third area we are making some very exciting investments is in scalable nanomanufacturing, so we invested a lot of funds in nanotechnology and nanoscience, and the question we are asking is, how will we manufacture the products at scale and at cost. So one example is, we funded some research that will use roll-to-roll printing as a way to manufacture this product, which if it works will be extremely cost-effective and produce products that will have big impacts. So these are some of the examples that we are very excited about.

Mr. WESTERMAN. Thank you.

Dr. Lauer?

Dr. LAUER. Thank you, Congressman. This is a very exciting time for biomedical research, and two themes are high throughput technologies and big data, so looking at complex systems and taking advantage of current exploding information technologies.

So some examples include three-dimensional mapping of neurons within the central nervous system in health and disease, quantification of DNA and gene sequencing technologies, drug screens for rare diseases, there are literally millions of political compounds that could be effective for diseases, and we're now being able to figure out ways in which we could identify potentially beneficial targets in a short period of time.

And then another interesting one from a different side, from a purely clinical side, would be the incorporation of patient-reported outcomes into electronic health records.

Mr. WESTERMAN. Thank you.

Dr. DEHMER. Well, in preparing for this hearing, I looked at a number of examples of outcomes from SBIR investments. I don't see them all because I don't look at them day to day, but one of them struck me as extremely important, and that is a small company in Lansing, Michigan, near Michigan State University called Niowave Incorporated. They received a number of SBIR/STTR awards over the last ten years or so to build superconducting linear accelerators, which sounds kind of techy, but one of the things that they did in 2015, they produced Molybdenum-99, Moly-99, by fissioning uranium using one of the superconducting linear accelerators. So the decay product of Moly-99 is Technetium-99, and that's used in 30 million diagnostic imaging procedures annually. The United States has no production of Moly-99. It's all imported. And so Niowave is going to begin, I hope, in a couple of years, 2016 or 2017, producing Moly-99 using this linear accelerator technology. If so, it would be a remarkable achievement. So that's the one that struck me as potentially the most impactful.

Ms. GARTON. Well, as you can imagine, at Georgia Tech there are technologies emerging all over the place. As with Dr. Dehmer, it's hard to keep up with all of them. A couple of the areas where we really see the next technologies emerging that we're all going to be

talking about in 5 or ten years or areas like cell-based manufacturing where we're beginning to be able to reduce these technologies to practical application. Some of the numbering technologies for carbon sequestration, similar to the examples that you cited, are probably going to go a long way toward helping us deal with controlling the emissions out of our carbon-producing factories and other sources of carbon in the atmosphere. And there's other technologies that are closer to the market like our new drug delivery technologies that will allow us to deliver vaccines across the world using delivery methods that don't require refrigeration and can be self-administered. So there's technologies that are emerging all across the spectrum that are just waiting to burst out there.

Mr. WESTERMAN. Thank you.

Thank you, Madam Chair, for indulging a little extra time. I yield back.

Chairwoman COMSTOCK. Thank you.

I now recognize Mr. Lipinski.

Mr. LIPINSKI. Thank you. I mentioned in my opening that early returns show that Innovation Corps, I–Corps teams have shown more success in the SBIR program. So I wanted to ask the witnesses what they could tell us about what they have seen or their thoughts moving forward, and I'll start with Dr. Lauer because I know that you are using—you are making I–Corps available to SBIR grantees at NIH.

Dr. LAUER. Yes. Thank you, Congressman. So, so far 38 companies have gone through the I–Corps program. We've had two cohorts. Our next cohort is kicking off on June 19th with 21 companies, and we're planning an additional two cohorts in 2017, and what we would say so far, it's still too early on in the program to talk about long-term outcomes but the responses have been quite positive. Over 90 percent of the participants have considered the experience to be worthwhile or excellent, and we've seen some interesting examples. One is a company called Cross Life Technologies, which is working on diagnostic tests for viruses like dengue, and some of the work that they're doing may also apply to Zika as well.

Mr. LIPINSKI. Thank you.

Dr. Khargonekar, do you have anything to add to that? I know you mentioned where that sort of fits in what a lot of researchers will do.

Mr. KHARGONEKAR. So we have been very excited about the I–Corps program. It is having tremendous impact on the research community. We constantly hear that those who have gone through the program are transformed by the experience and they think about their research quite differently than they did before. We are partnering with a number of federal agencies to share what we have learned about I–Corps including NIH and DOE but many others. We are also scaling it nationally. We have—has plans for up to eight to nine nodes, and 71 sites and 230 teams. The State of Ohio has adopted I–Corps methodology. So we feel that there is tremendous opportunity for the Nation to take the learning from I–Corps and the program that NSF has pioneered and really make it available to all scientists and engineers who want to take part in it.

Mr. LIPINSKI. Ms. Garton, do you have anything to add about how I–Corps can help those SBIR grantees?

Ms. GARTON. I believe the I–Corps program actually is a good entree to entrepreneurship for a lot of faculty and graduate students who have an invention and are trying to think about a way to commercialize it. So the I–Corps program really does provide that entree for those individuals who are developing the technology in the direction of creating a startup company and launching it, so I think that's a very good way to pull people into the program that leads to SBIR funding. And so I really view that as a piece of the continuum of the development of technologies.

One of the most exciting things I think I've seen really comes out of the Pindrop example where we have a laboratory that successfully launched a startup company, developed it through the I–Corps program, received SBIR funding, and then went on to be successful in the private sector. The graduate students who are coming along as the next cohort of students in that laboratory are bringing invention disclosures forward. They've got philanthropic funding and other funding that they're taking advantage of, and they're going to be your next I–Corps cohort, so you've created an example that others can follow.

Mr. LIPINSKI. And Dr. Dehmer, I know you—the National Labs don't have I–Corps but something very similar, Lab Corps. Have you seen the impact of this, or what do you hope to be the impact?

Ms. DEHMER. Well, actually, we're also a participant in I–Corps. Early on, the Office of Energy Efficiency and Renewable Energy, which is one of the largest contributors to SBIR, signed a one year MOU with NSF to participate in I–Corps. They subsequently extended that to five years, and they've been sending cohorts to that for the past few years. That same office also began Lab Corps, and it's my understanding that it's been very well received and very popular with the laboratory scientists. So yes, we're part of both I–Corps and Lab Corps.

Mr. LIPINSKI. Very quickly, another connected subject. Ms. Garton, NSF has come out with a solicitation to continue funding for the I–Corps nodes. I'm glad that this is continuing. However, it's noteworthy that the solicitation—in the solicitation, the funding for nodes drops to a small fraction of its original amount by the fifth year of the award. I understand the idea is that other sources of funding for the nodes will step in as federal funding declines. I have some concerns about this. I was wondering what your thoughts were on this. Has Georgia Tech identified other sources of funding for its node that could step in if federal support declines?

Ms. GARTON. We certainly would endeavor to work in that direction is that is the direction for the program, and I would have to get back with you specifically and talk with the folks that are developing the proposal about specific sources of funding that have been identified. Maybe I could take that question for later, but we would certainly—if those are—if that's the direction we want to go, that's what we will try to do, but it will be a challenge.

Mr. LIPINSKI. Thank you.

I'm way over time. I yield back. Thank you.

Chairwoman COMSTOCK. Thank you.

I now recognize Mr. Palmer.

Mr. PALMER. Thank you, Madam Chairman.

Mr. Khargonekar, the idea for the Small Business Innovation Research is to fund innovative technologies that the private sector may not be inclined to fund, in other words, address the problem of underinvestment in R&D. Is the program serving this purpose of it is focusing on proposals that are based on commercial viability, technical merit, or an agency's agendas?

Dr. KHARGONEKAR. So the NSF SBIR program is very much focused on technology risk, very early stage where there is a discovery or invention that has some commercial potential but it's very far from being worthy of private-sector investment. So that's where we come in and put funding to the Phase I, Phase II, Phase IIB to be sequenced to see if the technology risk can be reduced or even eliminated, and once that happens, private sector feels more comfortable coming in because that risk has been removed, so I would say absolutely. Our investments have been very much focused on reducing the technology risk and making the technology more mature so that private sector at that point can come in and scale the technology and commercialize it.

Mr. PALMER. But are any of these grants grants or research dollars the private sector would have provided? Are you displacing private-sector investment?

Dr. KHARGONEKAR. In my opinion, no. I mean, I think a great example of that is our Phase IIB programs. Let's say you are an inventor or a discoverer. You come up with something. You go through the Phase I and Phase II. In Phase IIB, we require a two-to-one match, so it's only at that point that the private sector is brought in—the private sector feels that they can come in but the risk has been reduced substantially, and so I don't think it's displacing the private sector, at least at NSF because we are at such early stage of the technology creation.

Mr. PALMER. Is any of it driven more by an agency's agenda? And Dr. Lauer, you can respond to that as well.

Dr. LAUER. Thank you, Congressman. There has been some work that's been done looking at whether or not NIH support is crowding out private investments, and we'd be happy to share some of that with you in follow-up, but it seems that most people are concluding that the answer is no and that the work that NIH is supporting is indeed work that otherwise would not have been supported by private sector.

Our primary goal is to enhance our understanding of the knowledge of living systems and then apply that knowledge to improve health and reduce burdens of disease. That's our agenda, and as best as we can tell, we're meeting that.

Mr. PALMER. Thank you.

Dr. Dehmer, are any of the grants primarily determined by the Department of Energy's agenda or are they strictly looking at the research or the project?

Dr. DEHMER. The way that we determine topical areas that are funding opportunity announcements is——

Mr. PALMER. Can you get a little closer to the microphone?

Dr. DEHMER. The way that we determine the topical areas for the funding opportunity announcements is by going out to all of the

programs and having them suggest the topical areas and the subtopics that we put out in the FOAs. I can't speak to all of the subtopics but certainly in the Office of Science, there are a number of topics that probably the private sector wouldn't be investing in in the very early stages.

Mr. PALMER. This is a question for all of you. The Inspectors General at federal agencies seem to identify and pursue instances of fraud and abuse in these programs with a fairly high degree of regularity. Are there facets of the programs that seem to invite wrongdoing? Are there identifiable characteristics that you look for for bad-apple applicants? Is there a way to vet these applicants to avoid fraud?

Dr. KHARGONEKAR. We at NSF certainly are very focused on this and try to do our very, very best to make sure that the amount of fraud is as minimal as possible. We have an extensive process of vetting the companies and looking at the financials and making sure that these are legitimate businesses with accounting and so on and so forth, so we can give you more detail about the process we follow at NSF to ensure that our recipients are worthy companies.

Dr. LAUER. I would say the same. Our SBIR grants go through the same rigorous vetting and review and oversight as all the grants at NIH.

Dr. DEHMER. Yeah, I'll echo that. I actually engaged in a discussion on this with the Director of the SBIR/STTR programs office just this week, and it's a complicated topic. We'd be happy to get back to you on that if you like.

Mr. PALMER. What I'd like to know, Madam Chairman, in these cases where there have been abuses of the program, what our remedies are, if there's any effort to recover this, because we are talking about oversight over taxpayer money ——

Chairwoman COMSTOCK. Okay. Thank you.

Mr. PALMER. —without——

Chairwoman COMSTOCK. We're going to have votes here at 11:15 to 11:30 so I'm going to have to move on.

I now recognize Ms. Bonamici.

Ms. BONAMICI. Thank you, Chair Comstock and Ranking Member Lipinski, for holding this hearing.

To our witnesses, the SBIR and STTR programs have helped universities and small businesses not only in my State of Oregon but of course across the country. TomegaVax is one example, an Oregon Health Science University-based startup that's received funding from the programs. They are developing vaccines and immunotherapies for chronic and recurring viral infections and they're now based on this research recruiting the first human volunteers for a clinical trial on a promising HIV vaccine. So great programs, but I had a conversation recently with our institutions of higher education and some innovative small businesses, and a couple things came up, and I'm going to ask you about those.

First, I heard about a woman who has a Ph.D. in cancer biology, decided not to go back to work after her kids were born because science funding is complicated and tenuous. I also heard from a small business—a creative small business owner, very innovative, who said that they don't even look at the SBA for funding because

application process is complicated and time-consuming. This is someone who's a patent attorney with an MBA, so if it's not user-friendly to somebody like that, the first issue is, what is being done to address the complication and the, I guess, tenuous nature of science funding in general?

The second issue that came up that I'll ask you to address is the funding gap between Phase I and Phase II, and we heard about up to 6 to 9 months can go by between Phase I and Phase II, and if it's a small business with just a couple of employees, they don't know what to do for that time, and they're really—it's really killing some efforts and what could be some very innovative products.

So I guess I'll start with Dr. Khargonekar, if you could discuss the whole process and how complicated it is and uncertain and the funding gap, please, between Phase I and Phase II. Thank you.

Mr. KHARGONEKAR. So the Phase I/Phase II gap has been a significant focus for the Foundation. Prior to 2015, we added a Phase IB supplement to Phase I grantees so that they would have some additional dollars so that the gap could be addressed to some extent, but in 2015 and 2016, we made a significant change. We did several things. We increased the Phase I duration to 12 months. We increased the Phase I amount to $225,000 from 150 so that gives you more dollars and longer runway. And then we changed the deadlines so that you can submit the Phase II grant after 8 months of Phase I start so that allows—it doesn't completely eliminate the gap but it allows it to be much smaller than it has traditionally been.

And I'll add one final point. We rely a lot on the Phase I interim report to know if the technology is really viable because we want to be responsible stewards of taxpayer dollars. So with these changes and making sure that the Phase I interim report guides us in terms of the Phase II decision, we feel that we have taken a number of steps that would address the funding gap that you point out, and it's an area that we will continue to work on.

Ms. BONAMICI. Thank you.

Dr. Lauer?

Dr. LAUER. Thank you, Congressman. We do recognize that it takes too long for applications to be processed and so beginning about a year ago, we made a number of administrative steps to streamline the SBIR application process, and we hope to have some promising metrics available for you before too long.

Regarding the Phase I/Phase II gap, we have a mechanism called Fast Track where one can apply for combined Phase I/Phase II at the same time. The idea is that if you meet certain metrics through Phase I, you automatically move into Phase II, and that has been growing. It's now—about 25 percent of our Phase II programs go through Fast Track, go straight from Phase I to Phase II.

Ms. BONAMICI. Great. Thank you.

Ms. DEHMER. We've done similar things to what's just been described. We have a fast track program, and we've made a number of changes in how the awards are handled to reduce the gap. Also, in terms of the complications of application, we've tried using a new electronic application system to streamline that somewhat, and as I mentioned in my own testimony, we reduced the time from the close of the FOA to the actual award by a factor of two,

and so we're trying very hard to make things easier for the applicants.

Ms. BONAMICI. Thank you.

Ms. Garton?

Ms. GARTON. Well, we don't—Georgia Tech as a university is not a direct recipient of SBIR funds, so the funding gap is less obvious to us. But in our subcontracting practices, we certainly do notice the discontinuity between Phase I and Phase II and try to work with our SBIR companies that are funding us under subcontracts to support their proposal efforts.

Ms. BONAMICI. And are you sensing the same sort of discouragement that I heard from a couple of people in this conversation about it's so complicated and tenuous? And for the record, I was not in Congress when the Budget Control Act passed, not part of the sequestration and those, you know, across-the-board budget cuts, but are things getting better out there or——

Ms. GARTON. It is very, very tough on the basic science side. The pay lines are such that it is very hard for faculty to get their basic and applied research programs funded, and that's really the balance part of the question. Do we have enough funding going into overall research programs, and what are the pay lines? It is very difficult. I think Dr. Lauer talked about it in his testimony.

Ms. BONAMICI. He did. We got that message clearly in Dr. Lauer's testimony.

Ms. GARTON. And yes, we are——

Ms. BONAMICI. Thank you.

My time is expired. I yield back. Thank you, Madam Chair.

Chairwoman COMSTOCK. Thank you.

I now recognize Mr. LaHood for five minutes.

Mr. LAHOOD. Thank you, Madam Chair, and I want to thank the witnesses for being here today and your testimony. I want to take a brief moment just to highlight the impact of the SBIR program in my home state of Illinois. The SBIR program is an important source of investment in new technology for the State of Illinois. Since the program's inception, Illinois has received over $600 million in SBIR funding, creating thousands of new jobs, new products and new services.

As others have mentioned, the recent National Academy reports on the SBIR and STTR program in the civilian agency side a very strong record of commercialization and return on investment as well as strong linkages to the university and basic R&D infrastructure within the country, which is clearly evident in the State of Illinois.

With the past successes of this program in mind, as we look to reauthorization of SBIR and STTR, what top recommendation would each of you make for improving the SBIR and STTR programs to more efficiently and effectively promote innovation and job creation? Doctor?

Dr. KHARGONEKAR. Yes. So we support permanent reauthorization. We support maintaining the flexibility in the program. That I think has been very, very important, at least for the National Science Foundation, to maximize the value to society and to the taxpayer of SBIR-funded research. Those are some of the top rec-

ommendations that I would make is maintaining the flexibility in the SBIR program.

Mr. LAHOOD. Thank you.

Dr. LAUER. Yes, I would echo that flexibility, which is especially important to biomedical research because of the additional challenges of getting a product into clinical practice. We also strongly encourage the continuation and strengthening of Phase zero, and the administrative support.

Dr. DEHMER. Absolutely. I echo that completely. The flexibility, the option to have a small fraction of the budget for administrative support are the key things that we would recommend.

Ms. GARTON. I agree. I think the flexibility that the agencies have, the ability to continue to expand the Phase 0 sorts of pilots and make those more generally available, and to maintain the set-asides at their current levels would be my major recommendations.

Mr. LAHOOD. Thank you for that.

In terms of measuring success or the metrics used to do that under both SBIR and STTR, can you comment a little bit on how you measure success in those two programs?

Dr. KHARGONEKAR. So as I described earlier, we think of SBIR/STTR as part of a portfolio that connects discovery in the lab, invention in the lab, with real-world commercialization. So it's a piece of an ecosystem involving Innovation Corps program that we talked about earlier in this testimony as well as many of our research centers—ERCs, RUCRCs, science and technology centers. In terms of success, one has to look at ultimately formation of companies, creation of new technologies, and I really emphasize people. I mean, ultimately it's people who go through these programs, they become lifelong contributors and inventors and discoverers that will add to the economic competitiveness of the Nation. So I would look at people who are changed by these programs.

Mr. LAHOOD. Thank you.

Dr. LAUER. I would say in addition to the traditional metrics for biomedical research, we would consider two important factors. One is incorporation into clinical practice; does it actually benefit real patients in the real world. And then the second is, some of our SBIR work goes into developing tools for research researchers can use to advance science, and we have seen examples where tools have led to advances in knowledge that otherwise could not have happened.

Mr. LAHOOD. Thanks.

Dr. DEHMER. One of the things that we've done in our STEM education—science, technology, engineering and mathematics—workforce development is to set up systems that will track students, participants over a long period of time and enable us to look at outcomes five, 10 and more years down the road, and I think if you really want to do these kinds of assessments properly, you can't look at short-term outputs; you have to look at the long term. And so those would be my recommendations.

Mr. LAHOOD. Thanks.

Ms. GARTON. And I think one of the major purposes of the SBIR and STTR programs is to help universities, at least from our perspective, is to help us get the research results, the things that come out of our laboratories, into the marketplace so that the public can

benefit from them. So I look at whether or not the technologies that we create and we launch through these companies are actually being used and are they available to the public.

Mr. LAHOOD. Thank you.

Those are all my questions, Madam Chair. Thank you.

Chairwoman COMSTOCK. Thank you.

And I now recognize Ms. Clark for 5 minutes.

Ms. CLARK. Thank you, Chairwoman Comstock and Ranking Member Lipinski, for this hearing, and thank you to all of our witnesses today. We are delighted to have you, and I think your testimonies have underscored the immense value of the SBIR and STTR in making sure we're taking that research out of the labs and into the private sector. We're very grateful for you being here.

Dr. Dehmer, I'd like to go back to a program that you mentioned, which is the Phase 0 assistance program. As we see women increasingly—we're up to 30 percent of women who are owning their own businesses, and it's one of the fastest growing sectors, but we're not where we should be, especially with women of color, and I wondered, as one of the primary focuses of these programs is to encourage participation women and minority-owned businesses, I wondered if you could go into a little more detail on how the Phase 0 program benefits businesses that may be submitting a proposal for the first time and how you see the Phase 0 encouraging women and minority-owned businesses.

Ms. DEHMER. Well, so there's two parts to that. The first is outreach to women and minority-owned businesses, and we're working hard to increase our outreach through various mechanisms, through physically getting on the road, through webinars and so forth, and the second is enabling people through small investments to be better prepared to write successful SBIR grants for the first time, and I think that's very important. This actually goes beyond just SBIR. This goes to enabling people who have never submitted a research grant to be able to do it successfully, and so our Phase 0 program—there's many different Phase 0 programs so they're not all the same. But ours specifically provides people with help in navigating the federal system, the application system, and giving them help in letter-of-intent writing. If you don't write a good letter of intent for the programs, you're out right away, at least in some of the research programs, how to write a Phase I proposal, how it gets reviewed, how you're going to submit it, communication and marketing research, technology advice and so forth.

So what I've personally observed with young people submitting proposals for the research programs, and that applies to first-time applicants to SBIR, is that they will need help navigating the federal system and learning the basics of how to do something successfully, and frequently they aren't successful just because they don't know.

Ms. CLARK. Do you know how many Phase 0 program participants have been successful in securing SBIR or STTR awards?

Ms. DEHMER. Yeah. So it's—so it's a new program, and the only thing we know so far is that the success rate for people who have been through the Phase 0 program is about the same as the success rate for others, and at first blush, you might think that that wouldn't be the case because the people submitting for the first

time would be less successful. But I think it's actually going to take a lot more statistical analysis with control groups and so forth to know for a fact that the Phase 0 program is helping, but we do know that the success rate is about the same for first-time applicants who have been—or for recent applicants who have been through the Phase 0 program compared to those who do not.

Ms. CLARK. Thank you.

And Dr. Lauer, the National Academies 2015 assessment of the SBIR/STTR at NIH found that women and minority participation is "low and declining." Are you aware of any changes or approaches that are being taken at NIH to address this problem?

Dr. LAUER. Congresswoman, yes. We are aware with the finding in the NAS report and we are quite concerned about that as well. Our SBIR office is engaged in a number of outreach efforts, which I mentioned specifically in my opening testimony. We're also looking, similar to my colleague here, at how the Phase 0 programs can help, and we'd be happy to follow up with some more details.

Ms. CLARK. Thank you very much.

And just very generally, Dr. Khargonekar, have you seen the discrepancy between NSF's overall funding level increases and the SBIR/STTR funding? Has that had an effect on NSF's mission?

Mr. KHARGONEKAR. I mean, I think what it has done is, since the growth in our basic research budget has not been as strong, it has reduced the amount of funding we have available for funding over core research programs in all areas of science and engineering, and that's the reason why we are saying that let's not increase the set-aside percentages as a way to increase the SBIR/STTR program, let's grow the entire research budget, which allows SBIR/STTR to grow. So yes, it has had impact.

Ms. CLARK. And I agree with you. I think we need to increase the pie, not reallocate the slices.

But thank you all. Thank you for your testimony and your work, and I yield back.

Chairwoman COMSTOCK. I now recognize Mr. Tonko for 5 minutes.

Mr. TONKO. Thank you, Madam Chair.

I for one am excited that we're holding this hearing today because I very strongly believe that reauthorization of the SBIR/STTR program is of the utmost importance. In fact, it should be broadened and extended and enhanced. I so much believe in it. This program has proven to be one of the most successful federal programs for technological innovation in our history, delivering more than 70,000 patents and valuable innovations in agriculture and defense and energy, health sciences, homeland security, space transportation and other fields. You can't get better results than that.

Through Phase I and Phase II, SBIR countless jobs have been created in the capital region of New York that I represent. It is through programs such as SBIR that my district has developed the underpinnings of support for a boom in high-technology innovation and economic development. I would cite International Electronic Machines Corporation in Troy as a stellar example of all of that.

Let me begin with Dr. Lauer. The 2011 reauthorization allows NIH, DOD and the Department of Education to conduct a pilot pro-

gram to allow a small business to receive a Phase II without having received a Phase II award, also known as the Direct to Phase II pilot. I have some concern that allowing companies to skip Phase I would shut out some small businesses from competing for SBIR award funding. Can you elaborate, Doctor, on Direct to Phase II funding and efforts to prevent marginalization of some small businesses out there?

Dr. LAUER. Thank you, Congressman. I think part of the reasoning for that is that we've observed that it's rare that a project goes from Phase 0, Phase I, Phase II, Phase IIB and then final approval and marketing. The process in the real world is not that linear, and often there are, for example, two Phase II awards that ultimately lead to development of a product. So the idea of Direct to Phase II was to consider other pathways by which a product may eventually make it.

Mr. TONKO. So there shouldn't be a risk of marginalization?

Dr. LAUER. Well, we certainly don't want that to happen, and that, I think, gets to the point that a number of your colleagues have made, which is that we have to track metrics very carefully, and that we are doing.

Mr. TONKO. Okay. I appreciate that.

The research and development of technologies in the biotech field, the energy sector, as well as other technology areas require large investments of capital in the range of hundreds of thousands if not to millions of dollars. The 2011 reauthorization provides increased flexibility to agencies in the amount of funding they award to small businesses under SBIR.

Additionally, I'm informed that the timeline for innovation does not necessarily fit neatly into the Phase I, Phase II and Phase III approach used by our SBIR program. The last reauthorization also allows agencies more flexibility to structure the funding award at their discretion. So I would ask each of our witnesses, how have each of your, you know, agencies or sections, your divisions, implemented these new flexibilities?

Mr. KHARGONEKAR. As I mentioned earlier in this testimony, we certainly have used the flexibility. For example, we've increased the Phase I award size. We have increased the duration of Phase I. We have increased the Phase II and Phase IIB sizes. We have used Phase IIB to attract more private-sector funding through the two-to-one match requirement. So if you want to get Phase II funding from NSF, private sector has to come in with the two-to-one—twice the amount that NSF would provide. So we certainly have used the flexibility that have been afforded to us to increase the overall impact of taking discovery and invention and commercializing it to the real world.

Mr. TONKO. Thank you, Dr. Khargonekar.

And Dr. Lauer?

Dr. LAUER. So at NIH, two examples would be the Phase IIB awards as well as the bridge awards, which the National Cancer Institute has implemented, and these awards enable up to three years of funding, a million dollars a year, and this is particularly important when you're trying to move a product into clinical trials.

Mr. TONKO. Thank you. And Dr. Dehmer?

Ms. DEHMER. Yeah. I think you've heard a lot of examples from me in DOE and from my colleagues. I think the bottom line here is that increased flexibility enables an agency to do experiments that are targeted at the kinds of small businesses that the agency wants to develop, and without that flexibility that allows experiments, you simply are going to be locked into a structure which may not fit everyone. I've observed in my own research career and in my management career at DOE watching several groups of the same kind that are funded at very different places evolve in different ways because we allow them the freedom to evolve, and what you find are best practices and innovation, and that then can be ported from one group to another. So the flexibility to allow experimentation is extremely critical in this program, and the 2011 authorization, which provided that, was terrific.

Mr. TONKO. Thank you.

And Ms. Garton?

Ms. GARTON. The flexibility that the agencies are using helps our companies. The companies that we create follow a non-linear path, as somebody just said. It really is variable across a sector and across the technology development pathway because things come up in the development of those technologies, and having that flexibility to have a second Phase II, to have bridge funding, that's really critical for those companies because that gives them flexibility.

Mr. TONKO. Well, I think harnessing the intellect of this Nation in the midst of an innovation economy is an awesome assignment. You're doing that and doing it very well.

And with that, Madam Chair, I yield back.

Chairwoman COMSTOCK. Thank you, and I'd like to thank the witnesses today, and thank you for your passion, for your important work, and the importance of basic research and our role in that, and really appreciate your support for the innovation economy and how we're going to do that, and I did note that we have a number of students here. Are these students that we have? If you're a student, raise your hand. Great. It's been very nice to have students here, and I hope you appreciate all the good work that's going on here, and see a lot of the support, and if you're science students and STEM students in any of those fields, we are definitely interested in making sure you stay in those fields. We need you in those fields, and these are the leaders that you'll want to be watching over the years and hopefully joining.

So thank you, students, for being here today, and again, thank our witnesses for all they do in this very innovative and exciting field, and we are now adjourned.

[Whereupon, at 11:22 a.m., the Subcommittee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Pramod Khargonekar

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Pramod Khargonekar, Assistant Director, Directorate for Engineering National Science Foundation

Question submitted by Rep. Barbara Comstock, Chairwoman, Subcommittee on Research and Technology

Q1: SBIR and STTR grants are awarded competitively. Could you describe the competitive process your agency uses? Do you think the underlying quality of applications has been increasing?

A: All NSF proposals are reviewed for Intellectual Merit and Broader Impacts. For more information, please see the following webpage: https://www.nsf.gov/eng/iip/sbir/peer_review.jsp. The merit review criteria are also listed in the solicitation document. All proposals are reviewed by external experts, who give advice to the NSF Program Directors on both technical and commercial aspects of the proposals. The NSF Program Directors in SBIR/STTR, who have both advanced technical background and business/entrepreneurial experience, make award recommendations.

NSF has been conducting extensive outreach activities to the entrepreneurial community and providing entrepreneurial training to existing Phase I and Phase II grantees. With the newly announced Phase 0 pilot, which helps companies increase their chances of submitting a successful Small Business Innovation Research (SBIR) or Small Business Technology Transfer (STTR) proposal, NSF will continue to make all efforts to increase the quality of SBIR/STTR applications.

Q2: What fraction of SBIR/STTR applicants at your agency are first-time applicants? Do you know what the success rate is for the first-time applicants? Do you conduct outreach activities to spur more interest among small businesses that haven't participated in SBIR or STTR?

A: In FY 2015, 52% of Phase I applications were from small businesses that had not previously applied to NSF. The success rate for these applicants was 14%, as compared to 12.5% for all applicants.

NSF conducts extensive outreach to communities which might not have participated in SBIR/STTR previously. This includes outreach to incubators and accelerators, industrial trade associations, and scientific groups. Just in the past 12 months, NSF has worked with dozens of such groups to get the message out to entrepreneurs who might not have any prior experience with the SBIR or STTR programs.

Q3: What fraction of SBIR/STTR awards are to small businesses that have received other SBIR/STTR awards? If it is a large fraction, is it a concern that awards are concentrated this way?

A: For the FY2015 Phase I SBIR/STTR awards made by NSF, only 12% of awardee small businesses had received any prior Phase II SBIR/STTR awards from any Federal agency. The percentage of NSF SBIR/STTR awards that go to small businesses with prior Phase II awards from other agencies has decreased dramatically over the past five years.

A Phase I award is required for a company to apply for a Phase II award. For Phase I awardees who successfully compete for Phase II awards, a separate tracking of Phase I awards is not necessary. For companies who received prior Phase I awards, but did not compete successfully for Phase II awards, NSF does not particularly track them. This is because Phase I awards have much smaller award sizes and shorter durations, aiming to demonstrate the feasibility of the innovative concepts. In the spirit of encouraging innovative thinking and risk taking, NSF generally encourages awardees who failed to receive Phase II award previously to try again.

Q4: Please compare the following:

Total SBIR/STTR dollar obligations in FY14 with estimated FY16.
Total number of SBIR/STTR applications in FY14 with estimated FY16.
Total number of SBIR/STTR awards in FY14 with estimated FY16.

Fiscal Year	Total Obligations	SBIR/STTR Applications	SBIR/STTR Awards
2014	$162.0M	2399	411
2016	$187.8M (est.)	2472	456 (est.)

Q5: GAO reports regularly that some agencies fail to comply fully with their SBIR/STTR data reporting requirements. Without reliable data, SBA can't give Congress the information and feedback needed to oversee the programs and assessing their success and value. Now that participating agencies are allowed to use a small percentage of the program set asides to cover administrative costs, is there any reason why data reporting requirements shouldn't be met by every agency?

A: NSF uses the administrative fee for a variety of purposes including outreach to underrepresented groups, establishing a national and regional SBIR/STTR conference planning process with SBA Phase 0 tutorial, etc. NSF also provides funding to collaborate with SBA in establishing standard data systems as required by the Policy Directive including applications, awardees, and commercialization results; integration of the company registration process; and timely submission of annual reports and other documents as required. This will help provide SBA-managed centralized data systems to meet reporting requirements in a timely fashion. The administrative fee is helpful for a variety of purposes including meeting the reporting requirements. NSF has been complying with SBIR/STTR data reporting requirements.

Q6: What could Congress do to spur full compliance by all agencies?

A: NSF is currently complying with all reporting requirements and cannot speak on the behalf of other agencies.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Pramod Khargonekar, Assistant Director, Directorate for Engineering National Science Foundation

Question submitted by Rep. Gary Palmer

Q1: What is the amount of SBIR and STTR granted funds your agency and your agency's IG have identified in the last five years as fraudulent or misused taxpayer dollars, and how much of that amount has been recovered by the agency or the Department of Justice?

A: Since FY2012, NSF has recovered $6,300,622 through award terminations, returned checks, civil settlements, criminal restitution and fines. These recoveries were made from awards to 29 different small businesses. The above figures only include the NSF portion of cases that involved awards from multiple agencies, and they do not include ongoing cases that may result in additional recoveries in the next few years.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Pramod Khargonekar, Assistant Director, Directorate for Engineering National Science Foundation

Question submitted by Rep. Ralph Lee Abraham

Q1: Is your agency taking any specific action to improve the number of awards or the participation by states that have not traditionally done well in the SBIR program? If so, are these steps working and could you be doing more?

A: Yes. The administrative fee provides NSF the flexibility and resource to conduct outreach to states which have not traditionally been active in SBIR/STTR. The NSF has participated fully in the recent SBIR Road Tour events, organized by SBA, through which NSF Program Directors have visited over 20 different states, almost all of them underrepresented in terms of SBIR/STTR funding. Beyond this activity, NSF also reaches out to many underrepresented states and communities and provides information about NSF SBIR/STTR programs.

We believe that these steps are working, because the number of new applicants to the program has grown significantly over the past several years, both in numbers and in terms of a percentage of total proposals.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Pramod Khargonekar, Assistant Director, Directorate for Engineering National Science Foundation

Question submitted by Rep. Daniel Lipinski, Ranking Member, Subcommittee on Research and Technology

Q1: Since SBIR and STTR are carved out as a percentage of extramural R&D obligations, SBA requires agencies to report their methodologies for calculating this figure. SBA requires agencies to submit their annual obligations rather than their budget plans for that fiscal year. What are the NSF's challenges calculating the extramural R&D budget? Additionally, what is the SBA doing to help, and what, if anything, can Congress do to assist? Also, agencies also have the flexibility to exclude certain expenditures from their extramural R&D budget, such as facilities. Please include in your response what challenges NSF faces distinguishing between and identifying R&D and non-R&D? What are the NSF's challenges calculating the extramural R&D budget?

A: NSF faces no major challenges in calculating its extramural R&D budget. NSF's intramural R&D costs are associated entirely with funding for Federally Funded Research and Development Centers. This is a specific set of activities that is tracked separately in NSF's budget process.

Q2: Additionally, what is the SBA doing to help, and what, if anything, can Congress do to assist?

A: The main concern from NSF's perspective is the expectation that annual funding be a specified share of agency obligations for a particular fiscal year. Since actual obligations are not known until the end of the fiscal year, NSF relies on prior year estimates to set an overall target for SBIR/STTR at the beginning of a particular fiscal year. Consequently, it is rare that NSF is exactly "on target" following the close of a fiscal year, but the results over time provide the required level of investment. Further clarity from SBA and/or Congress on the expectations for using actual obligations vs. planned budgets would be helpful.

Q3: Also, agencies also have the flexibility to exclude certain expenditures from their extramural R&D budget, such as facilities. Please include in your response what challenges NSF faces distinguishing between and identifying R&D and non-R&D?

A: NSF does not face any challenges distinguishing between and identifying R&D and non-R&D. At NSF, all costs classified as "conduct of research and development" under OMB Circular A-11's character classification schedule, with the exception of the costs of the Federally Funded Research and Development Centers , form the basis for calculating the SBIR/STTR budget.

Q4: Many small businesses use SBIR awards as a springboard to private sector funding and commercialization of their business, a goal of the SBIR program. However, there are some companies that receive SBIR awards year after year and never fully commercialize. How has NSF implemented the requirement to measure the rate of commercialization for a small business and to establish a minimum performance standard? What have been the outcomes?

A: NSF requires a full disclosure of the commercialization history for any applicant which has received prior Phase II awards from any Federal agency, and this information is a significant factor to be considered during the merit review process.

The NSF has not established a specific minimum performance standard for prior commercialization, above that mandated by the SBA, partly because most of our current SBIR/STTR awardees are new small businesses with little to no prior Federal funding.

Q5: The 2011 reauthorization requires agencies to increase their effort to prevent duplication of awards. Duplication of awards can happen as a result of one agency not knowing another agency has also funded the same work by an applicant. How has NSF implemented the new data sharing requirements, especially concerning awardees? What have been the challenges?

A: The NSF has uploaded data on all SBIR/STTR awards, typically quarterly, to the central database at www.sbir.gov. In addition, NSF has implemented rigorous processes, some of which leverage internal and external databases, to check for potentially overlapping funding, prior to the award of any Phase I or Phase II grant. NSF has not experienced any significant challenges in terms of data sharing or working with other agencies in this endeavor.

Q6: The SBIR program has faced a long-running issue with reports of fraud, waste, and abuse on the part of small businesses. As a result, the 2011 Reauthorization included significant new requirements for preventing and reporting fraud, waste, and abuse. Many agencies already had rules in place to prevent these kinds of acts of malfeasance by bad actors. What additional measures has NSF implemented to meet the new requirements?

A: The SBIR/STTR program at NSF has worked aggressively, in close cooperation with Office of Inspector General (OIG), to reduce fraud, waste, and abuse, and to more easily identify and prosecute suspected wrongdoing. Among other things, since 2011, NSF has taken the following steps:

(1) Clarified the definition of primary employment in legal certifications and program documentation;
(2) Created and mandated new legal certifications for Phase I awardees about award expenditures;
(3) Modified Phase II project spending report templates to ensure compliance and clarity;
(4) Added certifications to the financial management systems questionnaire used as part of their view of all potential Phase II SBIR/STTR awardees;

(5) Added certification requirements for all Phase I and Phase II supplemental awards;
(6) Clarified award terms and conditions language around project changes;
(7) Widely advertised the Fraud, Waste, and Abuse Notification hotline in program solicitations and on NSF website; and
(8) Organized and participated in a well-attended, OIG-led one-day workshop on fraud, waste, and abuse in the SBIR Program, held in May 2016, with participation from many Federal agencies as well as U.S. Attorney's offices.

Responses by Dr. Michael Lauer

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Michael Lauer, Deputy Director for Extramural Research, National Institutes of Health

Questions submitted by Rep. Barbara Comstock, Chairwoman, Subcommittee on Research and Technology

1. **SBIR and STTR grants are awarded competitively. Could you describe the competitive process your agency uses? Do you think the underlying quality of applications has been increasing?**

NIH uses a rigorous and congressionally mandated two-tiered peer review system to ensure only the most meritorious scientific proposals are awarded. All NIH applications, both SBIR and STTR applications as well as other grant programs, go through these two tiers. The first tier is peer review. When a small business applies for a SBIR or STTR award, their application is sent to NIH's Center for Scientific Review (CSR). Here, a referral officer will assign the application to a small business study section and to the appropriate Institute or Center (IC). In the study section, the application is assigned to a Scientific Review Officer (SRO), who will recruit the appropriate reviewers to establish the peer review committee. Before the peer review meeting, reviewers give the application a preliminary overall impact score on a nine point scale, with 1 being the best and 9 being the worst. These preliminary scores are used to determine which applications will be discussed in full at the meeting. During the peer review meeting, applications that are discussed will be assigned a final impact score by reviewers, which is based on scientific merit and does not determine if the application will be funded. For Phase II SBIR/STTR applications, a technology's commercialization potential is also evaluated during the review process. After the meeting the SRO prepares and releases a summary statement to the applicant and IC SBIR/STTR programmatic staff for all applications. The second tier of review is conducted by a National Advisory Council or Board of the respective IC. The Council or Board provides a secondary level of review for all applications and funding recommendations to the IC Director who makes final funding decisions. Advisory Councils or Boards are composed of scientists from the extramural research community and public representatives.

Because there are many potential measures of application quality and numerous caveats to each, it is difficult to make a quantitative assessment of whether it has been improving over time. However, there are some anecdotal and semi-quantitative indications that application quality has been improving over time.

2. **What fraction of SBIR/STTR applicants at your agency are first-time applicants? Do you know what the success rate is for the first-time applicants? Do you conduct outreach activities to spur more interest**

among small businesses that haven't participated in SBIR or STTR?

From year to year, approximately one third of applicants are first time applicants and are new to the program with success rates comparable to the remainder of the program. NIH conducts extensive in person and webinar outreach across the country to attract new businesses to the program.

3. **What fraction of SBIR/STTR awards are to small businesses that have received other SBIR/STTR awards? If it is a large fraction, is it a concern that awards are concentrated this way?**

Approximately two thirds of small businesses receiving NIH SBIR/STTR awards have received other SBIR awards. NIH has no concern about this proportion as the programs are designed to be sequential and there are mechanisms in place to ensure that applicants must demonstrate progress between Phase I and Phase II and not receive Phase I award after Phase I award.

4. **Please compare the following:**
   a. **Total SBIR/STTR dollar obligations in FY14 with estimated FY16.**
   b. **Total number of SBIR/STTR applications in FYI4 with estimated FY16.**
   c. **Total number of SBIR/STTR awards in FY14 with estimated FY16.**

Data for FY 2016 will not be available until after the completion of the FY. Therefore, the following table includes the requested data for FYs 2014 and FY 2015. Given the focus on applications and awards, the following table does not include non-competing obligations.

	FY 2014	FY 2015
Total SBIR/STTR obligations (grants & competing*)	$391,328,419	$372,766,143
Total number of SBIR/STTR applications (grants & competing*)	5,451	5,644
Total number of SBIR/STTR awards (grants & competing*)	1,154	1,011

*Does not include non-competing obligations, grant applications or awards where the competing award was made in a prior fiscal year.

5. **GAO reports regularly that some agencies fail to comply fully with their SBIR/STTR data reporting requirements. Without reliable data, SBA can't give Congress the information and feedback needed to oversee the programs and assessing their success and value.**
   a. **Now that participating agencies are allowed to use a small percentage of the program set asides to cover administrative costs, is there any reason why data reporting requirements shouldn't be met by every agency?**

b. What could Congress do to spur full compliance by all agencies?

NIH has appreciated the opportunity to use a small portion of the SBIR/STTR funding for administrative purposes including to enhance reporting capabilities. As found by GAO in each of its annual reports, the NIH continues to meet and exceed the spending requirements and is fully compliant with all data reporting requirements every year.

HOUSE COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY SUBCOMMITTEE ON
RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of
Technology Transfer"

Dr. Michael Lauer, Deputy Director for Extramural Research,
National Institutes of Health

Question submitted by Rep. Gary Palmer

1. **What is the amount of SBIR and STTR granted funds your agency and your agency's IG have identified in the last five years as fraudulent or misused taxpayer dollars, and how much of that amount has been recovered by the agency or the Department of Justice?**

In the last five years, the NIH has identified and administratively recovered $1,064,352 in misused taxpayer dollars from SBIR/STTR grantees. The NIH, a part of the U.S. Department of Health and Human Services (HHS), refers all potential fraud to the HHS Office of the Inspector General (OIG). The HHS OIG conducts investigations of SBIR/STTR grantees, including referrals made by the NIH.

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Dr. Michael Lauer, Deputy Director for Extramural Research, National Institutes of Health

Question submitted by Rep. Ralph Lee Abraham

1. **Is your agency taking any specific action to improve the number of awards or the participation by states that have not traditionally done well in the SBIR program? If so, are these steps working and could you be doing more?**

NIH has developed and enhanced its outreach efforts by coordinating its SBIR and Institutional Development Award (IDeA) program to broaden the geographic distribution of NIH funding for competitive biomedical research. IDeA builds research capacities in states that have not traditionally received significant levels of NIH research dollars. It supports basic, clinical, and translational research, faculty development, and infrastructure improvements in 23 states and Puerto Rico. IDeA states include Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, North Dakota, Nebraska, New Hampshire, New Mexico, Nevada, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming. The NIH has developed coordinated activities between the SBIR and IDeA programs. NIH has also submitted the required congressional reports on IDeA and SBIR coordination.

The NIH supports and participates in the SBA SBIR Road Tours in underrepresented states. On April 4, 2016, NIH participated, along with SBA and other agencies that participate in the SBIR/STTR programs, in an event hosted by Tulane University and the New Orleans BioInnovation Center in New Orleans, LA.

The HHS Annual SBIR/STTR Conference continues to go to underrepresented states and regions and draws attendees from across the country.

These efforts are beginning to produce positive results as we are seeing increased SBIR/STTR applications from underrepresented states. NIH is committed to continued outreach and will monitor outcomes from these efforts including applications from small businesses in these states.

HOUSE COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY SUBCOMMITTEE ON
RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of
Technology Transfer"

Dr. Michael Lauer, Deputy Director for Extramural Research,
National Institutes of Health

Questions submitted by Rep. Daniel Lipinski, Ranking Member,
Subcommittee on Research and Technology

1. **Since SBIR and STTR are carved out as a percentage of extramural R&D obligations, SBA requires agencies to report their methodologies for calculating this figure. SBA requires agencies to submit their annual obligations rather than their budget plans for that fiscal year. What are the NIH's challenges calculating the extramural R&D budget? Additionally, what is the SBA doing to help, and what, if anything, can Congress do to assist? Also, agencies also have the flexibility to exclude certain expenditures from their extramural R&D budget, such as facilities. Please include in your response what challenges NIH faces distinguishing between and identifying R&D and non-R&D?**

NIH has no challenges calculating the extramural R&D budgets or obligations used to determine the SBIR and STTR set-asides. NIH has faced no challenges in distinguishing our R&D and non R&D expenditures and is compliant with reporting to SBA on this matter.

2. **Many small businesses use SBIR awards as a springboard to private sector funding and commercialization of their business, a goal of the SBIR program. However, there are some companies that receive SBIR awards year after year and never fully commercialize. How has NIH implemented the requirement to measure the rate of commercialization for a small business and to establish a minimum performance standard? What have been the outcomes?**

NIH, as part of HHS, and in collaboration with the other 10 agencies and the SBA has developed common performance Benchmarks per the Reauthorization Act of 2011. SBA calculates Phase I – II Transition Rate benchmarks for all companies annually. SBA then notifies the companies and agencies that fail the benchmark. NIH uses the list and ensures that companies cannot receive new Phase I awards until SBA removes them from this list. SBA and the agencies have also implemented the Phase II-III Commercialization Rate benchmark. SBA is refining its database to enable agencies to be able to enforce this benchmark.

3. **The 2011 reauthorization requires agencies to increase their effort to prevent duplication of awards. Duplication of awards can happen as a result of one agency not knowing another agency has also funded the same work by an applicant. How has NIH implemented the new data sharing requirements, especially concerning awardees? What have been the challenges?**

NIH has had and continues to have a robust pre-award process for ensuring compliance with all program requirements including screening for duplicate or potentially duplicative awards by other agencies for all of its grant programs, including applications to the SBIR and STTR programs. NIH performs the required checks for duplication across other Federal agencies. Likewise, NIH shares information about pending and awarded SBIR/STTR applications and awards in response to requests from other Federal agencies to minimize the opportunity for duplication across the SBIR/STTR portfolio.

4. **The SBIR program has faced a long-running issue with reports of fraud, waste, and abuse on the part of small businesses. As a result, the 2011 Reauthorization included significant new requirements for preventing and reporting fraud, waste, and abuse. Many agencies already had rules in place to prevent these kinds of acts of malfeasance by bad actors. What additional measures has NIH implemented to meet the new requirements?**

NIH has a robust process for reviewing allegations of fraud, waste and abuse in its programs including the SBIR and STTR programs. The Division of Program Integrity in the Office of Management Assessment manages a portfolio of allegations NIH receives either from members of the public, internal NIH components, and allegations referred to NIH by the HHS OIG for action. As a result of the Reauthorization, NIH and other HHS operating divisions partnered with the Office of the Inspector General (OIG) to develop fraud risk indicators which have been distributed to program, and grants management during Program Integrity presentations. NIH and OIG have also established twice yearly meetings to discuss issues affecting the SBIR/STTR programs and consultation with OIG occurs as issues arise.

5. **The 2011 Reauthorization gave NIH authority to conduct a pilot on proof-of-concept activities, which in part led to the REACH and Centers for Accelerated Innovations. The administration has included in their list of priorities for reauthorization the ability for more agencies to participate in the proof-of-concept pilot program. Please describe how these efforts are going and whether continuing, unrestrictive pilot authority would be helpful to NIH's efforts.**

NIH appreciates the pilot authority provided in the 2011 Reauthorization and is administering two programs that use this authority. First, The NIH Centers for Accelerated Innovations

(NCAI) were established by the National Heart, Lung and Blood Institute (NHLBI) to identify emerging technologies in the academic laboratory research setting and help speed the translation of basic biomedical discoveries into commercial products, such as new drugs, devices, and diagnostics, to improve patient care and enhance health. Launched in September 2013, the three Centers, located in Massachusetts, Ohio, and California, merge the strengths of 15 high-impact research institutions with expertise and resources from both federal (including FDA, CMS, NSF, and USPTO) and private-sector (Kaiser Permanente) partners. The NHLBI invested $6 million of STTR funds plus $24 million of additional funding to support these three centers for seven years and the Centers have raised non-federal matching capital to leverage this federal investment. The purpose of the NCAI is to address key issues that have been identified as impeding the translation of discovery research to patient benefits, including (1) a funding gap for proof-of-concept studies, (2) academic researchers' general lack of knowledge about the commercialization process, (3) insufficient access to expertise and resources for technology development, and (4) a decline in interest in certain unmet medical needs by the private sector. To accomplish their goals, the NCAIs support proof-of-concept studies, educate academics on the technology development process, and provide early access to the scientific and business expertise needed for commercialization.

Second, in March 2015, the NHLBI NCAI model was scaled across NIH by using the Small Business Technology Transfer (STTR) authorization SEC.5127 Phase 0 Proof of Concept Partnership Pilot program to establish the Research Evaluation and Commercialization Hub program (REACH). This three year trans-NIH, $9 million dollar program was awarded to institutions in Minnesota, Kentucky and New York. REACH expands the NIH proof-of-concept network to six sites and 20 institutions that work collaboratively to leverage synergies, efficiencies and resources; build and strengthen public private partnerships; educate the academic workforce; and optimize commercialization of promising technologies. Working in concert, these two flagship NIH programs, provide early mentoring to innovators to develop key business elements (legal, business development, regulatory, reimbursement, access to partners and capital), which are often not well understood by academic scientists and are critical for commercial success of developed technologies. Education and skills development is accomplished in part by implementing both the ICorp program and industry-style project management with go/no go milestones. These programs will enable development of self-sustaining biomedical technology development ecosystems that encourage the conversion of laboratory discoveries into products and services and disseminate best practices for technology development to other agencies, institutions, and regions across the nation. By moving innovative technologies into the private sector for patient benefit, this network will enhance the commercial outcomes of federally-funded research for health, societal, and economic benefit. Additional information about the NCAI and REACH programs are located at https://ncai.nhlbi.nih.gov/ncai/.

The Administration and NIH support the extension of this authority, and NIH will evaluate the two programs through completion of these current projects. NIH has also proposed in its budget justification using this authority for another program focused on Phase 0 activities within Institutional Development Award (IDeA) states.

Responses by Dr. Patricia Dehmer

QUESTIONS FROM CHAIRWOMAN BARBARA COMSTOCK

Q1. SBIR and STTR grants are awarded competitively. Could you describe the competitive process your agency uses? Do you think the underlying quality of applications has been increasing?

A1. The Department of Energy (DOE) Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) Programs issues two annual Phase I SBIR/STTR Funding Opportunity Announcements (FOAs) in collaboration with twelve participating DOE program offices: six research and development (R&D) programs within the Office of Science; the Offices of Electricity Delivery and Energy Reliability, Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy; and the Offices of Defense Nuclear Nonproliferation and Environmental Management. Each DOE program office considers its high priority research needs and program mission, as well as the Department's goals for the program in developing research topics. The specific research topics selected for the SBIR and STTR programs are developed by the Department's technical program managers.

Small businesses submit applications to the Phase I FOAs using grants.gov. The applications undergo peer review as part of the award selection process and are ranked by merit by each program office. Merit review criteria include strength of the scientific and technical approach, ability to carry out the project in an effective manner, and impact. As part of the impact criteria consideration is given to past commercialization performance of the small business on prior DOE SBIR/STTR awards. Awards are made to the top ranked applications based on available funding set aside for the SBIR/STTR programs.

Phase I awardees are eligible to submit applications to one of two annual Phase II FOAs issued in the subsequent fiscal year. Phase II applications undergo peer review and selection process similar to Phase I, but include, in addition, a separate review of the Phase II commercialization plan by a reviewer with business development expertise. Phase II awardees are eligible to submit applications for Sequential Phase II applications.

With regard to the quality of applications, the DOE SBIR/STTR Programs Office tracks the number of Phase I applications that are recommended for funding each fiscal year.

The table below includes data for Phase I applications for the past four fiscal years. The general trend has been an increase in number of high quality applications.

Fiscal Year	Number of Phase I Applications Recommended for Funding
2013	489
2014	566
2015	681
2016	642

In addition, the Advanced Research Projects Agency-Energy (ARPA-E) manages its own SBIR/STTR program. ARPA-E develops SBIR/STTR programs through the same competitive, merit-based process that it uses for all of its programs and receives applications to FOAs through the ARPA-E eXCHANGE portal. ARPA-E typically releases SBIR/STTR FOAs as "parallel" opportunities for eligible small business concerns within a specific, larger ARPA-E program that focuses on a limited technology area. Therefore, ARPA-E's SBIR/STTR FOAs utilize the same technical requirements, merit review process, and substantially similar merit review criteria as the larger ARPA-E program under which the eligible small business concern applied. During the merit review process, ARPA-E uses expert reviewers from industry, academia, and government to review and provide comments on applications. ARPA-E's thorough application and merit review processes ensure that the Agency funds only the most responsive and meritorious applications.

ARPA-E issues combined phase SBIR/STTR awards to reduce time and funding gaps between phases: Phase I, Phase II, and Sequential Phase II awards (designated as "Phase IIS"). Combined Phase I/II/IIS awards are intended to develop transformational technologies with disruptive commercial potential. Such commercial potential may be evidenced by (1) the likelihood of follow-on funding by private or non-SBIR/STTR

sources if the project is successful, or (2) the small business concern's record of successfully commercializing technologies developed under prior SBIR/STTR awards. Phase IIS awards are a "sequential" (i.e., additional) Phase II award, intended to allow the continued development of promising energy technologies. ARPA-E reserves the right to select all or part of a proposed project (i.e. only Phase I, or only Phase I and Phase II).

Q2. What fraction of SBIR/STTR applicants at your agency are first-time applicants? Do you know what the success rate is for the first-time applicants? Do you conduct outreach activities to spur more interest among small businesses that haven't participated in SBIR or STTR?

A2:

Fiscal Year	Percent of DOE SBIR/STTR Applicants that are First Time Applicants	Success Rate of First Time DOE SBIR/STTR Applicants	Success Rate of All DOE Applicants
2013	12%	9%	13%
2014	16%	18%	15%
2015	14%	14%	18%
2016	19%	20%	21%

First time Phase I applicants have been trending upward the past few years and reached 19% in fiscal year (FY) 2016. The success rate of first time applicants does vary year to year but is typically slightly lower than that for the overall applicant pool. Reviewer comments are provided to all applicants to assist them in improving the quality of their future applications.

The SBIR/STTR outreach events that DOE conducts are aimed at small businesses that have not applied for or are not familiar with the DOE SBIR/STTR grants process. In FY 2016, DOE committed to participating in outreach events in 20 states, including one national conference and three SBIR bus tours sponsored by the U.S. Small Business Administration (SBA). In addition to these in-person events, DOE also conducts multiple, free SBIR/STTR webinars. These interactive webinars provide introductory overviews of the application process and discuss Phase I topics with DOE technical program managers.

Fiscal Year	Percent of ARPA-E SBIR/STTR Applicants that are First Time Applicants	Success Rate of First Time ARPA-E SBIR/STTR Applicants	Success Rate of Focused FOA ARPA-E Applicants
2013	N/A*	N/A*	13.09%
2014	100%	30.8%	14.21%
2015	94.8%	8.1%	12.54%
2016	93.8%	13.3%	18.10%

*No SBIR/STTR FOAs were offered in FY 2013 as ARPA-E was still creating its SBIR program.

From FY 2013 - FY 2016, almost all of ARPA-E's SBIR/STTR applicants were first time applicants to ARPA-E's SBIR/STTR Program, with the percent falling from 100% in FY 2014 to just under 94% in FY 2016.

Q3. What fraction of SBIR/STTR awards are to small businesses that have received other SBIR/STTR awards? If it is a large fraction, is it a concern that awards are concentrated this way?

A3.

Fiscal year	Percent of DOE Phase I Award Winners That Have Received Prior DOE SBIR/STTR Awards
2009	72%
2010	67%
2011	75%
2012	70%
2013	58%
2014	62%
2015	69%
2016	62%

DOE has made an effort to increase its outreach to businesses that have not previously applied to the DOE SBIR/STTR programs and, although there is year to year variation, the general trend for the past eight years has seen a decrease in the awards going to Phase I Awardees that have prior DOE SBIR/STTR awards.

Although DOE will continue its vigorous outreach efforts to first-time applicants, DOE notes that many of the areas (e.g. scientific instrumentation, nuclear nonproliferation) in

which DOE seeks mission driven innovation do not have high rates of new business creation based on our experience with the applicant pool. Therefore, while we are interested in reaching new applicants, our primary concern is the ability of the firms to conduct innovative R&D in these fields and to bring those innovations to market. In addition, to this point ARPA-E has not awarded any SBIR/STTR awards to a small business that has previously received an SBIR/STTR award from ARPA-E.

Q4. Please compare the following:
a. Total SBIR/STTR dollar obligations in FY14 with estimated FY16.
b. Total number of SBIR/STTR applications in FY14 with estimated FY16.
c. Total number of SBIR/STTR awards in FY14 with estimated FY16.

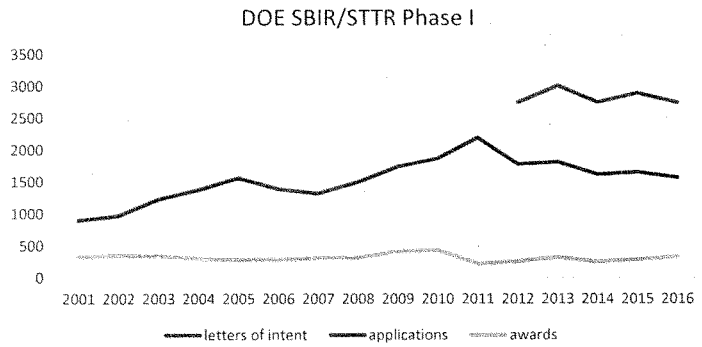
A4.

	FY 2014	FY 2016
4a. SBIR/STTR Dollar Obligations		
Phase I	$52,889,006	$61,797,957
Phase II	$131,052,931	$156,732,321
Total	$183,941,937	$218,530,278
4b. SBIR/STTR Applications		
Phase I	1,672	1,588
Phase II	326	340
Total	1,998	1,928
4c. SBIR/STTR Awards		
Phase I	246	329
Phase II	130	153
Total	376	482

Both the SBIR/STTR obligations and number of awards have increased from FY 2014 to FY 2016 as a result of the increase in the SBIR/STTR allocation percentages and the increase in the DOE extramural R&D budget. The SBIR allocation percentage increased from 3.0% to 3.2% in the same period, and STTR increased from 0.40% to 0.45%. The DOE extramural R&D budget increased from $5.92B to $6.28B, or 6.1%.

The number of applications decreased approximately five percent from FY 2014 to FY 2016. In FY 2012, DOE implemented a letter of intent requirement prior to application.

DOE provides feedback to applicants whose letter of intent appears to be nonresponsive to the topic. This led to a reduction in the total number of applications but has helped to increase the number and percentage of high quality applications.



ARPA-E:

	FY 2014	FY 2016 (estimate)
4a. SBIR/STTR Dollar Obligations	$9,030,862	$8,174,500
4b. SBIR/STTR Applications	26	34
4c. SBIR/STTR Awards	8	6

ARPA-E expects obligations to decrease from $9,030,862 in FY 2014 to $8,174,500 in FY 2016. Over that same period, applications increased from 26 to 34. The number of SBIR/STTR awards did decrease slightly, from 8 in FY 2014 to 6 in 2016.

Q5. GAO reports regularly that some agencies fail to comply fully with their SBIR/STTR data reporting requirements. Without reliable data, SBA can't give Congress the information and feedback needed to oversee the programs and assessing their success and value.

a. Now that participating agencies are allowed to use a small percentage of the program set asides to cover administrative costs, is there any reason why data reporting requirements shouldn't be met by every agency?
b. What could Congress do to spur full compliance by all agencies?

A5. GAO reports on expenditure compliance made no recommendations to the agencies to spend administrative funds to support reporting requirements. DOE has no plan to use

the set-aside administrative funds for this purpose. Instead, GAO recommendations made to SBA include clarifying the reporting requirements in its policy directives, analyzing and providing appropriate fields in its data collection system, and providing additional communication to the agencies or Congress regarding reporting.

There is currently an interagency working group that is examining in more detail the issue of expenditure compliance and reporting. This is not a simple issue. The complexities stem from the statutory mechanism for funding the SBIR/STTR programs, a set-aside of an agency's extramural R&D obligations—a number that an agency does not know until the end of the fiscal year. The different types of funding (such as one year versus multi-year) at agencies and different extramural R&D practices and policies at the agencies complicate the measurement of compliance. The working group, which aims to complete its work this fiscal year, will clearly summarize these issues and make recommendations to improve both the measurement and reporting of expenditure compliance.

QUESTION FROM REPRESENTATIVE GARY PALMER

Q1. What is the amount of SBIR and STTR granted funds your agency and your agency's IG have identified in the last five years as fraudulent or misused taxpayer dollars, and how much of that amount has been recovered by the agency or the Department of Justice?

A1. The Department of Energy Office of the Inspector General reported $11,948,235 for recovered funds related to Small Business Innovation Research and Small Business Technology Transfer awards for Fiscal Year 2013-2015. Recoveries include criminal and civil judgements, settlements, administratively recovered funds and funds put to better use. Recoveries reflect total funds recovered for cases which may have been collaborative efforts with other agencies, and therefore also reported by other entities.

QUESTION FROM REPRESENTATIVE RALPH LEE ABRAHAM

Q1. Is your agency taking any specific action to improve the number of awards or the participation by states that have not traditionally done well in the SBIR program? If so, are these steps working and could you be doing more?

A1. Yes, Department of Energy (DOE) is taking specific actions to improve the number of awards and participation by under-represented states. Our strategy for improving participation includes three elements: (1) A Phase 0 Outreach and Assistance program, (2) improved online assistance, and (3) participation in the Small Business Innovation Research (SBIR) Road Tour.

The Phase 0 Outreach and Assistance program, which was implemented in Fiscal Year (FY) 2015, is free to small businesses and designed to increase the number of responsive, high quality applications submitted to DOE from states with historically low Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) grant applications and from women-owned and minority-owned businesses. Phase 0 services include assistance with required federal SBIR/STTR registrations, Letter of Intent writing assistance, small business development training and mentoring, basic market research, application preparation and review assistance, technology advice and consultation, intellectual property consultation, and assistance with calculating indirect rates and financials. Following an intake meeting, a customized suite of services is provided to each company, based on its specific needs. To date, the DOE Phase 0 program has provided services to more than 180 small businesses.

The Phase 0 Outreach and Assistance program was implemented less than two years ago and it is still too early to empirically determine its effectiveness at improving participation by under-represented states. However, of the 180 Phase 0 small business participants, 70 (or 39 percent) were from one of the 25 under-represented DOE SBIR/STTR states.

Following Phase 0 service, DOE participants are asked to comment on the value of the services provided. Anecdotally, the response has been quite positive. An example comment from a firm in an under-represented state said: "I think the Phase 0 Assistance

is a very valuable program for first-time applicants. I do not think I could have been able to submit my application without such assistance. The level of details that is required for a successful application is usually ignored by inexperienced applicants, and therefore puts him into non-competitive position in comparison to the applicant with prior winning experience. The Phase 0 team helps to make such competition fair."

In addition to the Phase 0 Outreach and Assistance program, DOE developed an online assistance web site to assist all first-time SBIR/STTR applicants. A prominent and popular feature of this site is its 34 tutorials involving more than 150 short videos. These were developed specifically for those first-time firms looking to prepare a Phase I SBIR or STTR proposal to submit to the DOE. The online tutorials, which are found at http://www.doesbirlearning.com seek to answer common questions and concerns when dealing with the DOE SBIR/STTR application process, such as why an applicant is required to submit a Letter of Intent or how to select a Principal Investigator, and when an applicant should contact the DOE SBIR/STTR topic managers.

The value of the DOE SBIR online learning web site is its ability to help first-time applicants methodically apply for a DOE Phase I SBIR/STTR grant by breaking the application process down into manageable tasks over a specific timeline.

In FY 2015 and FY 2016, DOE participated in the SBIR Road Tour (http://www.sbirroadtour.com/) sponsored by the Small Business Administration. These events, held in under-represented states, help to educate small businesses about federal research and development opportunities offered by the SBIR and STTR programs and provide the ability to meet individually with agency personnel.

Through the SBIR Road Tour events, DOE has been able to introduce its SBIR/STTR programs to several hundred small business owners in 20 under-represented states. In addition to this introduction, during each SBIR Road Tour, DOE SBIR/STTR program managers are able to conduct approximately 50 one-on-one meetings with small businesses to discuss the responsiveness of their respective technology and innovations to DOE SBIR topics. DOE will track meeting participants to quantify the impact of the SBIR Road Tour on future applications and awards.

Each element of this strategy to improve participation by under-represented states has been made possible by the SBIR Administrative funding pilot. With this funding, we have also been able to engage and partner with state Small Business Development Centers and other state service providers in all 25 under-represented states. Through these partnerships, we have provided free webinars, attended onsite/in-state meetings and shared social media news.

Since Advanced Research Projects Agency-Energy (ARPA-E) includes SBIR/STTR as a parallel opportunity within a specific, larger ARPA-E program, the outreach for SBIR/STTR applicants is already a part of each program's outreach strategy. Moreover, Small businesses receive a substantial percentage of all ARPA-E funding. Currently ARPA-E funds projects across 43 states and approximately 37% of all ARPA-E research funding goes to small businesses as lead organizations. In addition, as of February 2016, 36 new companies have been created based on technologies developed under ARPA-E awards.

QUESTIONS FROM RANKING MEMBER DANIEL LIPINSKI

Q1. Since SBIR and STTR are carved out as a percentage of extramural R&D obligations, SBA requires agencies to report their methodologies for calculating this figure. SBA requires agencies to submit their annual obligations rather than their budget plans for that fiscal year. What are the DOE's challenges calculating the extramural R&D budget? Additionally, what is the SBA doing to help, and what, if anything, can Congress do to assist? Also, agencies also have the flexibility to exclude certain expenditures from their extramural R&D budget, such as facilities. Please include in your response what challenges DOE face distinguishing between and identifying R&D and non-R&D?

A1. During the Fiscal Year (FY) 2017 Budget process, the Department's research and development (R&D) reporting was expanded to include administrative support activities such as program direction, safeguards and security, and infrastructure that support the R&D programs. This change is consistent with government-wide and international R&D reporting practices.

This change to R&D reporting created challenges in determining the extramural R&D obligations that are used to calculate the Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) contributions. We requested help from Office of Management and Budget (OMB) and they provided additional guidance stating that "conduct of R&D," as defined for reporting in the budget, is not equal to "extramural R&D" for the purposes of calculating SBIR/STTR. OMB defined extramural R&D as "funding executed through an R&D contract or agreement with a non-federal entity (e.g., grant, CRADA, or M&O contract)." This includes the portion of the grant or contract funds used by the non-federal entity for overhead or administrative activities.

OMB's definition also described what extramural R&D is not, specifically:

- Funding for R&D executed by federal entities;
- Funding to establish, maintain, or secure federally owned R&D infrastructure (e.g., R&D facilities, R&D equipment, safeguards and securities, etc.);
- Funding for Federal R&D program administration (e.g., federal salaries, benefits, travel, etc.); and

- General support services for Federal R&D program administration executed through a contract with a non-federal entity (e.g., administrative assistants, print and copy, IT services, etc.).

Using the guidance above, Department of Energy (DOE) R&D program offices identified both R&D and the base extramural R&D obligations, which they used to calculate SBIR/STTR. The process should become easier as reporting of R&D becomes consistent across the various governmental and international entities.

Q2. Many small businesses use SBIR awards as a springboard to private sector funding and commercialization of their business, a goal of the SBIR program. However, there are some companies that receive SBIR awards year after year and never fully commercialize. How has DOE implemented the requirement to measure the rate of commercialization for a small business and to establish a minimum performance standard? What have been the outcomes?

A2. DOE has developed both an internal commercialization rate requirement and has collaborated with Small Business Administration (SBA) and other agencies on a separate federal transition rate requirement.

DOE's internal commercialization rate requirement was implemented in FY 2012 and examines past performance on prior DOE Phase II awards. A company must have had at least 5 past DOE Phase II awards in the most recent 10 year period that excludes the past 5 years to be evaluated. Firms with low past commercialization rates are flagged during the application review process. A DOE program manager cannot recommend these firms for award unless the program manager provides a written justification that addresses the firm's commitment to commercialization. This justification is reviewed by the DOE SBIR/STTR Program Director for approval.

The internal commercialization rate requirement has helped to highlight the need for commercialization among DOE program managers and has resulted in some shifts in topic selection that have greater potential for commercialization. It has also caused small businesses to have increased awareness of the commercialization objectives of the SBIR/STTR programs and to be more diligent in reporting their past commercialization

results to DOE both in their applications and in the commercialization survey issued by DOE.

Advanced Research Projects Agency-Energy (ARPA-E) requires small businesses which have received multiple prior SBIR or STTR awards to meet DOE's Phase II Transition Rate Benchmark and the SBA Commercialization Rate Benchmark requirements for progress towards commercialization. DOE's Phase II Transition Rate Benchmark requires that 25% of all Phase I awards received over the past five years transition to Phase II awards. The current SBA Commercialization Rate Benchmark, agreed upon and established by all 11 SBIR agencies, is that the applicants must have received, to date, an average of at least $100,000 of sales and/or investments per Phase II award received, or have received a number of patents resulting from the relevant SBIR work equal to or greater than 15% of the number of Phase II awards received during the period.

ARPA-E collects information on whether a small business meets both benchmarks during the full application process in the Business Assurances & Disclosures Form. If ARPA-E determines that a small business has failed to meet either of the benchmarks, the entity is not eligible to receive a new SBIR or STTR award for a period of one year from the time of the determination.

When projects are awarded at ARPA-E, the expectation is that the project team will develop a path to additional funding and commercialization. There is a dedicated ARPA-E tech-to-market team that partners with project teams from day one, assisting awardees to identify the path that is right for them based on both their technology and their target market. ARPA-E's tech-to-market team then helps awardees navigate this path as ARPA-E learns more about both the technology and the market challenges.

Internally, commercialization or project "hand-offs" are a major area of focus for all of ARPA-E's projects, including SBIR/STTR awardees. These hand-offs include new company formations, partnerships with other government agencies, and partnerships with existing companies. As of February 2016, ARPA-E has successfully facilitated many hand-offs:

- At least 45 ARPA-E project teams have cumulatively received more than $1.25

billion in private sector follow-on funding, including 42 small businesses, of which six are SBIR awardees;

- At least 36 ARPA-E project teams have formed new companies to further advance their technologies, of which three are SBIR awardees;
- More than 60 ARPA-E project teams have partnered with other government agencies for further project development, including 30 small businesses, of which one is an SBIR awardee.

The federal transition rate requirement was implemented in FY 2015 and examines past performance on prior federal-wide SBIR/STTR Phase II awards. A company must have had at least 15 past SBIR/STTR Phase II awards during the most recent 10 year period that excludes the past two to be evaluated. There were issues in implementing this metric because companies needed to update their commercialization history at SBA so the metric could be properly evaluated. SBA is currently addressing these issues.

Q3. The 2011 reauthorization requires agencies to increase their effort to prevent duplication of awards. Duplication of awards can happen as a result of one agency not knowing another agency has also funded the same work by an applicant. How has DOE implemented the new data sharing requirements, especially concerning awardees? What have been the challenges?

A3. When a company selected for award indicates on its application that it has submitted an application for essentially equivalent work to another agency, our Financial Assistance office contacts that agency to verify the status of those applications prior to award. This is the primary means of avoiding duplicative funding. Applicants that receive awards must also certify that the proposed R&D is not duplicative of other federally funded R&D received by the company.

DOE reports its awards to SBA at the sbir.gov website. In the past, this was reported on an annual basis and we are transitioning to performing this on a quarterly basis. The information reported to SBA does include an abstract of the proposed R&D, however past experience indicates that the abstract is not a sufficient basis for determining duplicative funding.

ARPA-E requires applicants to submit detailed information on other sources of funding as part of each full application in the Business Assurances and Disclosures Form. During the merit review process, ARPA-E documents any other sources of funding that are reported in the Business Assurances & Disclosures Form in the Merit Review Report to ensure potentially duplicative sources of funding are reviewed during award negotiations. During award negotiations, technical personnel perform any necessary due diligence to ensure ARPA-E funds are not duplicative of prior or existing efforts (e.g., contacting other federal agencies or DOE departments for more information). ARPA-E also checks the VentureDeal database to ensure the selectee has not received previous capital funding for identical research. The results of ARPA-E's due diligence are documented in an internal "Pre-Award Review Form" and signed by the Program Director.

In addition to contacting other agencies and reporting to SBA, ARPA-E's activities, by statute, are "coordinated with, and do not duplicate the efforts of, programs and laboratories within the Department and other relevant research agencies."[1] To ensure that ARPA-E's efforts are not duplicative, the Agency engages with staff from other program offices within the Department during the program review process.

Q4. The SBIR program has faced a long-running issue with reports of fraud, waste, and abuse on the part of small businesses. As a result, the 2011 Reauthorization included significant new requirements for preventing and reporting fraud, waste, and abuse. Many agencies already had rules in place to prevent these kinds of acts of malfeasance by bad actors. What additional measures has DOE implemented to meet the new requirements?

A4. In compliance with the 2011 Reauthorization DOE implemented the following requirements:

- Implemented lifecycle certifications for SBIR/STTR awards
- Included on our webpage and in each SBIR/STTR solicitation information on how an individual can report fraud, waste and abuse to the DOE Office of Inspector General (OIG)
- Designated the SBIR Program Coordinator as the SBIR/STTR liaison to the DOE OIG

[1] 42 U.S.C. §16538(i)(1), available at: http://arpa-e.energy.gov/arpa-e-site-page/authorization

- Included examples of successful OIG prosecutions of SBIR/STTR fraud, waste, and abuse on our webpage and in outreach webinars

DOE had existing practices that covered other requirements of the 2011 Reauthorization. For example, DOE already had existing policy related to reporting of fraud, waste and abuse to the DOE OIG by federal personnel. In addition, the OIG and the SBIR/STTR Program meet regularly to discuss coordination issues and reducing fraud, waste, and abuse.

DOE has utilized SBIR administrative funding to allow DOE program managers to perform site visits to SBIR/STTR awardees. With reductions to Program Direction travel budgets in recent years, travel funding was identified as one reason that DOE program managers were not able to perform site visits to SBIR/STTR awardees. The OIG is notified in advance about the planned visits should they wish to accompany program managers.

Responses by Dr. Jilda D. Garton

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY SUBCOMMITTEE ON RESEARCH AND TECHNOLOGY

"SBIR/STTR Reauthorization: A Review of Technology Transfer"

Ms. Jilda Garton, Vice President for Research and General Manager, Georgia Tech Research Corporation, Georgia Institute of Technology

Question submitted by Rep. Daniel Lipinski, Ranking Member, Subcommittee on Research and Technology

1. During the hearing, we started discussing NSF's latest solicitation for I-Corps Node program. While the awards will provide five years of funding, the amount of funding available to awardees in the later years will be significantly less than the first and second year. I understand that the idea is for other sources of funding for the nodes to step in as federal funding declines. What steps will Georgia Tech take to identify other sources of funding for its node that could fill the gap when federal support declines?

Although the funds provided by NSF for the I-Corps South Node will begin to decline in the third year of the grant, Georgia Tech intends to continue its programming through the project period and into the future. As stated by Dr. Keith McGregor who serves as the Director of Georgia Tech's I-Corps Node, "[I]t is our expectation that those processes, as conducted by trained national faculty, will continue to facilitate the promotion of local and regional teams into the national I-Corps program. Indeed, we believe that our plan for sustainment and our institutional philosophical alignment to I-Corps will persist for many years."

To meet the challenge of sustaining the I-Corps Node in the latter years of the grant and those after the grant period, at a level consistent with the initial funding from NSF, Georgia Tech has developed an approach that brings together sponsor, program, and institutional support. Specific elements in the plan—which tend to build on past experience gained as an I-Corps Node—include the following:

- Sponsored support for I-Corps programming will continue to be part of delivering I-Corps activities. The Georgia Tech team has successfully conducted programs for the Centers for Disease Control and Prevention, Grupo Guayacan in Puerto Rico, and various SBIR programs. This indicates the potential for identifying other sponsors who seek I-Corps programs for their constituencies.
- Based on a successful demonstration at Georgia Tech's campus in Metz, France, the I-Corps South Node may charge individual teams to participate in regional activities as

early as year three. Economic development partners may also be identified to fund entire cohorts.

- For the affiliate program, the I-Corps South Node will charge an annual fee beginning in year three. The Node will endeavor to assist the programs of historically black colleges and universities in seeking private and government grant funds to achieve sustainable participation.
- Train-the-trainers programs will be marketed to a broad set of both 2-year and 4-year institutions of higher education which would pay a modest fee for participation.
- Georgia Tech's Enterprise Innovation Institute receives funding from the legislature of the State of Georgia to support commercialization and entrepreneurship activities conducted at Georgia Tech. A portion of these funds may be redirected to support activities such as I-Corps.

I-Corps principles seeded by the grants awarded by NSF and other agencies have been recognized by many organizations as efficient and successful ways to identify markets, create companies, and launch new ventures. As part of the ecosystem that supports the transfer of new discoveries from laboratories to the marketplace, I-Corps programs fill an important niche and have become a part of the repertoire of entrepreneurship. Although identifying cost-sharing at this point is challenging, it is Georgia Tech's expectation that sponsor and program resources along with institutional efforts will sustain the program well beyond the grant term.