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Introduction

Chairman Smith, Ranking Member Johnson, and Members of the Committee, it is a privilege to be here with you today to discuss the President's Fiscal Year (FY) 2019 Budget Request for the National Science Foundation (NSF).

Established by the National Science Foundation Act of 1950 (P.L. 81-507), NSF is an independent Federal agency whose mission is "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF is unique in carrying out its mission by supporting fundamental research across all fields of science, technology, engineering and mathematics (STEM) and all levels of STEM education. NSF is also committed to the development of a future-focused science and engineering workforce that draws on the talents of all Americans. NSF accounts for approximately 27 percent of the total Federal budget for basic research conducted at U.S. colleges and universities and has been vital to many discoveries that impact our daily lives and drive the economy. NSF seeks to be a respected steward of taxpayer dollars, operating with integrity, openness, and transparency.

A vibrant scientific workforce and breakthrough discoveries enabled by NSF investments sustain, accelerate, and transform America's globally preeminent innovation ecosystem. For example, last year, eight American scientists were awarded Nobel prizes in the fields of physics, economics, biology and chemistry. All eight of those world-class researchers were, at some point in their careers, supported by NSF. In fact, since the 1950's – only shortly after NSF's creation – NSF has funded more than 230 Nobel laureates. Last year's awardees included the Laser Interferometer Gravitational Wave Observatory (LIGO) scientists who in 2015 detected gravitational waves – first predicted by Albert Einstein a century ago – and opened a new and exciting chapter in astrophysics. Their work will enable new commercial applications and countless new discoveries.

Notably, LIGO represents a 40-year investment by the NSF and speaks to the importance of our ability to invest in high-risk, high-reward research and facilities that allow scientists to explore the frontiers of science.

The complex global and domestic challenges facing the Nation today require NSF investments. Federal investment in basic research and the STEM workforce, led by NSF, is vital to the Nation's continued global leadership. Other nations continue to increase their support of research, development, and STEM education, as they innovate in next-generation technologies. China and the European Union have invested significantly in quantum technology, and continue to invest billions of dollars in artificial intelligence research with an eye to a future of global leadership in these areas. There is unprecedented global competition for highly skilled, technical workers who will lead tomorrow's innovations. Continued U.S. support for basic research has never been more vital for the Nation and for the world.

The President's FY 2019 Budget Request is steady with what Congress enacted for FY 2017. While the funding level is the same as FY 2017, the content differs some since this budget reflects Administration priorities. With this level of funding, NSF will be able to support basic research across all fields of science and engineering that create knowledge while allowing us to invest in priority areas like:

- Advancing NSF's Big Ideas - bold questions that will drive NSF's long-term research agenda;
- Accelerating focused, cross-disciplinary efforts that will have impact in a short timeframe around two of the Big Ideas: Harnessing the Data Revolution for 21st-Century Science and Engineering; and the Future of Work at the Human-Technology Frontier.
- Initiating the Antarctic Infrastructure Modernization for Science project; and
- Building two Regional Class Research Vessels, a major component in the plan for modernizing the U.S. Academic Research Fleet.

In a world of converging disciplines and interdependencies among fields of research, NSF is making changes to our funding structure that will allow us to leverage resources and the science we fund. Increasingly, collaboration and convergence are necessary to achieving our mission, especially in a world of flat budgets. The Big Ideas and the Convergence Accelerators that we are prioritizing in the FY 2019 Budget Request are prime examples of funding across disciplines. We must leverage the science across all fields of NSF research to remain at the frontiers of science and engineering.

The President's Fiscal Year 2019 Budget Request

The FY 2019 Budget Request for the National Science Foundation is $7.47 billion, the same as the final funding for FY 2017. This level of funding reflects the Administration's commitment to NSF's role in strengthening the Nation's economy, national security, and global leadership, while also restraining non-defense spending across the government. NSF funds the basic research that advances cybersecurity, infrastructure, manufacturing, and military technology, and sustains American preeminence in innovation. NSF also makes critical investments in STEM education that prepare the Nation's future-focused workforce. At NSF, because our education activities are integrated with science and engineering, research and innovation, we recognize that combining the

best that we know from research about learning and cognition with exciting opportunities to learn STEM is a winning combination for helping to effectively inspire the next generation STEM skilled workforce. In FY 2019, NSF would expect to evaluate approximately 50,600 proposals through its competitive merit review process and make approximately 11,100 new competitive awards. NSF expects that over 93 percent of its FY 2019 requested budget would be used to fund research and education grants and research infrastructure in the science and education communities.

NSF has made a strong commitment to agency-supported research infrastructure. NSF plans to invest in the Antarctic Infrastructure Modernization for Science (AIMS) project, a necessity for maintaining U.S. scientific and geopolitical eminence across the continent of Antarctica. The AIMS project is the primary component of the McMurdo Station Master Plan, with a specific focus on the core elements of this critical logistics hub following the recommendations in a 2012 Blue Ribbon Panel report. The project is funded in the Research and Related Activities (R&RA) account as the first stage of a long-term capital plan for all of NSF's Antarctic assets. It is feasible for the Office of Polar Programs to manage AIMS from R&RA since the program is unique in having no-year R&RA authority. All of NSF's current oversight requirements for major facility construction projects will apply to the AIMS project, as McMurdo Station is considered a "major facility" under the definitions contained in the American Innovation and Competitiveness Act.

The agency will begin support for rigorously-reviewed Mid-Scale Research Infrastructure, an effort that will address a gap between small existing research infrastructure instrumentation and existing large facility funding. Using funds in the Major Research Equipment and Facilities Construction (MREFC) account, NSF will fund the construction of two Regional Class Research Vessels, pivotal components in the modernization of the academic research fleet that helps scientists to understand numerous ocean processes along our coasts. Scientific infrastructure has long been a cornerstone of NSF-funded research across the Nation, and the FY 2019 Budget Request enables further such investment.

Complementing NSF's commitment to infrastructure is the agency's constant pursuit of innovation. In FY 2019, NSF will invest heavily in its 10 Big Ideas, research agendas that identify areas at the frontiers of science and engineering which promise to be among the most transformative in the coming decades. NSF will also initiate two Convergence Accelerators, which are new organizational structures that will leverage external partnerships for convergence science to produce results and outcomes in an accelerated timeframe, with streamlined operations that allow for nimbleness and mid-course adjustments to support the most innovative science. NSF's support for the Big Ideas and the Convergence Accelerators reflects the agency's ongoing commitment to advancing science at the frontiers, while supporting the core fundamental research that has advanced the Nation since the agency's founding. Collaboration and convergence are required across NSF to achieve the agency's mission and support the maximum number of researchers. No longer is any one research directorate the sole NSF funder of all science in a given field. Science and engineering today requires innovative approaches to leveraging resources across all fields of science.

NSF is essential to advancing American leadership in science and technology. NSF investments in all 50 states of the Union and all U.S. territories have resulted in both short- and long-term innovation and the robust creation of jobs. Over 50 percent of America's economic growth of the

past 50 years is attributable to technological innovation. This innovation depends on significant investment in basic research. NSF had a role in the development of important advances such as the Internet, 3-D printing, and cell phones, and in responding to national and international crises, including the Ebola and Zika outbreaks, the Deepwater Horizon oil spill, Hurricane Katrina, and more recently, Hurricanes Harvey, Irma, and Maria.

NSF awarded $16.5 million in 192 grants after recent natural disasters to help quickly mobilize resources to aid in relief efforts, and to help understand how to better protect human lives, infrastructure, and resources during these crises. These awards helped scientists understand how best to respond to disasters in the future and how to provide immediate assistance when people need it most. NSF investments in disaster research have advanced understanding of the paths of tropical cyclones, improved water decontamination, deployed underwater rescue robots, and helped to understand the long-term psychological and emotional effects of disasters. For example, after hurricanes Harvey and Irma hit, researchers quickly used the NSF-funded Stampede2 supercomputer to create useful computer models that showed the likely depth and location of water in different regions, which helped first responders navigate flooded areas and allowed them to reach those most in need of assistance. Other researchers are studying the short- and long-term effects of extreme flooding in urban areas to understand the spread of diseases after floods.

Finally, NSF remains committed to investing in the basic research that helps the U.S. military both on and off the battlefield. This includes innovative military technologies to support those on the front lines. Years of NSF-funded research allowed the creation of the Worldwide-Integrated Crisis Early Warning System, which has helped the military predict where conflict is likely to break out, and how best to mitigate a potential crisis. NSF funding developed Hemogrip, a biopolymer foam that expands in a wound to minimize blood loss and save lives on the battlefield. NSF investments also work to improve the lives of veterans as they readjust to civilian life. NSF-funded research has created better prosthetics and improved screening and treatment of post-traumatic stress disorder, depression, and other issues afflicting America's veterans.

These priority funding areas, for which additional details are provided below, will help ensure that NSF and the Nation remain global leaders in innovation. The support of Congress has been, and will continue to be, vital to NSF's ability to continue innovating and pushing the boundaries of science.

NSF's Big Ideas

In 2016, NSF announced a set of bold questions that will drive the agency's long-term research agenda – questions that will ensure future generations continue to reap the benefits of fundamental research. These 10 "Big Ideas," supported in the FY 2019 Budget Request, aim to capitalize on what NSF does best: catalyze interest and investment in fundamental research, which is the basis for discovery, invention, and innovation, along with education. The Big Ideas define a set of cutting-edge research agendas and processes that are suited for NSF's broad portfolio of investments, and will require collaborations with industry, private foundations, other agencies, science academies and societies, and universities. They will provide platforms to bring together every field of study, from science and education, to engineering and astrophysics, to radically alter the conduct of science and engineering across the scientific enterprise in a manner that is not possible by simply continuing discipline-specific efforts at current levels. The Big Ideas represent unique opportunities to position our Nation at the frontiers—indeed to define the frontiers—of

global science and engineering leadership and to invest in fundamental research that advances America's economic competitiveness and security.

About the Big Ideas:

Six of the Big Ideas focus on research, building on a foundation made possible by earlier investments in fundamental research. Four of the Big Ideas focus on process, and address NSF practices that could be altered or enhanced to capture the best research and to expand the Nation's science and engineering community.

Research Big Ideas:

- **Harnessing the Data Revolution for 21st-Century Science and Engineering:** Engaging NSF's research community in the pursuit of fundamental research in data science and engineering, the development of a cohesive, federated, national-scale approach to research data infrastructure, and the development of a 21st-century data-capable workforce.
- **The Future of Work at the Human-Technology Frontier:** Catalyzing interdisciplinary science and engineering research to understand and build the human-technology relationship; design new technologies to augment human performance; illuminate the emerging socio-technological landscape; and foster lifelong and pervasive learning with technology.
- **Windows on the Universe: The Era of Multi-Messenger Astrophysics:** Using powerful new syntheses of observational approaches to provide unique insights into the nature and behavior of matter and energy and to answer some of the most profound questions before humankind.
- **The Quantum Leap: Leading the Next Quantum Revolution:** Exploiting quantum mechanics to observe, manipulate, and control the behavior of particles and energy at atomic and subatomic scales; and developing next-generation quantum-enabled science and technology for sensing, information processing, communicating, and computing.
- **Understanding the Rules of Life: Predicting Phenotype:** Elucidating the sets of rules that predict an organism's observable characteristics, i.e., its phenotype.
- **Navigating the New Arctic:** Establishing an observing network of mobile and fixed platforms and tools across the Arctic to document and understand the Arctic's rapid biological, physical, chemical, and social changes.

Process Big Ideas:

- **NSF INCLUDES:** Transforming education and career pathways to help broaden participation in science and engineering.
- **Growing Convergence Research at NSF:** Merging ideas, approaches, tools, and technologies from widely diverse fields of science and engineering to stimulate discovery and innovation.
- **Mid-scale Research Infrastructure:** Developing an agile process for funding experimental research capabilities in the mid-scale range, spanning the gap in research infrastructure between the $4 million cap on NSF's Major Research Instrumentation program and the $70 million lower bound for projects supported by NSF's Major Research Equipment and Facilities Construction account. This is a "sweet spot" for

science and engineering that has been challenging to fund through traditional NSF programs.

- **NSF 2026 Fund:** Stimulating and seeding investments in bold foundational research questions that are large in scope, innovative in character, originate outside of any particular NSF directorate, and may require a long-term commitment. This Big Idea is framed around the year 2026, providing an opportunity for transformative research to mark the Nation's 250th anniversary.

Big Ideas Stewardship Funding Model:

The fundamental research underlying the Big Ideas has been supported through many NSF programs for several years, and in some cases, for decades. The FY 2019 Budget Request will accelerate NSF's progress on the Big Ideas through the following funding models.

In FY 2019, an investment of $30.0 million is requested for each of the six research Big Ideas, for a total of $180.0 million. This is in addition to the significant investments already being made by individual NSF directorates and offices in these areas. This additional investment for each of the Big Ideas will support convergent research that transcends traditional disciplinary boundaries of individual NSF directorates and offices. The research directions for each Big Idea will be overseen and managed collaboratively by a multi-directorate/office leadership team. Budget management and reporting will be the responsibility of the directorate to which the $30.0 million is assigned for a given Big Idea, with the multi-directorate/office leadership providing oversight.

The process Big Ideas are also emphasized in this Budget Request:

- NSF INCLUDES will establish the NSF INCLUDES Alliances, as NSF begins to move the NSF INCLUDES program to national-scale collaborations.
- NSF 2026 will initiate mechanisms to catalyze new research areas that may become future research Big Ideas.
- Growing Convergence Research at NSF will support research projects that span not only the Big Ideas but also new ideas, as NSF continues to break down barriers.
- An increased investment in mid-scale research infrastructure will be used to continue to span the midscale gap noted above.

Agency Reform

The landscape in which NSF executes its mission is constantly evolving. Today's research questions are increasingly interdisciplinary in nature, requiring new levels and forms of scientific and engineering collaboration. At the same time, the Nation is addressing pressing challenges, including maintaining the security of cyber systems and physical infrastructure, building resiliency to disasters, improving Americans' health and quality of life, educating and inspiring the next-generation workforce, and growing American jobs and economic productivity. To continue to achieve its mission, NSF must therefore adapt to this evolving environment.

In support of this adaptation, and in alignment with NSF's history of continued organizational improvement and the Administration's government-wide agency reform activities, NSF will focus reforms in five areas in FY 2019.

Convergence Accelerators:

The Convergence Accelerators are new structures that represent an evolution from how funding for research has been organized at NSF. The Convergence Accelerators will be time-limited structural entities intended to leverage external partnerships to facilitate convergent and translational activities in areas of national importance. An investment of $60.0 million in FY 2019 will support two Convergence Accelerators pursuant to two of NSF's Big Ideas: Harnessing the Data Revolution for 21st-Century Science and Engineering; and the Future of Work at the Human-Technology Frontier. These Big Ideas were selected for the initial Convergence Accelerators because of their readiness for convergent and translational research. The $60.0 million investment is expected to catalyze an additional $40.0 million in investment by external partners, including the private sector, other federal agencies, and international funders. The Convergence Accelerators will be launched through NSF's Office of Integrative Activities. Funding for the Convergence Accelerators will be separate from, and in addition to, the funding for the Big Ideas.

Make information technology (IT) work for us:

For NSF to continue funding cutting-edge science and engineering, leading-edge IT solutions that can adapt easily and quickly are essential. NSF will work to ensure that IT tools enhance employee productivity and satisfaction by enabling access, through easy-to-use interfaces, to reliable, readily available, and fully integrated data to support decision making. For example, NSF will continue efforts started under its Proposal Management Efficiency activity to automate proposal processing and improve mission-critical systems in ways that reduce workload, increase operational efficiency, and serve our clients more effectively.

In FY 2019, NSF will invest an additional $4.0 million in adoption of automated, intelligent tools that enable evolution of NSF's business processes, including its core business process of merit review; and accelerated modernization of NSF's IT infrastructure via adoption of cloud offerings, consolidated computing platforms, software-defined network infrastructure, and automated change management processes to improve overall resilience of NSF's systems.

Align NSF's workforce and work:

As the Nation's research enterprise evolves and NSF's proposal volume grows, the agency's workforce stands to benefit from enhanced capabilities that advance day-to-day business processes and enable the best service to the scientific community. In parallel with the IT-enabled business process improvements described above, NSF will optimize the alignment of staffing and position descriptions with the changing landscape. NSF will maintain its already lean workforce through continuous improvements in personnel training and utilization, and through effective performance management.

Expand public and private partnerships:

Private industry, foundations, and non-profits, together with other federal agencies and international funding organizations, bring additional expertise, resources, and capacity to NSF-funded research, which can accelerate discovery and translation of research to products and services that benefit society and grow the American economy. NSF will increase efficiencies in developing, implementing, and managing partnerships that maximize the scientific, economic, and societal impacts of its investments. In particular, NSF will revise policies to enhance partnership development, including implementing new and innovative models with external organizations in

science and engineering areas ripe for leverage. NSF will also explore additional partnerships with the private sector, philanthropies, and other federal agencies.

Streamline, standardize, and simplify programs and processes:

Many NSF business processes are managed and executed locally within the agency's directorates and offices, posing efficiency and collaboration challenges. NSF will revise policies and business processes to increase standardization across NSF organizations and eliminate unnecessary complexity. There are significant opportunities for improvement relating to the merit-review process, NSF's core business process, and expanded use of shared services for business operations.

NSF-Wide Investments

NSF continues to bring together researchers from all fields of science and engineering to address today's cross-disciplinary questions and challenges through Foundation-wide activities. In FY 2019, NSF will support four continuing cross-Foundation investments.

Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS)

$16.4 million is requested in FY 2019 for INFEWS, which aims to understand, design, and model the interconnected food, energy, and water system through an interdisciplinary research effort that incorporates all areas of science and engineering and addresses the natural, social, and human-built factors involved. INFEWS is the first program to study the interconnected food-energy-water nexus. This program is driven by pressing needs and challenges, such as growing U.S. and global populations, changes in land use, and increasing geographic and seasonal variability in precipitation patterns, all of which are placing an ever-increasing stress on these critical resources.

NSF Innovation Corps (I-Corps™)

$30.0 million is requested for the I-Corps™ program, which improves NSF-funded researchers' access to resources that can assist in bridging the gap between discoveries and technologies, helping to transfer knowledge to downstream technological applications and use at scale. In FY 2019, NSF will continue to support I-Corps™ Nodes and I-Corps™ Sites to further build, utilize, and sustain a national innovation ecosystem that helps researchers effectively identify viable market opportunities and augments the development of technologies, products, and processes that benefit the Nation. NSF will also continue to support I-Corps™ Teams that are provided access to experiential entrepreneurial education and mentoring in order to determine the readiness to commercialize technologies resulting from NSF-funded research.

The Secure and Trustworthy Cyberspace (SaTC)

$129.0 million is requested for SaTC. This investment aims to build the knowledge base in cybersecurity that enables discovery, learning, and innovation, and leads to a more secure and trustworthy cyberspace. Through a focus on long-term, foundational research, SaTC will develop the scientific foundations for cybersecurity research for years to come. SaTC also focuses on the training of the next generation cybersecurity workforce, especially for government. This program aligns NSF's cybersecurity investments with the national cybersecurity strategy.

Understanding the Brain (UtB)

$127.2 million is requested for this important initiative, which encompasses ongoing cognitive science and neuroscience research and NSF's contributions to the ongoing Brain Research through Advancing Innovation and Neurotechnologies (BRAIN) Initiative. The goal of UtB is to enable scientific understanding of the full complexity of the brain, in action and in context. There remains much to discover to attain a comprehensive understanding of the general principles underlying how cognition and behavior relate to the brain's structural organization and dynamic activities; how brain, behavior, and environment interact; and how the brain can recover from lost functionality. Investments that address critical research questions relevant to UtB are also central to the Big Ideas activities.

Education and STEM Workforce

NSF's education and STEM workforce investment, centered in the Directorate for Education and Human Resources (EHR), funds activities that support students, teachers, faculty, researchers, and the public. The EHR investment in core STEM education research is critical to building the Nation's knowledge base for strategic and impactful STEM learning. NSF's investments for FY 2019 focus on the following priorities.

The CyberCorps®: Scholarship for Service (SFS)

$55.0 million is requested for the CyberCorps® program, which supports cybersecurity education and research at higher education institutions. SFS also focuses on workforce development by increasing the number of qualified students entering the fields of information assurance and cybersecurity, which enhances the capacity of the U.S. higher education enterprise to continue to produce professionals in these fields to secure the Nation's cyberinfrastructure. FY 2019 activities will include engaging first- and second-year undergraduate students, with a focus on veterans.

Computer Science for All (CSforAll)

$20.0 million is requested for CSforAll to build on ongoing efforts to enable rigorous and engaging computer science education in schools across the Nation, to prepare the STEM workforce of the future. Funds will support the development of prototype instructional materials, scalable and sustainable professional development models, approaches to preservice preparation for computer science teachers, teacher resources, and the research to study their impact. CSforAll aims to provide high school teachers with the preparation, professional development, and ongoing support that they need to teach rigorous computer science courses and to give preK-8 teachers the instructional materials and preparation they need to integrate computer science and computational thinking into their teaching.

The Improving Undergraduate STEM Education (IUSE)

$102.5 million is requested for the IUSE initiative, which supports the development of the STEM and STEM-capable workforce by investing in the improvement of undergraduate STEM education, with a focus on attracting and retaining students and on degree completion. The initiative funds the development and implementation and the related research and assessment of effectiveness.

Advanced Technological Education (ATE)

$66.0 million is requested for the ATE program, through which NSF is able to reach technicians in undergraduate programs preparing for the high-technology fields that drive our Nation's economy. Funds will support partnerships between academic institutions and industry to promote improvement in the education of science and engineering technicians at the undergraduate and secondary school levels.

The Graduate Research Fellowship Program (GRFP)

$270.7 million is requested for the GRFP, which recognizes students with high potential in STEM research and innovation and provides support for them to pursue research across all science and engineering disciplines. GRFP fellows may participate in Graduate Research Opportunities Worldwide (GROW), which provides opportunities to conduct research with international partner countries and organizations, and Graduate Research Internship Program (GRIP), which provides professional development through research internships at federal agencies. In FY 2019, NSF will support 1500 new fellows.

Major Research Equipment and Facilities Construction (MREFC)

The FY 2019 Request includes funding to construct two Regional Class Research Vessels and to continue construction of the Daniel K. Inouye Solar Telescope and the Large Synoptic Survey Telescope.

Daniel K. Inouye Solar Telescope (DKIST)

The construction of DKIST will enable the study of magneto-hydrodynamic phenomena in the solar photosphere, chromosphere, and corona. It will allow scientists to study these phenomena at unprecedented spatial, temporal, and wavelength resolutions. These phenomena are associated with what is generally known as space weather, which can severely impact the Nation’s infrastructure. $16.13 million is requested in FY 2019, which will be the final year of funding in an 11-year funding profile.

Large Synoptic Survey Telescope (LSST)

The LSST will be an 8-meter-class wide-field optical telescope capable of carrying out surveys of the entire sky. It will collect nearly 40 terabytes of multi-color imaging data every night to produce the deepest, widest-field sky image ever. It will also issue alerts for moving and transient objects within 60 seconds of their discovery. $48.82 million is requested in FY 2019, which will be year six of its nine-year construction funding profile.

Regional Class Research Vessels (RCRV)

The RCRV will provide scientific infrastructure that enables increased understanding of: the potential impacts of geohazards, such as storm surges and tsunamis; transportation and recreation; natural resource identification and extraction; and fisheries and aquaculture, among many other topics. $28.7 million is requested in FY 2019 for the construction of two RCRVs. This project is a major component in the plan for modernizing the U.S. Academic Research Fleet.

Implementation of the American Innovation and Competitiveness Act

Signed into law in January 2017, the American Innovation and Competitiveness Act (AICA) reflects continued strong support for NSF's investments in basic and collaborative research and STEM education that benefit the Nation and the world. The AICA affirms NSF's long-standing and world-renowned merit review process and addresses NSF's implementation of issues of importance such as increased transparency and accountability, and management of multi-user facilities and mid-scale projects, while maximizing research and education opportunities that help create the innovations that fuel our economy. The AICA promotes the Foundation's commitment to diversity in STEM fields, incentivizes NSF's programs that encourage private-sector involvement, and re-affirms NSF's continued commitment to entrepreneurship and commercialization.

The AICA does not change NSF's portfolio of investments or the way we do business – in research, education, infrastructure, and administration – rather, it enhances and strengthens it, and serves to codify how NSF invests in science, innovation, and education. NSF has taken an agency-wide approach in the implementation of AICA requirements. In May 2017, an AICA Coordinating Committee was established to ensure an effective and efficient agency response to the AICA. The Coordinating Committee was charged to: coordinate and oversee the implementation of NSF's response to the AICA; produce an agency-wide action plan to identify AICA sections requiring policy development or executive management decisions; and develop a central repository of AICA-related tasks, deliverables, and documentation.

Recognizing the importance of the public's confidence in our work, the AICA requires that the research goals of funded projects are clearly identified in a manner that can be easily understood by all audiences. Over the past year, NSF has re-emphasized the need for clarity and strong justifications so that the public can understand what we are funding and, most importantly, why we are funding it. Each award now explains the project's significance and importance in clear language.

The AICA also focuses on strengthening oversight and accountability for large facilities and support for "mid-scale projects." In response, NSF has maintained a Large Facilities Office and appointed the agency's first Chief Officer for Research Facilities. This position reports directly to the Director. These steps, and others such as requiring independent cost estimates, will lead to even greater outcomes in our large facilities portfolio.

NSF has also evaluated the existing and future needs for mid-scale projects as defined by the AICA. A request for information was issued to assess the demand for projects that could cost between $20 million and $100 million. NSF received 191 responses totaling a demand of at least $10 billion. Based on the demand evident from the responses, $55.0 million is included in the FY 2019 Budget Request for mid-scale research infrastructure. Separate tracks within the Mid-scale program will fund acquisition, design/development, and implementation.

Title III of the AICA highlights some areas of STEM Education that have been key investments for NSF for many years and where we are seeing positive impacts. The law also demonstrates a

commitment to drawing more people who are talented into STEM fields by inspiring them early on with excellent learning opportunities, including engagement in computer science.

NSF, in collaboration with other agencies, is forming a STEM Education Advisory Council as required by the AICA. We solicited nominations and the response was impressive – NSF received over 500 nominations, including many with support from Members of Congress. Appointments are likely to be made in the next month or two.

The AICA also highlighted the I-Corps™ program. Since the I-Corps™ program was established in 2011, NSF has facilitated the formation of over 450 companies that have collectively raised over $250 million in seed capital. The I-Corps™ program is helping to focus efforts on ideas that are commercially viable and avoiding expenditures on those that are not. This efficiency, in addition to the entrepreneurial skills I-Corps™ teaches, has made it a highly sought program. NSF currently has memorandums of understanding with nine other federal agencies and the State of Ohio. The funding requested in the FY 2019 Budget Request will continue and build upon that track record of success.

Conclusion

In summary, the FY 2019 President's Budget Request for NSF represents a $7.47 billion investment in strengthening the nation's economy, security and global leadership through research in cutting-edge science and engineering and investments in STEM education and the future workforce. At this proposed level of funding, steady with FY 2017 congressional appropriations, NSF would continue its work supporting research that advances national priorities such as growth in manufacturing, defense, and cybersecurity.

Robust NSF investments in discovery research have returned exceptional dividends to the American people, expanding knowledge, improving lives, and ensuring our security. To keep those benefits flowing, we need to constantly replenish the wellspring of new ideas and train new talent while serving as good stewards of the public trust. That is the fundamental and continuing mission of NSF.

Through strong federal leadership, we can not only maintain the standing of our businesses and universities, but also seek to increase our strengths: leadership in fundamental discovery, including high-risk, high-reward transformational research; state-of-the-art facilities and scientific research infrastructure; and a world-class science and engineering workforce. With a firm commitment to these fundamental building blocks of our high-tech economy, we can solidify the role of the United States as the world leader in innovation.

Mr. Chairman, I can say with certainty that the results of frontier research funded by NSF have a long record of improving lives and meeting national needs. With the support of this Committee and Congress, NSF will continue to invest in the fundamental research and the talented people who make the discoveries that transform our future.

Thank you for the opportunity to testify today and for your continued support of NSF. I will be pleased to answer any questions you may have.