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Official Written Testimony in Support of Fiscal Year 2020 National Science Foundation and National Aeronautics and Space Administration Funding

Submitted to the House Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
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Summary: This written testimony is submitted on behalf of the American Society for Engineering Education (ASEE) to the House Subcommittee on Commerce, Justice, Science, and Related Agencies for the official record. ASEE appreciates the Committee's support for the National Science Foundation (NSF) in fiscal year (FY) 2019 and asks you to robustly fund the agency in FY 2020, including the Research and Related Activities and the Education and Human Resources accounts. ASEE joins the academic and scientific community in requesting support of at least $9 billion for NSF in FY 2020 to help alleviate impacts of historical underinvestment at NSF and advance both core research and education activities and NSF's Big Ideas for Future Investment. Additionally, ASEE supports continuation of funding at the National Aeronautics and Space Administration (NASA) dedicated to the Space Technology Mission Directorate (STMD), which supports engineers and scientists in developing technology to advance science and space missions in the national interest, and the Office of STEM Engagement, which supports and coordinates NASA educational efforts in engineering and STEM.

Written Testimony: The American Society for Engineering Education (ASEE) is dedicated to advancing engineering and engineering technology education and research, and is the only society representing the country's schools and colleges of engineering and engineering technology. Membership includes over 12,000 individuals hailing from all disciplines of engineering and engineering technology and including educators, researchers, and students as well as industry and government representatives. The **U.S. college-educated engineering workforce numbered 1.7 million** people in 2015,[1] the most jobs of any STEM discipline, and the demand for engineering professionals continues to grow. As the pre-eminent authority on the education of engineering professionals, ASEE works to develop the future engineering and technology workforce, expand technological literacy, and convene academic and corporate stakeholders to advance innovation and sound policy.

[1]National Science Board. 2018. Science and Engineering Indicators 2018. NSB-2018-1. Alexandria, VA: National Science Foundation.

National Science Foundation

Engineering shapes our Nation and powers our innovation ecosystem. **National Science Foundation (NSF) basic research,** conducted in engineering schools and colleges around the country, **catalyzes new industries and revolutionary advances**. A workforce of well-trained engineers in industry and government takes those discoveries and develops innovative new technologies to improve our future. This system is **essential to growth and innovation across our economy**, and is helping to solve challenges in health, energy, and national security. **NSF is an essential partner, funding basic engineering and engineering education research at universities and supporting students to enable access to engineering education.**

ASEE would like to commend you for your commitment to funding NSF and for providing critical increases in fiscal years (FY) 2018 and 2019. Prior to these funding boosts, NSF received flat funding for several years, challenging the agency's ability to spur innovative discoveries and research, particularly as the buying power decreased. Due to budget limitations, NSF rejected about $3.92 billion in cutting edge research proposals rated "very good or higher" according to the agency's merit criteria in FY 2017. Tremendous amounts of additional research and development could be undertaken, leading to novel and transformative discoveries, if more funding were available. Increasing NSF funding would help the U.S. stay the global innovation leader, as other countries have been accelerating research funding. The National Science Board predicted that in 2018 China surpassed U.S. investments in research and development. ASEE is also concerned that the shutdown significantly set back NSF research and education efforts. Increased support is needed for the agency to catch up on crucial initiatives put on hold.

ASEE joins the research and higher education community in requesting that the Committee fund NSF at $9 billion in FY 2020 to continue the momentum from increased funding in FY 2019 to **drive advances in research and education** and **ensure the U.S. retains global competitiveness and scientific leadership**.

Investments in engineering education and research from NSF are essential for having a workforce trained and ready to contribute to industry, government, and academia. NSF is a major supporter of engineering research and workforce initiatives funding 36 percent of engineering and 85 percent of computer science academic fundamental research. NSF-funded advancements touch every corner of our lives and economy, from wireless systems to advanced manufacturing, and from new tools to combat brain diseases to technologies to ensure our cybersecurity. NSF supports engineering education at all levels, ensuring the next generation of the U.S. engineering workforce is appropriately prepared to contribute and innovate and that domestic students are attracted to careers in engineering and engineering technology.

ASEE strongly supports NSF's **Big Ideas for Future Investment** that dramatically propel engineering research and education forward while revolutionizing the human-technology frontier, medicine, quantum communications, and other areas. We urge continued investment in INCLUDES[2] to move the needle nationally on broadening participation. NSF needs additional

[2] Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science

investment to adequately pursue these exciting, new interdisciplinary and transformative ideas while investing in core research activities that power our research ecosystem. These core programs have stagnated for several years, threating research innovation.

NSF-funded research catalyzes fundamental advances that are utilized for national security applications while engineers trained with NSF funding become key components of the national security workforce and industrial base. Our national security ecosystem depends on healthy NSF research and workforce support. NSF is also tackling major national security challenges through the *Navigating the New Arctic* and other Big Ideas.

The NSF **Directorate for Engineering** (ENG) provides critical support for engineering education and research across the breadth of the discipline. These investments have dual outcomes of training future engineers that will discover tomorrow's innovations, all while furthering today's cutting-edge research. Engineering investments at NSF provide critical advancements in areas such as resilient infrastructure, advanced materials and manufacturing, and bioengineering, in addition to equipping students with the skills they need to be the next generation of technological leaders. Divisions such as Engineering Education and Centers (EEC) support university research and Engineering Research Centers. ENG grantees have robust partnerships with industry and provide experiential opportunities fundamental to engineering education.

The NSF **Directorate for Computer and Information Science and Engineering** also plays a key role supporting engineering education and research, particularly within the Division of Information & Intelligent Systems, which supports efforts at the frontiers of information technology, data science, artificial intelligence, among other areas. These investments are critical as we move into a world even more reliant on human-technology interactions.

ASEE strongly supports NSF **Education and Human Resources** (EHR) funding to foster inclusive and effective learning and learning environments, though growth to this crucial NSF directorate has been neglected for several years. The STEM workforce, particularly engineers, technologists, and computer scientists, drives our innovation and economic development. We need to fully develop all of our nation's human talent in order to tackle pressing problems. Access to STEM experiences and skills are a critical aspect of developing well-rounded citizens, technological literacy, and the future STEM workforce. ASEE supports EHR programs including *Improving Undergraduate STEM Education* (IUSE), which is critical for preparing professional engineers and enhancing engineering educational experiences to broaden participation and retention in engineering and engineering technology programs, and *Innovations in Graduate Education* (IGE) to revolutionize graduate studies to best prepare students for STEM careers.

NSF plays a key role ensuring the development of new tools for teaching engineering design and analysis skills, which are under-taught in today's K-12 classrooms. As noted in the 2009 National Academies report *Engineering in K-12 Education*, engineering education has received little attention yet has the potential to improve student learning and achievement in other areas of STEM, increase awareness of engineering careers, and increase technological literacy. Engineering's focus on design and analysis enhances problem solving, teaches students new

ways to approach challenges, and encourages students to connect science and math topics to real-world applications— all skills critical to the future technical workforce. ASEE supports programs to fill workforce needs including Advanced Technical Education (ATE) that prepares advanced technicians for America's high-skills workforce and graduate fellowships to create a pipeline of students knowledgeable and excited about engineering.

National Aeronautics and Space Administration

ASEE is concerned with the Administration's proposal to consolidate the **Space Technology Mission Directorate** (STMD) of the **National Aeronautics and Space Administration** (NASA) and redirect its activities solely towards human exploration. Of importance to ASEE, STMD activities support the workforce development pipeline of future space engineers and technologists by engaging directly with the academic community through early career faculty programs, early stage research grants, and university-led multidisciplinary research institutes. STMD's broad portfolio of activities helps to meet NASA's science objectives, establishes new commercial and academic partnerships, and stimulates the growth of the nation's technology sector. STMD programs fill significant capability gaps for NASA and better position the agency to meet its long-term strategic goals in areas across all its directorates ranging from propulsion and power generation to materials science and high-performance computing. **ASEE urges the Committee to block the Administration's proposal** and protect STMD's ability to focus on a broad array of NASA technology challenges, continue its engagement with the academic and private sectors, and keep its long-term focus beyond specific near-term mission goals. **ASEE joins the research community in requesting $973 million for STMD in FY 2020.**

ASEE is also concerned with the Administration's proposed elimination of **NASA's Office of STEM Engagement,** renamed from the NASA Office of Education, and asks that the Committee sustain funding for this office in FY 2020 and beyond. NASA STEM Engagement programs inspire students to pursue engineering, science, and technology careers, and this office plays a vital role coordinating STEM education programs throughout the agency, including those at NASA centers. ASEE supports the continuation of the *National Space Grant College and Fellowship Program* (Space Grant), which supports university consortia in all 50 states, funding fellowships for engineering and other STEM students, while also offering important resources for faculty professional development and strengthening curricula. ASEE is also supportive of initiatives at the NASA Office of STEM Engagement to broaden participation in STEM and to bring engineering design and analysis experiences to K-12 students.

Conclusion: NSF education and research investments have truly transformed our world through engineering breakthroughs such as the internet, fiber-optics, and medical imaging technology. These investments keep our communities safe, lower healthcare costs, and spur our economy. Today, engineering research is opening possibilities through advances in areas such as artificial intelligence, biosensors, and advanced materials. We ask that you robustly fund NSF at $9 billion to support critical education and research programs. In addition, we urge you to continue both STMD and the Office of STEM Outreach at NASA in FY 2020. Thank you for the opportunity to submit this testimony.