

**Outside Witness Testimony from: Society for Industrial and Applied Mathematics (SIAM)**

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**Submitted to the Subcommittee on Commerce, Justice, Science, and Related Agencies Committee on Appropriations, United States House of Representatives**

**Testimony on the Fiscal Year 2024 Appropriations for the National Science Foundation**

**April 14, 2023**

Summary: This written testimony is submitted on behalf of the Society for Industrial and Applied Mathematics (SIAM) to ask you to continue your support of the National Science Foundation (NSF) in fiscal year (FY) 2024 by providing NSF with at least \$11 billion. In particular, we urge you to provide strong support for the Research and Related Activities Account (R&RA) that supports key applied mathematics and computational science programs in the Division of Mathematical Sciences and the Office of Advanced Cyberinfrastructure. In order to fully realize the transformative aim of the *CHIPS and Science Act*, SIAM request full implementation of the science provisions of the legislation. SIAM also requests your support for the STEM Education (EDU) directorate that addresses fundamental challenges in mathematics and STEM education.

Full Statement: On behalf of SIAM, we submit this written testimony for the record to the Subcommittee on Commerce, Justice, Science, and Related Agencies of the Committee on Appropriations of the U.S. House of Representatives.

SIAM has over 14,000 members, including applied and computational mathematicians, computer scientists, numerical analysts, engineers, statisticians, and mathematics educators. They work in industrial and service organizations, universities, colleges, and government agencies and laboratories all over the world. In addition, SIAM has almost 500 institutional members, including colleges, universities, corporations, and research organizations. SIAM members come from many different disciplines but have a common interest in applying mathematics in partnership with computational science to solve real-world problems, which affect national security and industrial competitiveness.

First, we would like to emphasize how much SIAM appreciates your Committee's continued leadership on and recognition of the critical role of the National Science Foundation (NSF) and its support for mathematics, science, and engineering in enabling a strong U.S. economy, workforce, and society.

Today, we submit this testimony to ask you to continue your support of NSF in FY 2024 and beyond. ***In particular, we join with the research and higher education community and request that you provide NSF with at least \$11.9 billion in funding for FY 2023.*** This is approximately \$600 million over the President's budget request for FY 2024 that calls for \$11.31 billion. After years of inadequate funding,

NSF needs bold growth to protect U.S. competitiveness as countries such as China are rapidly increasing their science and engineering investments. According to the National Science Board, in FY 2020, NSF rejected close to \$4 billion worth of research proposals rated “very good or higher” due to budget constraints. At least \$11.9 billion in funding is needed to ensure NSF can meet Congress’s vision for the agency, launch new programs in priority areas such as Regional Innovation Engines to transform regional economies in critical technology areas, invest in revolutionary breakthroughs to address resilience and catalyze clean energy innovation, and provide sustainable growth to the core research and education activities undergirding our science and technology ecosystem.

As we are reminded every day, the nation’s health, economic strength, national security, and welfare are being challenged in profound and unprecedented ways. Many of these challenges are fueled by gaps in our understanding of complex systems such as biologic processes, the energy grid, cyberspace, terrorist networks, or the human brain. Mathematics and computational science play a foundational and cross-cutting role in understanding these systems through advanced modeling and simulation, developing techniques essential to designing new breakthrough technologies like artificial intelligence (AI), and providing new tools for managing resources and logistics. Progress in computational sciences and applied mathematics also underpins advances across an array of fields and challenges in computing, materials, biology, engineering, and other areas.

### **National Science Foundation**

NSF serves a unique and critical function supporting all areas of science and engineering to further innovation and seed the knowledge and technologies for a strong future America. NSF provides essential federal support for applied mathematics and computational science, including more than 57 percent of all federal support for basic academic research in the mathematical sciences. Of particular importance to SIAM, NSF funding supports the development of new mathematical models and computational algorithms, which are critical to making substantial advances in such fields as neuroscience, energy technologies, genomics, and nanotechnology. In addition, new techniques developed in mathematics and computing research often have direct application in industry. Modern life as we know it – from search engines like Google to the design of modern aircraft, from financial markets to medical imaging – would not be possible without the techniques developed by mathematicians and computational scientists using NSF funding. NSF also supports mathematics education at all levels, ensuring that the next generation of the U.S. workforce is appropriately trained to participate in cutting-edge technological sectors and that students are attracted to careers in mathematics and computing.

SIAM supports NSF’s efforts to expand its mission towards transforming innovation ecosystems with the new Directorate for Technology, Innovation, and Partnerships (TIP) and encourages Congress to give NSF the resources it needs, in line with the amounts authorized in the *CHIPS and Science Act*, to fully carry out programs such as Regional Innovation Engines and enabling support for NSF priorities in climate, clean energy, emerging industries, and broadening participation. Even before the launch of the new TIP directorate and other new programs authorized in CHIPS and Science, NSF was unable to fund more than \$4 billion worth of research proposals rated “very good or higher” each fiscal year. It is imperative that the rest of NSF see sustainable growth, such as programs funded by the Division of Mathematical Sciences (DMS) and the Office of Advanced Cyberinfrastructure (OAC), which have stagnated in recent years and whose foundational investments underpin advances across many science and engineering

challenges. New efforts can only be successful when built on a strong foundational research enterprise that supports research, education, and infrastructure to sustain our science and technology ecosystem. NSF is a critical supporter of the SIAM community, providing 57 percent of all federal support for basic academic research in the mathematical sciences.

***SIAM urges strong investment in the Research and Related Activities account (RRA) to enable robust funding for the Division of Mathematical Sciences (DMS), the Office of Advanced Cyberinfrastructure (OAC), and other core programs and crosscutting initiatives for essential mathematical and computational science research, workforce development programs, and early career researcher support.***

### **NSF Division of Mathematical Sciences**

The NSF Division of Mathematical Sciences (DMS) in the Directorate for Mathematical and Physical Sciences (MPS) provides core support for all mathematical sciences. DMS also funds national mathematical science research institutes; infrastructure, including workshops, conferences, and equipment; and postdoctoral, graduate, and undergraduate training. The activities supported by DMS and performed by SIAM members, such as modeling, analysis, algorithms, and simulation, underpin advancements across science and engineering and provide new ways of obtaining insight into the nature of complex phenomena, such as the power grid, software for national security applications, and the human body.

Investment in DMS is critical because of the foundational and cross-cutting role that mathematics and computational science play in sustaining the nation's economic competitiveness and national security, and in making substantial advances on societal challenges such as energy and public health. NSF, with its support of a broad range of scientific areas, plays an important role in bringing U.S. expertise together in interdisciplinary initiatives that bear on these challenges. DMS has taken a leadership role in promoting partnerships with other agencies and foundations to leverage federal funding for maximum impact. In addition, DMS funding supports a broad array of activities in modeling, analysis, algorithms, and simulation that underpin advancements across science and engineering. Agencies such as the Department of Defense and National Institutes of Health depend on the NSF-supported applied math and computational sciences ecosystem to fulfill their missions as they build on NSF-funded modeling, algorithm, and simulation breakthroughs and leverage the workforce trained using NSF support. Both agencies and foundations partner with NSF thereby leveraging federal funding for maximum impact, such as with the Joint NSF/National Institutes of Health Initiative Quantitative Approaches to Biomedical Big Data (QuBBDD).

### **NSF Office of Advanced Cyberinfrastructure**

Work in applied mathematics and computational science is critical to enabling effective use of the rapid advances in information technology and cyberinfrastructure. Programs in the NSF Office of Advanced Cyberinfrastructure (OAC) in the Directorate for Computer and Information Science and Engineering (CISE) focus on providing research communities access to advanced computing capabilities to convert data to knowledge and increase our understanding through computational simulation and prediction. SIAM strongly endorses NSF's and OAC's role advancing high performance computing to meet critical national security needs, fully leverage computing technology for economic competitiveness and scientific discovery, and position the U.S. for sustained technical leadership. OAC funding will support its

role as steward for computational science, building bridges across NSF to accelerate transformational science and engineering.

### **Supporting the Pipeline of Mathematicians and Scientists**

SIAM is encouraged by the FY 2023 increases for NSF's **STEM Education** (EDU) directorate; however, critical gaps remain in addressing fundamental challenges for mathematics and STEM education across educational levels. SIAM supports EDU and its programs like **Improving Undergraduate STEM Education** (IUSE), which is key to both advancing STEM professional development and developing a STEM literate citizenry. SIAM notes that mathematical education is foundational to STEM learning across disciplines, and NSF should continue to fund development of mathematical and computational skills, including at the undergraduate level when young scientists and engineers gain critical interests and competencies. SIAM supports the NSF **CAREER awards**, **Graduate Research Fellowships**, and **Mathematical Sciences Postdoctoral Research Fellowships (MSPRF)** that are crucial to the training and professional development of the next generation of leadership in mathematical sciences research and education.

### **Conclusion**

We would like to thank you again for your ongoing support of NSF that enables the research and education communities it supports, including thousands of SIAM members, to undertake activities that contribute to U.S. health, security, and economic strength. NSF needs sustained growth to maintain our competitive edge in science and technology, and therefore we respectfully ask that you continue robust support of these critical programs in FY 2024.

We appreciate the opportunity to provide testimony to the Committee on behalf of SIAM. SIAM looks forward to providing any additional information or assistance you may ask of us during the FY 2024 appropriations process.