

**Official Written Testimony in Support of
Fiscal Year 2022 Funding for the National Science Foundation**

Submitted by

Peter Hancock, DSc, PhD, President, Human Factors and Ergonomics Society
Steven C. Kemp, CAE, Executive Director, Human Factors and Ergonomics Society

Prepared for the Senate Subcommittee on Commerce, Justice, and Science, and Related
Agencies;

Committee on Appropriations
United States Senate
June 23, 2021

On behalf of the Human Factors and Ergonomics Society (HFES), we are pleased to provide this written testimony to House Appropriations Subcommittee on Commerce, Justice, and Science, and Related Agencies for the official record. **HFES urges the Subcommittee to provide at least \$10 billion for the National Science Foundation (NSF) in the fiscal year (FY) 2022 appropriations process.** In addition, HFES supports efforts by NSF to broaden participation in science for underrepresented groups to ensure a diverse, equitable, and inclusive workforce and research enterprise, such as the INCLUDES and ADVANCE initiatives. These efforts are critical to not only fixing inequities in the U.S. research enterprise but also to ensuring that the U.S. has the robust, 21st Century workforce needed to maintain its competitive edge in technological innovation.

HFES is a multidisciplinary professional association with over 3,000 individual members worldwide, comprised of scientists and practitioners, all with a common interest in enhancing the performance, effectiveness, and safety of systems with which humans interact through the design of those systems' user interfaces to optimally fit humans' physical and cognitive capabilities. The Society and its members strongly believe that investment in scientific research serves as an important driver for innovation and the economy, national security, and maintaining American global competitiveness. Funding for fundamental research at NSF to address national and societal needs will be critical as Congress looks at legislation to ensure the U.S. remains the global leader in advancing science and technology. We thank the Subcommittee for its longtime recognition of the value of scientific and engineering research and its contribution to innovation in the U.S.

Human Factors and Ergonomics at the National Science Foundation

HFES and its members strongly believe that federal investment in NSF will have a direct and positive impact on the U.S. economy, national security, and the health and well-being of Americans. It is for these reasons that HFES supports robust funding for the Foundation to encourage further advancements in the fields of technology, education, defense, and healthcare, among others. In the past, NSF funding for HF/E basic research has strengthened interdisciplinary partnerships allowing for a multilateral approach to technology research and development, including the human and user perspectives. The benefits of this research are not

confined to one field but rather span across a range of disciplines to increase understanding of the way humans interact with technology, as well as with each other.

In particular, NSF funds HF/E research to:

- Better understand and improve the effectiveness of how individuals, groups, organizations, and society make decisions.¹
- Improve understanding of the relationship between science and engineering, technology, and society, in order to advance the adoption and use of technology.²
- Gain a better understanding of how humans and computers interact to ensure the development of new devices or environments that empower the user.³
- Inform decision making in engineering design, control, and optimization to improve individual engineering components and entire systems.⁴

HF/E research will be especially critical as Congress and the Federal Government work to develop, adopt, and broadly integrate emerging technologies such as artificial intelligence (AI). HFES recognizes that most systems that rely on AI will not operate independently but will be initially programmed and trained by humans to augment, collaborate, or perform specific tasks.

The HF/E profession has conducted detailed research on impacts of AI on human performance, and HFES believes AI must be designed to successfully support human capabilities and overcome known human cognitive limitations, so that humans can understand the actions and intentions of AI. More research is needed to understand how systems can be designed to overcome AI biases, provide transparency and explainability for human use, and provide clear interfaces for human-AI interactions. Interdisciplinary research programs at NSF to address these challenges, such as its Fairness in Artificial Intelligence program⁵ and the AI Research Institutes⁶, will be critical to ensuring the U.S. achieves the promised benefits AI can bring to society.

The Value of Human Factors and Ergonomics Science

For over 50 years, the U.S. federal government has funded scientists and engineers to explore and better understand the relationship between humans, technology, and the environment. Originally stemming from urgent needs to improve the performance of humans using complex systems such as aircraft during World War II, the field of human factors and ergonomics (HF/E) works to develop safe, effective, and practical human use of technology. HF/E does this by developing scientific approaches for understanding this complex interface, also known as “human-systems integration.” Today, HF/E is applied to fields as diverse as transportation,

¹ Decision, Risk & Management Sciences (DRMS) Program
(http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423)

² Science and Technology Studies (STS) Program (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505697)

³ Human Centered Computing (HCC) Program (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504958)

⁴ Operation and Design Cluster (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13473)

⁵ NSF Program on Fairness in Artificial Intelligence in Collaboration with Amazon (FAI)
(https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505651)

⁶ Artificial Intelligence Research Institutes (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686)

architecture, environmental design, consumer products, electronics and computers, energy systems, medical devices, manufacturing, office automation, organizational design and management, aging, farming, health, sports and recreation, oil field operations, mining, forensics, and education.

With increasing reliance by federal agencies and the private sector on technology-aided decision-making, HF/E is vital to effectively achieving our national objectives. While a large proportion of HF/E research exists at the intersection of science and practice—that is, HF/E is often viewed more at the “applied” end of the science continuum—the field also contributes to advancing “fundamental” scientific understanding of the interface between human decision-making, engineering, design, technology, and the world around us through research funded by NSF. The reach of HF/E is profound, touching nearly all aspects of human life from the health care sector to the ways we travel, to the hand-held devices we use every day.

Conclusion

Given NSF’s critical role in supporting fundamental research and education across science and engineering disciplines, HFES supports an overall FY 2022 NSF budget of at least \$10 billion. This investment funds important research studies, enabling an evidence-base, methodology, and measurements for improving organizational function, performance, and design across sectors and disciplines.

On behalf of HFES, we would like to thank you for the opportunity to provide this testimony. Please do not hesitate to contact us should you have any questions about HFES or HF/E research. HFES truly appreciates the Subcommittee’s long history of support for scientific research and innovation.