Submitted Electronically

To: National Science and Technology Council Executive Director, Chloe Kontos
From: IEEE-USA and the Computing Research Association
Subject: RFI Response: JCORE
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IEEE-USA and the Computing Research Association appreciate the efforts of the National Science and Technology Council's Joint Committee on the Research Environment to address issues of research rigor and integrity, manage administrative requirements, enhance research security and foster safe and inclusive research environments.

Research Rigor and Integrity
1. What actions can federal agencies take to facilitate the reproducibility, replicability, and quality of research?

In engineering, reproducibility is built into the research process. Through troubleshooting and testing, engineers ensure reproducibility and research quality. While there are not as many incentives to discuss negative results in engineering, testing overall system design or components associated with computing, electrical or mechanical systems are all vital to engineering research. Research results do not work without this type of testing and engineering research forums and publications discuss these results. Where engineering failures have occurred, in many cases these were due to management and time pressures. Therefore, as the federal government looks to improve reproducibility, replicability and research quality, agencies should take this into consideration as they establish cost estimates and schedules or deadlines for research projects.

In computing research, transparency and computational reproducibility has received substantial attention, both as an important component of the scientific process and as a topic of active research. Increasingly, journals and conferences are incorporating reproducibility evaluation in the peer review process, thus encouraging the publication of results that can be replicated. However, the adoption of reproducibility best-practices is still low. While open-source tools have been developed that facilitate the record-keeping required to make computational processes transparent and reproducible, there are still gaps and unsupported requirements: in many scenarios, making an experiment reproducible can be difficult, and sometimes impossible. Addressing these gaps requires not only the development of new tools, but also research to better understand the limits of computational reproducibility in complex computational systems, such as systems that use artificial intelligence and distributed computing infrastructure.

Reproducibility is often discussed as a requirement for scientific research, but it is also critical in many other applications/sectors that rely on data and computations to guide critical decisions. The

ability to reproduce a computational process is needed in order to build trust in its result as well as assess its properties (such as, for example, to check whether it has biases).

In sum, as the federal government looks to improve reproducibility of computational results, it needs to invest in:

- the development of a software ecosystem (i.e., a set of tools) that makes reproducibility seamless and natively supported by the computing environment; and
- research that tackles the many open problems involved in supporting reproducibility for complex computational systems, as well as new methods for debugging computational processes as a means to better understand and build trust in their results.

2. How can federal agencies best work with the academic community, professional societies and private sector to enhance research quality, reproducibility, and replicability? What are current impediments and how can institutions, other stakeholders and Federal agencies collaboratively address them?

Federal agencies can encourage discussions of negative results and provide forums for those discussions in meetings that take place at the various agencies that support engineering research. Professional society conferences are another means for these types of discussions. Engineers regularly seek to replicate and build upon the research of their peers, so the academic and industrial research community is certainly involved in research reproducibility and replicability.

3. How can we ensure that researchers, including students, are aware of ethical principles of integrity that are fundamental to research?

There is a role for organizations such as ours which represent practitioners, scholars and the institutions that educate them to help those institutions adopt curricula that expose students, faculty and industry professionals to ethical principles. Federal agencies can help this process by publishing clear guidance, whether via public websites or throughout the grants process. Federal research agencies could also help support efforts by professional and higher-ed organizations to develop appropriate curricula. Engineering and Computer Science Accreditation bodies (i.e. ABET) already have the assessment of ethics instruction as an important aspect of Engineering and Computer Science degree programs.

4. What incentives can federal agencies provide to encourage reporting of null or negative research findings? How can agencies best work with publishers to facilitate reporting of null or negative research results and refutations, constraints on reporting experimental methods, failure to fully report caveats and limitations of published research, and other issues that comprise reproducibility and replicability?

Federal agencies could provide forums for discussing null or negative research findings. Federally led workshops, webinars, or websites requesting negative research results could be helpful in addressing technical challenges. The US government is very good at establishing grand challenges to solve problems from energy to national security technology. Fora organized to discuss and collaborate on grand challenges also should include efforts to address and report on negative research findings and refutations, as well as constraints on research.

5. How can the US government best align its efforts to foster research rigor, reproducibility and replicability with those of international partners?

Research rigor, reproducibility and replicability should be a topic of discussion as the US government pursues and enters into Memoranda of Understanding and other international research partnerships. The State Department and other federal agencies should ensure that these discussions are part of their negotiations with foreign entities as they establish opportunities for collaborations.

Coordinating Administrative Requirements for Research

The researchers that our organizations represent work in academia, industry and the business community. While there has been a lot of progress in identifying issues of administrative burden in academic settings, extremely burdensome regulations also encumber researchers in Federal and National labs. We would encourage the Administration to examine comprehensively the regulations governing users of federal facilities at the Department of Energy, Department of Defense, NIST and other research agencies to identify those that can and should be streamlined, reduced or eliminated.

1. What actions can the federal government take to reduce administrative work associated with FCOI requirements for researchers, institutions and Federal agency staff?

Federal agencies should have a single web-based portal for researchers to disclose conflict of interest information. Particularly for researchers who receive federal funding from multiple federal agencies, a singular, streamlined mechanism for providing this information would be useful for reducing the administrative burdens associated with applying for research grants. Institutions should also accept this form, which researchers should be required to keep current but not to fill out a new with each grant application.

2. How can Federal agencies best achieve the appropriate balance between reporting and administrative requirements and the potential risk of unreported or managed financial conflicts that could compromise the research?

Federal agencies should agree to a set of consequences for unreported financial conflicts. Consequences for not reporting conflicts of interest should be uniform across the federal government and consistent between agencies.

3. From the perspective of institutions, describe the impact of the 2011 revisions to the Public Health Services FCOI regulations.

Not applicable.

4. Please comment on whether and how streamlined, harmonized, federal-wide policy for FCOI would provide benefits with respect to reducing administrative work and whether there would be anticipated challenges.

Streamlined, harmonized federal-wide policy and document changes for disclosure of financial conflicts of interest would most certainly provide benefits to the research community by reducing administrative work for researchers seeking federal funding. Potential challenges exist for researchers seeking funding for multi-disciplinary projects particularly since those researchers can apply to multiple federal agencies for funding.

> 5. How can agencies best reduce workload associated with submitting and reviewing applications for Federal research funding? What information is necessary to assess the merit of the proposed research, and what information can be delayed until after the merit determination is made?

As the Federal government seeks to reduce workload associated with submitting and reviewing applications for Federal research funding, it also should not only establish uniform guidance for research universities, but also provide information such that those universities are not compensating for misunderstandings of the regulatory environment. Institutions have a tendency to institute stricter-than-necessary policies that increase regulatory burdens on researchers when regulations are unclear so as to be sure they are in compliance. Regulatory reform is needed for researchers outside of academia who work through the national labs and other research facilities to secure federal funding.

Information relating to the research proposal and the ways in which research will be conducted should be submitted as part of the application for research grant funding. Conflict of interest, detailed biosketches and CVs, as well as non-research information, should be submitted after the merit determination is made.

Research Security

America's global economic and military leadership is built upon innovations that stem from a research ecosystem the National Academies described as an "extraordinarily productive interplay of federally funded university research, federally and privately funded industrial research, and entrepreneurial companies founded and staffed by people who move back and forth between universities and industry." This ecosystem has at its heart Federal support for fundamental research, and the payoff of that Federal investment continues to be significant. In the information technology space, for example, that $4 billion federal annual investment in fundamental IT research and development built a $2.1 trillion a year internet sector that continues to grow, spawn more innovation, and create millions more U.S. jobs.

As the recent JASON report on Fundamental Research Security[1] notes, there is a "long and illustrious history of foreign-born scientists and engineers training and working in the United States, and they make essential contributions to our preeminence in science, engineering and technology today. Maintaining that leading position will require that the United States continues to attract and retain the best science talent globally." Our organizations endorse that view and therefore urge caution in applying policies designed to limit foreign participation in research, particularly fundamental research, in an effort to "protect" U.S. leadership roles. Wrongly applied, those policies could actually cause great damage to the very system they aim to protect.

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[1] www.nsf.gov/JASON_Security_Report

With that caveat, our organizations share the concerns noted in the JASON report about worrisome actions by foreign actors that suggest problems with research transparency, lack of reciprocity in collaborations and consortia, and reporting of commitments and potential conflicts of interest related to these actions.

1. How can the US Government work with organizations that perform research to manage and mitigate the risk of misappropriation of taxpayer or other funds through unethical behaviors in the research enterprise?

Federal research agencies should consider creating guidance or requirements, in coordination with professional societies and publishers, to maintain research integrity throughout the federal grant process. The National Science Board has reported issues with foreign interference in the merit review process at the National Science Foundation and other federal research agencies. Researchers involved with the reviewing process should be required to adhere to a set of requirements -- government-wide -- that ensures that reviewed proposals are not shared with our adversaries. The requirements for those researchers should include disclosure of international research collaborations and establish a foundation for ethical conduct. Such requirements should apply to all stages of the research process from merit review to publication.

Research funding should be contingent upon researchers' full disclosure to granting institutions of any foreign funding, collaborations and other sources of support they have received. This should become standard for all those seeking federal funding, as well as those involved in the decision-making process to determine which researchers will receive federal funding. Both Principal Investigators and students should be subject to these requirements.

Many federal agencies are involved in ensuring that US research and international collaborations remain free of foreign influence. Whether it be the Federal Bureau of Investigations or the State Department, these agencies should jointly provide resources to the organizations who perform research. Specifically, the research community should be made aware of attempts at espionage and foreign influence. It also should be provided information and resources about what public activities these federal agencies are involved in to counter the attempts of foreign governments to exploit the open and internationally collaborative nature of our science and engineering enterprise.

2. How can the US Government best partner across the research enterprise to enhance research security?

Federal research agencies should coordinate and collaborate to enhance research security. Where possible these federal agencies should provide information about foreign influence on the US research enterprise to the academic and professional society community.

Especially in cross-disciplinary fields, and fields such as cybersecurity where a researcher could potentially receive grants from multiple agencies, there should be a standard set of requirements for disclosure of foreign funding and collaborations. Conflicts of interest issues are broader than financial conflicts of interest; for example, foreign research collaborations can present conflicts of interest.

Federal research agencies should be properly cautious about efforts to exploit US science and engineering in areas where the research can lead to national security risks. Institutions should collaborate with the federal government to establish disclosure requirements and policies for dual-use technology-related research. However, federal agencies should reaffirm the principles of National Security Decision Directive (NSDD) 189, established in 1985 and reaffirmed as recently as 2010, which makes clear that fundamental research should remain unrestricted to the fullest extent possible, and, as the JASONs noted, "should discourage the use of new [Controlled Unclassified Information] definitions as a mechanism to erect intermediate-level boundaries around fundamental research areas."

3. What other practices should organizations that perform research adopt and follow to help protect the security and integrity of the research enterprise?

International researchers in the United States have longstanding partnerships with US-born researchers and these partnerships are vital to the scientific enterprise. The effort to strengthen these partnerships should consider that some governments do not share US research ethics and values.

Federal agencies should work with research institutions, the academic community and professional societies to disclose information about foreign influence and make everyone involved in the research process aware of measures to balance risks associated with international research cooperation.

Safe and Inclusive Research Environments
IEEE-USA and CRA applaud JCORE for working to identify actions that will ensure research environments are free from harassment. Such negative behavior thrives when strict policies are overlooked or not enforced. We encourage federal agencies to follow the example of the National Science Foundation and set policies that tie one's ability to receive federal funding for research with one's commitment and ability to abide by rules that foster appropriate research environments for all faculty, staff and students.

1.   What policies and practices are most beneficial in fostering a culture of safe and inclusive research environments?

Key to ensuring a culture of safe and inclusive research environments is the requirement that organizations participating in that research environment adopt policies that promote a safe and welcoming environment, free from discrimination and harassment, for all participants. For organizations like IEEE-USA and CRA, this means adopting policies that apply not only to staff of the organization, but to: attendees of our workshops and conferences, sponsored attendees, guests, speakers, external vendors, sponsors, board members, committee members, faculty members, and student mentees. It also means applying those policies to our organizations' work environments, ancillary social gatherings, and on-line communications -- including email and social media -- and verbal communications to organize or otherwise contribute to these activities. At its root, these policies boil down to a simple requirement that all participants are required to treat each other with respect in all their behavior. Our organizations prohibit discrimination, harassment, or retaliation.

Organizations in the research environment should note that the following classes of behaviors violate the policy of respect and are unacceptable:

Discrimination -- Any behavior that discriminates against, abuses, offends, or denigrates other participants based on race, ethnicity, national origin, age, gender, gender identity, sexual orientation, marital status, parental status, disability, appearance, political affiliation, religion, veteran status, or any other personal characteristic or identity.

Sexual and physical harassment -- Any unwelcome verbal, physical, conduct of a sexual nature, or conduct of a perceived sexual nature. For example, propositions, comments on physical appearance, offensive sexual comments, promises of favors for sexual activity, physical threats, touching, sexual assault, and displaying of sexual images.

Harassment -- Any behavior directed at individuals that intimidates, abuses, offends, disrupts, denigrates, creates psychological, physical or physiological fear, bullies, stalks, records, or in any way interferes with these individuals' participation or responsibilities at organization activities.

Retaliation -- Any harassment directed at individuals who report or bear witness to violations or investigations of potential violations of the organization's code of conduct, or falsely reporting violations of the code of conduct.

Violations of codes of conduct ought to have consequences. In most cases, organizations in the research environment can consider participation in their activities to be a privilege, not a right. They thus should be understood to reserve the right to remove individuals violating the code of conduct from activities without warning and without reimbursement or refunding meeting participation costs. Organizations may also then prohibit individual offenders from participating in future organization activities, remove them from leadership roles in the organization, or prevent them from deriving benefits from organization activities.

Finally, organizations in the research environment should have appropriate mechanisms by means of which the targets of unacceptable behavior can report the behaviors and seek protection. For organizations such as ours, this means policies that urge targets of unacceptable behaviors to first feel empowered to take appropriate action to ensure their immediate safety, then enable them to contact organization staff and/or designated participants in person during the activity, or by phone or mail. Organizations should post the designated people and contact information for each activity. Those contact individuals should be empowered to take immediate action on the basis of verbal reports of unacceptable behavior, such as removing an individual violating the code of conduct from an activity. Targets and witnesses of unacceptable behavior should also be encouraged to file a formal complaint with the organization through a defined process.

Beyond having clear codes of conduct, there are broader policies that also can bear on fostering safe and inclusive environments. Because sexual harassment claims often lead to non-disclosure agreements as part of separation agreements, disclosure of sexual harassment is complicated. Allowing employees to disclose harassment regardless of non-disclosure agreements thus would be a big step toward fostering inclusive environments. Clear Federal guidance about how organizations handle complaints could alleviate some of the fear of coming forward with a complaint.

2. What barriers does your organization face in the recruitment and retention of diverse researchers?

The primary barrier to our institutions recruiting and retaining a diverse base of researchers to participate in our activities is the demographic challenge of diversity within the computing and engineering disciplines. In computing in particular, efforts to increase the participation of women and members of underrepresented groups in the field have been significant and ongoing for more than a quarter century. The community has devoted considerable support to efforts designed to increase the diversity of students at the K-12 level interested in careers in computing fields. Those efforts are beginning to bear fruit. Efforts by organizations like Code.org and their hundreds of partners in the public and private sectors to increase opportunities for computing in K-12, along with efforts in Federal agencies like NSF to reform AP computer science testing, have more than doubled the number of high school females taking AP computer science tests (from less than 12,000 in 2016 to nearly 30,000 in 2017) and nearly tripled the number of underrepresented minority students taking AP computer science tests (from less than 8,000 in 2016 to nearly 23,000 in 2017). Ensuring this K-12 pipeline stays full and ensuring that organizations adopt codes of conduct like those discussed above, will help ensure that the field itself becomes more diverse and representative in the future.

Federal agencies can help by ensuring that professional and research-related awards are granted in a manner that is unbiased towards women and minorities, and that Federal dollars continue to support efforts aimed at diversifying the "pipeline" to a research career at all stages.

3. Are Federal agency policies on harassment complimentary or conflicting with regard to state or organizational policies?

The National Science Foundation has taken a leadership role in this context by requiring its funded organizations to adopt codes of conduct that address harassment and discrimination. In our view, other federal funding agencies should follow suit.

Conferences play a major role in the careers of research scientists and often attendees are in situations away from supervisors and a formal work setting. Given the benefits of networking at conferences, conference organizers, including universities and professional technical societies, need to address the issues that occur when combining the extreme power discrepancy between graduate students and tenured researchers mixed with unsupervised activities often including alcohol. Federal agency policies should complement conference attendance policies. They should be discussed and enforced to ensure that everyone is able to reap the benefits of both the formal and informal networking that is vital to the progress of STEM research.

4. What metrics can the Federal government use to assess progress in promoting safer and more inclusive research environments?

In many cases, sexual harassment is not reported because the often-considerable value of a researcher's life work and that individual's "legacy" is seen as more important than the needs of his (or, in rare cases, her) students. The STEM community is a long way from respecting equally the need for a safe and inclusive work environment and the prestigious research of a tenured professor. When scientific value of publications and research findings are constantly placed ahead of the needs

of female and minority students who seek to research in a lab free from harassment, negative behavior inevitably will continue. Organizational leadership actions that place the needs of females and minority students on equal footing with the desire for professors to conduct prestigious research will foster a culture of safe and inclusive research environments.

About our Organizations:

IEEE-USA *represents 180,000 engineers, computer, and technology professionals in the United States, including members in every Congressional District.*

IEEE-USA – The Institute of Electrical and Electronics Engineers – is the world's largest technical professional organization, with more than 423,000 members in over 160 countries. IEEE is also one of the world's leading producers of both technology standards and technical publications.

*The **Computing Research Association (CRA)** is an association of more than 200 North American academic departments of computer science, computer engineering, and related fields; laboratories and centers in industry, government, and academia engaging in basic computing research; and affiliated professional societies. CRA's mission is to strengthen research and advanced education in the computing fields, expand opportunities for women and minorities, and improve public and policymaker understanding of the importance of computing and computing research in our society.*