

**National Science Foundation
Directorate for Computer and Information Science and Engineering
Advisory Committee (CISE AC)**

June 7-8, 2018

**National Science Foundation
2415 Eisenhower Ave.
Alexandria, VA 22314**

Meeting Summary

The spring meeting of the National Science Foundation's (NSF) Directorate for Computer and Information Science and Engineering (CISE) Advisory Committee (AC) was held at NSF on June 7-8, 2018.

Thursday, June 7

Welcome, Introductions, Review of Agenda, and Approval of Minutes

Drs. Margaret Martonosi and Rob Rutenbar, CISE AC co-chairs, opened the meeting at 12:30 p.m. After introductions of all members in attendance, Drs. Martonosi and Rutenbar reviewed the meeting agenda, and the CISE AC members unanimously approved the minutes from the December 2018 meeting.

NSF and CISE Update

Dr. Erwin Gianchandani, Acting Assistant Director of NSF for CISE, welcomed the AC members. Dr. Gianchandani provided an update on recent activities for the agency and directorate. Starting with an overview of the President's Fiscal Year 2019 Budget Request for NSF and CISE, he noted that the budget request names several research areas that are priorities within CISE, including Artificial Intelligence (AI) and quantum computing. Dr. Gianchandani then described CISE's continued involvement in all 10 of NSF's Big Ideas, and gave a detailed update on CISE activities within three of these Big Ideas—Harnessing the Data Revolution, Future of Work at the Human-Technology Frontier, and Growing Convergence Research. He also discussed CISE's increasing attention to strategic partnerships, through both joint research solicitations and activities enabling research infrastructure; pointed the AC to two new National Academies' reports on data science as well as growth in undergraduate enrollments in computer science; and discussed the expanded efforts in CISE in Broadening Participation in Computing (BPC). Dr. Gianchandani concluded by noting that there is tremendous interest in CISE across the Federal Government.

Enabling Computer and Information Science and Engineering Research and Education in the Cloud: Summary of Workshop

Dr. Jen Rexford, Gordon Y.S. Wu Professor in Engineering at Princeton University, presented a summary of the January 2018 workshop on Enabling CISE Research and Education in the Cloud; that workshop brought together academic and other stakeholders to identify how academia could make increased use of cloud computing, including the potential barriers to this use. Specifically, the workshop participants identified many value-added aspects of cloud computing, including

easier data sharing and reproducibility of research results. The most significant barrier that emerged from the workshop is the artificially high cost of cloud computing resources, resulting, in part, from the need for each academic institution to separately negotiate pricing with the cloud computing providers. Among other findings and recommendations, the workshop report recommended that an external entity be a broker between the cloud computing providers and academic institutions.

CISE Center-Scale Investments and Industry Engagement

Dr. Ken Calvert, CISE Division Director for Computer and Network Systems (CNS), provided an update on CISE's largest single investment awards: the Expeditions in Computing program as well as Frontier awards within the Cyber-Physical Systems (CPS) and Secure and Trustworthy Cyberspace (SaTC) programs. Dr. Calvert noted that many of these projects engage with industry, including through active industry advisory boards and through the InTrans funding mechanism, which involves 1:3 matching funds between NSF and a researcher-identified industry partner. Dr. Dawn Tilbury, Assistant Director of NSF for Engineering (ENG), provided a summary of the Engineering Research Centers (ERC) program as an analogue to the Expeditions and Frontiers programs within CISE, including the ERC program's aims to spur economic competitiveness and innovation, the current and future envisioned structures of ERC projects, and the requirement within ERCs for an industry/practitioner advisory board that is involved in an annual review of the corresponding center. Dr. Meghan Houghton, CISE Staff Associate for Strategic Engagements, then provided an overview of models for engagement with industry, including the need to align partnerships in CISE with NSF's core mission, the value proposition to industry partners, and the types of industry partnerships—joint solicitations, in-kind industry support through solicitations, and the standing-up of research infrastructure. Dr. Houghton then discussed the programs across NSF and CISE that facilitate direct academic-industry partnerships. The session concluded with breakout discussions elaborating on the topic of center-scale investment and associated industry engagement.

Quantum Leap Big Idea

Dr. Thyaga Nandagopal, CISE Deputy Division Director for Computing and Communication Foundations (CCF), provided an update on NSF's Quantum Leap (QL) Big Idea. He described the ambitious goals of the QL Big Idea, and the role of computing in supporting these goals. Dr. Nandagopal further noted that, in addition to NSF's efforts to address the challenging questions required to advance quantum computing, NSF is also considering how to build the academic workforce capacity, particularly in CISE areas, necessary to realize these advances. He also described ways in which NSF may work with industry to further quantum computing. He said that the initial steps pursuant to this effort have been through workshops, an Expeditions in Computing award, a Dear Colleague Letter encouraging interdisciplinary research at the intersection of CISE, ENG, and Mathematical and Physical Sciences interests, and an NSF Ideas Lab. Dr. Martonosi then provided a workshop report-out on the "Computing Community Consortium Workshop – Next Steps in Quantum Computing: Computer Science's Role." She stated that the workshop had around 50 participants and focused on algorithms, technologies, programming, and architectures. Dr. Martonosi shared some of the key takeaways from the workshop, including the value of a roadmap in order to assist in coordination across the quantum computing research landscape, the need for education and workforce development, and the need to set realistic expectations regarding the capabilities of quantum computing.

The meeting adjourned for the day at 5:30 p.m.

Friday, June 8

Welcome and Overview of Day

Drs. Martonosi and Rutenbar opened the second day of the meeting at 8:30 a.m.

Broadening Participation in Computing (BPC) Effort

Dr. Calvert provided an update on a relatively new expansion of CISE's BPC effort. Notably, a BPC pilot requiring meaningful BPC activities in Expeditions and Frontier proposals began in FY 2018, with the expectation that this requirement for BPC activities would be expanded to additional programs and awards in FY 2019. Dr. Nandagopal then noted efforts to spread BPC awareness throughout the CISE community, including through a resource guide for NSF program directors and training of peer reviewers across the community in order to provide clear feedback to PIs on BPC activities. Dr. Jan Cuny, Program Director in CISE/CNS, shared with the AC several BPC resources that are being developed and will soon be available to PIs, including the creation of an online resource portal with BPC ideas, as well as collective action efforts that will allow faculty to tap into already existing efforts within, for example, their institutions.

Meeting with the NSF Chief Operating Officer (COO)

The AC spoke with Dr. Joan Ferrini-Mundy, NSF's COO, about a variety of topics. The conversation began with a discussion on cloud computing, both the tremendous technology opportunity that this resource provides as well as the barriers to adoption; they noted that while this is an NSF-wide issue, CISE is naturally taking the lead in considering paths forward. The conversation then addressed CISE's center-scale investments—Expeditions and Frontier awards—and how these exploratory-type research projects have been instrumental in leading to foundational scientific breakthroughs impacting other science disciplines and society more generally. A key component of this discussion was the importance of synergies with industry. The discussion then addressed CISE's leadership in quantum computing, the value in assessing NSF-wide investments in quantum computing, and the need for increased entry points and education pathways in this field. The conversation ended with an update on CISE's BPC activities, including connections to NSF INCLUDES (Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science).

Report-outs from Center-Scale Investments and Industry Engagement Breakouts

Drs. Martonosi and Rutenbar reported on the outcomes of the breakout sessions. The discussions included the definition of what is meant by industry engagement, the pros and cons of such engagement, and the value proposition to industry. One takeaway from the discussion was that the CISE principal investigators (PIs) often have their own direct funding with industry, independent of NSF funding mechanisms—so there are various means for achieving industry engagement. The AC members noted that it would be valuable to further explore at what points

and how researchers partner with industry, i.e., to better characterize effective practices for industry engagement.

CISE AC Retiring Members' Reflections

Dr. Gianchandani thanked the retiring CISE AC member, Dr. Vijay Kumar.

Looking Forward, Closing Remarks, and Wrap-up

In closing, Dr. Martonosi thanked Dr. Gianchandani, CISE staff, and CISE AC members for a successful meeting.

The meeting adjourned at 12:15 p.m.