2023 CISE COV Management Response

The National Science Foundation (NSF) relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Committee of Visitors (COV) reviews provide NSF with external expert judgments in two areas: assessments of the quality and integrity of program operations; and program-level technical and managerial matters pertaining to proposal decisions. COV reviews are held approximately every four years.

The NSF Directorate for Computer and Information Science and Engineering (CISE) charged a COV to review program operations and program-level matters pertaining to proposal decisions in the Divisions of Computing and Communication Foundations (CCF), Computer and Network Systems (CNS), and Information and Intelligent Systems (IIS) over the period fiscal year (FY) 2019 through FY 2022. [The Office of Advanced Cyberinfrastructure (OAC) within CISE previously conducted a COV review covering the period FY 2017 through FY 2020; that COV meeting was held on August 8-9, 2022.] In particular, the COV was asked to comment on the quality and effectiveness of the merit review process; the selection of reviewers; the management of the programs under review; and the resulting portfolio of awards. In addition, the COV was asked to identify themes that cut across the divisions as well as programmatic opportunities at the CISE level that could enhance the directorate's ability to deliver on its mission.

The COV consisted of 31 members, including a chair and two CISE Advisory Committee members, and was composed of a diverse group with respect to technical expertise, institution type, geography, and background. The COV was divided into three subcommittees, one for each of CCF, CNS, and IIS. Each subcommittee had at least one vice chair and was responsible for completing a report template for its assigned division. In advance of an in-person meeting, the COV was provided with a comprehensive set of materials for review, including 1) the previous COV report and management response; 2) CISE and division overviews; 3) a dashboard presenting data for the covered period; 4) strategic documents; and 5) a sample of proposal jackets. Upon request, additional information was provided. The COV met in person at NSF on September 20-22, 2023. The meeting included breakout sessions on topics of interest to the COV. The COV completed a draft report on September 29, 2023. The CISE Advisory Committee accepted the COV's report on December 6, 2023. The COV concluded that:

- *CISE continues to manage the review process with impressive quality and integrity, and maintain a balanced portfolio of awards that addresses national priorities, despite a shortage of staffing and limited software tools.*
- *CISE processes are supported by an exceptional and dedicated team.*
- *CISE is to be commended on continuing to update and refine its processes, e.g., eliminating fixed submission deadlines for programs.*
- *CISE has made a considerable effort to address the recommendations of past COVs, e.g., by developing innovative programs for broadening participation, by adjusting the CAREER and CRII programs for early career faculty members, and by developing effective data analysis tools.*
- *The above-mentioned successes notwithstanding, the current state of affairs is not sustainable. There is a significant risk that, without sufficient staffing and budget support, CISE will soon become unable to continue to fulfill NSF's mission. This is critical due to CISE's leadership in emerging technologies, national security, and research infrastructure.*

The COV report includes extensive findings and offered twelve recommendations. This management response to the COV report addresses each of the COV's recommendations in the order in which they were presented.

Recommendation #1: To continue to support NSF's mission --- and, specifically, to (a) match the increasing importance of foundational computing research for tackling societal grand challenges, and (b) train the next generation of the nation's computing workforce that will drive economic growth --- the COV recommends increasing funding for CISE.

CISE strongly agrees with the COV's observation that the directorate contributes fundamentally to NSF's mission and priorities, including the agency's themes to Advance Emerging Industries for National and Economic Security; Build a Resilient Planet; Create Opportunities Everywhere; and Strengthen Research Infrastructure. CISE also appreciates the risks to NSF's mission in failure to take full advantage of the opportunity for foundational computing research to tackle societal and grand challenges and train the next generation computing workforce, and this requires funding for these activities. The budgets for CISE funding units since the last COV for CCF, CNS, and IIS are indicated in Table 1.

Table 1: Budgets of CISE units (dollars in millions)

Unit	FY 2020*	FY 2021*	FY 2022	FY 2023**	FY 2024***	FY 2025 Request
CCF	$199	$201	$201	$200	*TBD*	$201
CNS	$236	$238	$243	$246	*TBD*	$246
IIS	$216	$218	$218	$218	*TBD*	$218
ITR	$116	$118	$123	$123	*TBD*	$123
OAC	$228	$231	$231	$249	*TBD*	$279
CISE	**$995**	**$1,005**	**$1,015.57**	**$1,036**	***TBD***	**$1,068**

*For comparability with subsequent years, these numbers reflect the movement of programs and associated funding to the Directorate for Technology, Innovation, and Partnerships in FY 2022.
**For comparability with FY 2025, FY 2023 does not include Mission Support Services that were previously funded through NSF directorates and offices.
***FY 2024 budget levels not available yet

Recommendation #2: To effectively serve the growing community, the COV recommends that NSF CISE expand the mechanisms for attracting, retaining, and supporting CISE personnel.

The success of CISE relies critically on our ability to attract, retain, and support our personnel: our administrative and scientific staff, whether they are permanent or temporary staff. Their professional development and work-life balance must continue to be priorities for our organization.

- As NSF has returned to increased onsite work following the COVID-19 pandemic, the agency has established new policies for telework and remote, and CISE will continue to follow these policies to take advantage of the flexibilities offered by telework and remote work, as well as the benefits of in-person collaboration.
- CISE will continue to explore ways to enhance attracting retaining and supporting our scientific staff. For example, CISE will explore appointments for scientific staff other than full-time

appointments, such as increased reliance on part-time Experts. CISE scientific staff typically already support cross-divisional activities, and many join the organization with industry experience, and CISE will continue to look to match the backgrounds of the staff recruited with the needs of our mission.

- CISE will also continue to explore ways to enhance attracting, retaining, and recruiting our administrative staff. Upward mobility and career growth for administrative staff are of utmost importance for these efforts, and CISE is actively participating in an NSF-wide examination of this issue. And CISE will continue to follow NSF and government-wide policy on the grading of such positions.

Recommendation #3: To bridge the widening gap in access to computing resources and education, the COV recommends that CISE expand the on-ramp for access to computing-related opportunities.

CISE is taking a number of steps to expand access to computing-related opportunities by building computing infrastructure and enhancing capacity for research and education. In fiscal year 2023, CISE and other directorates issued a Dear Colleague Letter (NSF 23-091) to advance cybersecurity and privacy education and workforce development and invested in exploratory projects and project supplements. The Expanding AI Innovation through Capacity Building and Partnerships (ExpandAI) program is broadening participation of minority-serving institutions in AI research, education, and workforce development, leveraging the National AI Research Institutes ecosystem. The new Chip Design Hub program aims to lower the barrier to chip design resources for researchers and students. On January 24, 2024, NSF launched the National Artificial Intelligence Research Resource (NAIRR) pilot – a shared research infrastructure for strengthening and democratizing access to resources needed to support responsible AI discovery and innovation. And in alignment with NAIRR, the Advancing education for the future AI workforce (EducateAI) initiative enables educators to make state-of-the-art, inclusive AI educational experiences available nationwide to K-12, community college, four-year college, and graduate students, as well as adults interested in formal training in AI.

CISE's investments in expanding access to computing opportunities continues.   A major re-examination of the Secure and Trustworthy Cyberspace (SaTC) program is underway, including an examination of the need for nationally accessible cybersecurity infrastructures. Several infrastructure workshops to engage the computer science community are planned for FY 2024 or FY 2025 including (1) a training workshop for submitting proposals to the Mid-Scale Research Infrastructure programs, (2) a Mid-Scale Platforms Workshop that brings together the user community and the CISE Mid-Scale Research Infrastructure platforms, and (3) a topic-specific research infrastructure workshop to bring the advanced wireless research community together for training and collaboration.

Recommendation #4: To grow a more inclusive community, the COV recommends that CISE institute processes that analyze portfolios to identify and further engage underserved communities.

Expanding the engagement of people and institutions with our activities and with the science and engineering enterprise in general is a major priority for NSF, including CISE. CISE recently launched several new initiatives to engage underserved communities. For example, CISE launched the Advancing education for the future AI workforce (EducateAI) activity to enable educators to make state-of-the-art, inclusive AI educational experiences available nationwide; the Expanding AI Innovation through Capacity Building and Partnerships (ExpandAI) activity to broaden participation of minority-serving institutions in AI research, education, and workforce development through capacity development projects and

through partnerships within the National AI Research Institutes ecosystem; the NSF Expanding Capacity in Quantum Information Science and Engineering (ExpandQISE) program that aims to increase research capacity and broaden participation in Quantum Information Science and Engineering (QISE); and the Expanding TRIPODS through Partnerships (XTRIPODS) activity to supports partnerships between non-R1 universities and current TRIPODS (Transdisciplinary Research In Principles Of Data Science) Phase II Institutes to broaden participation and diversity in data science research.

An area of major focus across NSF is increased geographic diversity in our award portfolio through the expansion of investments at institutions in EPSCoR jurisdictions. The CHIPS and Science Act mandates increases in the percentages of the amounts appropriated to NSF to be awarded to institutions in EPSCoR jurisdictions over the next several years. CISE issued a Dear Colleague Letter on February 15, 2024 to raise awareness with the CISE community of this goal and encourage proposal submissions from institutions in EPSCoR jurisdictions to any and all active CISE funding programs. Other CISE strategies for increasing support for EPSCoR institutions include building tools and dashboards to identify EPSCoR investment opportunities, such as tools for program level proposal activity tracking; strategic program outreach to individuals and institutions in EPSCoR jurisdictions, including workshops for aspiring PIs from EPSCoR and underserved institutions and workshops for connecting EPSCoR and non-EPSCoR investigators; and in-reach to CISE staff to raise awareness of EPSCoR funding goals and mechanisms such as EAGER awards for promising exploratory research and to enhance participation of reviewers from EPSCoR jurisdictions. CISE will also explore new funding opportunities dedicated to enhancing support for institutions in EPSCoR jurisdictions.

Recommendation #5*: To frequently align programs with national needs, the COV recommends that CISE refine the processes for creating, prioritizing, and sunsetting programs.*

CISE supports a portfolio of programs. Some of these programs are intended to be broad and long-lived, while others are intended to be more focused in topic and duration. In the former category are CISE core programs. Core programs are designed with an expansive technical purview and built-in topical flexibility to accommodate changing research horizons and national needs over decadal durations. For example, the Algorithmic Foundations program in CCF, the Information Integration and Informatics program in IIS, and Network Technology and Systems program in CNS cover broad knowledge domains. Thus, changes in core programs must be deliberate and at a high level of description. Regardless, new topics can be included, effectively researched topics can be discontinued, and novel ideas in the national interest can be pursued with a thoughtful modification of the program synopsis based on community-driven proposal submissions, program portfolio analysis, and program officer expertise. The scope of CISE core programs are annually examined as part of the process for revising the core programs solicitation.

While CISE core programs are intended to be broad and long-lived, many other CISE programs are intended to be more focused in topic and duration. Such programs are developed to address current and emerging research opportunities, spur community interest in specific areas, and respond to national needs. CISE has already moved towards a model of making deliberate decisions at the time a program is created to establish a definite timeframe for re-evaluation of the program, and CISE has established regular program reviews with the CISE leadership team. CISE will explore additional steps to refine the process for creating, prioritizing, and sunsetting programs. For example, CISE will look to capture additional elements of the plan for a program in the program's management plan. These elements may include the motivation for starting a program in relation to existing programs, current and emergent

opportunities, and national priorities; the anticipated duration of the program after which a decision on moving forward or not will become necessary; and suggested data needs to inform decisions on continuation. CISE will also look to create a template for the management plan containing the above-mentioned elements and share it through internal collaboration sites. Moreover, CISE will look to establish standard information elements for CISE program reviews.

Recommendation #6: To develop effective partnerships with industry, the COV recommends that CISE periodically perform a cost/benefit analysis of each partnership, and share best practices on managing partnerships across CISE.

CISE will continue to enhance partnerships to increase their impact and reduce inefficiencies. CISE and several other NSF directorates have staff with specific responsibility for coordinating partnerships. Such staff from across NSF regularly meet to share best practices and work towards agency-wide improvements. NSF is conducting an evaluation of agency partnerships to understand and improve their impacts. This evaluation focuses on the study of direct partnerships with industry through CISE. The evaluation is identified in the NSF Learning Agenda Fiscal Year 2022 – 2026 and the NSF Annual Evaluation Plan (FY 2024). CISE coordinates actively with NSF's new Directorate for Technology, Innovation, and Partnerships (TIP). TIP has established a strategic partnership hub and has begun staffing this function.

Recommendation #7: To increase the visibility of CISE-funded research and education, the COV recommends that CISE extend and enhance methods of communicating project outcomes and impact.

Over the last several years, CISE has devoted increased effort in external communication to highlight the long-term impact of its research portfolio. The CISE communication specialist, data team, and an AAAS fellow have collaborated with program officers and investigators to produce these impact stories. The separate Committee of Visitors for the Office of Advanced Cyberinfrastructure (OAC) had also recommended OAC to better track impacts. CCF, CNS, and IIS will learn from OAC's implementation experience. Going forward, CISE will look to scale up the process for generating impact stories with more timely and active involvement from the research community. For example, CISE will look to use tools to collect data that will inform impact stories; institute a process to request highlights from PIs based on a standard template to minimize post-processing on the NSF side; and organize an open competition for a *Test of Time* award for CISE-funded research outcomes, either to be administrated by NSF or via an award to an external organization.

Recommendation #8: To streamline proposal processing, the COV recommends that CISE work with foundation IT staff to establish infrastructure stability and update pathways for CISE-developed tools.

CISE supports the need for creating new tools, but generating pathways for tool stability is critical for streamlining proposal processing. CISE staff has been very active in multiple NSF IT working groups to address this issue. For example, CISE is very active in the Foundation-wide Proposal Management Efficiency and Distributed IT Specialists Knowledge Outfit working groups. Each of these working groups collects information to ensure that the Division of Information Systems has input from all the key stakeholders. For example, CISE works with the Proposal Management Efficiency working group to see that CISE-created created tools for proposal processing are incorporated into the NSF enterprise system which will optimize and stabilize the tools for all staff.

NSF also has ongoing robust quality improvement programs in which CISE is very active. This includes enhancements to the Research.Gov and MyNSF systems, as well deployment of a new Panel Evaluation System to replace the Interactive Panel System in Fastlane. These systems also include new tools to support staff in finding diverse potential panelists. NSF has also analyzed the amount of time staff spend in processing declined proposals and is piloting an effort to streamline this process. In all these areas, CISE personnel at all levels are very active.

Finally, it has become clear to CISE leadership that knowledge management is challenging in an information rich environment. Thus, the directorate is supporting a working group that is developing a new approach to more effectively share information across CISE. This knowledge management effort will provide better and easier access to information, including training materials, in a consistent and sustainable manner for all CISE. This group's work also complements the effort of the NSF Office of the Director's knowledge management program that will address better ways of sharing official documents and information. NSF has also established the [Division of Data and Artificial Intelligence](#) in FY 2024 with the goal of supporting data and AI services across the agency. All these efforts should enhance information sharing and training.

Recommendation #9: *To increase the quality of proposal reviews, the COV recommends that CISE communicate expectations at the time of reviewer invitation or review assignment.*

CISE program officers already use several mechanisms to train reviewers before panels for consistent and rigorous evaluation of proposals. CISE will review these mechanisms and identify ways to enhance reviewer preparation. CISE will document practices and share with program officers for adoption. CISE will develop training material, specifically, briefing slides and review guidance and templates in advance of the reviewer selection. For core programs, these will be standing documents that would be gradually modified and improved with new directives and practices. For other programs, these documents may need revision on an annual basis based on changes to the solicitation. CISE will provide training material to reviewers with proposal assignments. CISE will also look to develop a recorded briefing to make available to reviewers and hold training webinars for solicitations with a large pool of reviewers. And CISE will look to use the new proposal evaluation system (PES) to provide specialized review templates.

Recommendation #10: *To facilitate community interactions, the COV recommends that CISE consider both modalities, virtual and in-person, for proposal review panels.*

CISE fully agrees with the COV's observations that virtual panels can increase inclusion and reduce time commitment for reviewers, while in-person panels can be valuable for community building. CISE is moving ahead with decisions on review panel format to achieve an appropriate mix of review panels in these formats.

Recommendation #11: *To streamline the review of proposals submitted to programs with rolling deadlines, the COV recommends that CISE evaluate the impact of rolling deadlines and make any necessary adjustments.*

CISE will do an in-depth analysis of programs with no-deadlines to understand the trends in submissions, impact on the research community, and workload implications on NSF staff. CISE will ensure that submission and eligibility rules for proposal submission under no-deadlines are intuitive and consistent across programs. CISE will consider changes to internal review processes to address workload issues and ensure that the reviewer community is not overburdened while maintaining review quality. And CISE will consider the use of multiple submissions windows in lieu of no-deadlines where appropriate, as currently implemented in the ExpandAI program.

Recommendation #12: *To facilitate coordination across CISE, the COV recommends that CISE expand the processes and invest in systems for sharing best practices among program directors.*

CISE is very aware of the challenges of coordination across the directorate, especially given the rotating nature of a significant fraction of our program officers. CISE is working on multiple fronts to address this issue. As noted earlier, there are multiple efforts occurring in parallel that will help knowledge management. Having a unified system should both streamline processes and standardize information and best practices.

CISE also has a long-standing effort to provide support for best practices with a group designed by and for program directors (PDs) called PD Assist. This group meets monthly to share best practices. The group also maintains a wiki that is populated with tools and instructions (both written and video) to share best practices. This includes information on each stage of the proposal life cycle. The group is extremely successful, with an average of 20 program directors attending monthly. CISE will examine how to keep PD Assist materials up-to-date effectively and efficiently.

NSF is also supporting efforts that can reduce burden and streamline practice. As noted earlier, NSF is currently enhancing the Research.Gov and MyNSF systems. Both have amenities that should enable staff to generate new best practices. For example, Research.Gov will soon have a volunteer-to-review option to help program directors find new and diverse panelists with an easy-to-use interface that can match potential panelists to specific panels or proposals. NSF is also exploring betters ways to survey the community to identify prospective reviewers. Both efforts should reduce the time required to create a high-quality review panel.