

**FY 2022 REPORT OF
NSF COMMITTEES OF VISITORS (COVs)**

Table 1 - Summary Information

Summary Information	
Date of COV: FY 2017 – FY 2020	
Program/Cluster/Section: Office of Advanced Cyberinfrastructure (OAC)	
Division: OAC	
Directorate: Computer and Information Science and Engineering (CISE)	
Number of actions reviewed: 3,465	
Awards:	1,079
Declinations:	2,320
Other:	66 (returned without review)
Total number of actions within Program/Cluster/Division during period under review: 4,397	
Awards¹:	1,548
Declinations:	2,339
Other:	510
Manner in which reviewed actions were selected: See 'Sampling Overview' on next page.	

¹ This number of awards (1,548) is an increase from the number of awards reviewed (1,079) because it includes non-competitively reviewed actions such as internally reviewed EAGER awards, supplements, etc.

Sampling Overview

The NSF requires 5-10% of the total portfolio be available to COV members for review. Sampling data consists of competitively reviewed proposals (awards and declines) as well as proposals that were returned without review. OAC has randomly generated a sample of **314 out of 3,465 proposals**, which is an **aggregate of 9%** across all fiscal years under review. The sample data has been categorized into the five program areas representative of the office and its programs. COV members have been assigned to review proposals based on their areas of expertise and complexity of proposals and programs in each area, while avoiding any declared conflicts of interests.

Portfolio Size

Program Area	2017	2018	2019	2020	Total
Advanced Computing	60	67	46	73	246
AWD	25	27	18	44	114
DECL	35	40	23	28	126
RTNR			5	1	6
Learning & Workforce Development	92	143	256	173	664
AWD	27	45	52	50	174
DECL	64	94	203	122	483
RTNR	1	4	1	1	7
Networking & Cybersecurity	229	125	92	124	570
AWD	40	39	39	67	185
DECL	187	83	45	50	365
RTNR	2	3	8	7	20
Software & Data	392	505	284	273	1454
AWD	74	140	76	66	356
DECL	312	365	204	196	1077
RTNR	6		4	11	21
Special Projects & DD Reserve	11	158	326	36	531
AWD	10	90	128	22	250
DECL		63	195	11	269
RTNR	1	5	3	3	12
Total	784	998	1004	679	3465

Program Area	Number of Proposals Sampled	Total Portfolio Size	Percent of Portfolio Sampled	Number of COV Reviewers	Sampling Notes
Advanced Computing	64	246	26%	3	Has represented the largest portion of new spending each year.
Learning & Workforce Development	86	664	13%	2	Has the second largest variety of programs, nearly all of which solicit proposals every year.
Networking & Cybersecurity	50	570	9%	2	
Software & Data	84	1454	6%	3	Has the largest proposal volume of all program areas.
Special Projects & DD Reserve	30	531	6%	1	Has the largest variety of programs but not all programs solicit proposals every year.

Additional Notes:

Sample excludes proposals for which OAC did not have direct responsibility and did not lead the merit review process. However, these proposals contribute to portfolio size and are represented in Part IV Questions 1 and 4, where co-funding data are displayed.

Each COV reviewer has been assigned to review at least 1 AWD, 1 DECL, and 1 RTNR proposal where applicable for every program element code within his or her assigned program area for each fiscal year under review.

COV Membership

Table 2 - COV Membership

Role	Name	Affiliation
COV Chair or Co-Chairs:	<ul style="list-style-type: none"> • David A. Bader (Chair) 	<ul style="list-style-type: none"> • New Jersey Institute of Technology
COV Members:	<ul style="list-style-type: none"> • Helen Berman • Richard Carlson • Susan Gregurick • Michael Heroux • Gwen Jacobs • Julia Lane • Richard Moore • Hakizumwami Birali Runesha • Victoria Stodden • Valerie Taylor • Ellen Zegura 	<ul style="list-style-type: none"> • Rutgers University New Brunswick • Department of Energy • National Institute of Health • Sandia National Laboratories and St. John's University • University of Hawaii • New York University • University of California San Diego (retired) • University of Chicago • University of Southern California • Argonne National Laboratory • Georgia Institute of Technology

MERIT REVIEW CRITERIA

An understanding of NSF's merit review criteria is important in order to answer some of the questions on the template. Reproduced below is the information provided to proposers in the Grant Proposal Guide about the merit review criteria and the principles associated with them. Also included is a description of some examples of broader impacts, provided by the National Science Board

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These broader impacts may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities. These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. Both criteria are to be given full consideration during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. ([PAPPG Chapter II.C.2.d](#) contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including [PAPPG Chapter II.C.2.d](#), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to:
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

3. Examples of Broader Impacts

The National Science Board described some examples of broader impacts of research, beyond the intrinsic importance of advancing knowledge.² “These outcomes include (but are not limited to) increased participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education at all levels; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a globally competitive STEM workforce; increased partnerships between academia, industry, and others; increased national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education. These examples of societally relevant outcomes should not be considered either comprehensive or prescriptive. Investigators may include appropriate outcomes not covered by these examples.”

² [NSB-MR-11-22](#)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, returns without review, and withdrawals) that were *completed within the past four fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

Table 3 - Quality and Effectiveness of the Merit Review Process

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Are the review methods (for example, panel, ad hoc, site visits) appropriate?</p> <p>Comments:</p> <p>Review methods were consistent and appropriate to the proposed submissions. Panels and ad hoc reviews were utilized in accordance with agency guidelines and procedures. For the small to midlevel jackets reviewed, the balancing of panel and ad hoc review appears appropriate and in particular tied to the size of the award, with larger awards tending to have more panels rather than ad hoc reviews. Small grants that did not involve panels often included consultation among program directors as an integral part of the evaluation process.</p> <p>A small number of proposals were returned without review, including several large proposals, because the proposal did not comply with the budget/schedule limits in the PAPPG or solicitation or the proposal was not responsive to the solicitation requirements.</p> <p>In all cases the information contained in the jackets provided sufficient documentation to show that the PO was following NSF practices and policies.</p> <p>The dwell time generally was better than the 180 day/75%-compliant thresholds, particularly in 2018 and 2019. Longer dwell times in FY20 may be due in part to the onset of COVID pandemic.</p> <p>Data Source: COV Databook Part I Question 1</p>	<p>YES</p>

<p align="center">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p align="center">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>2. Are both merit review criteria addressed</p> <ul style="list-style-type: none"> a) In individual reviews? b) In panel summaries? c) In Program Officer review analyses? <p>Comments:</p> <p>The panel summary documents contain details showing that the responsible NSF Program Officer (PO) and panelists followed the NSF practices and policies including the two basic merit criteria. Additional review criteria were commonly added by the PO for a specific solicitation. The individual solicitations contained sufficient details regarding the specific review criteria the PO would use when evaluating the proposals.</p> <p>The individual reviews were, for the most part, substantive, and gave both strengths and weaknesses. A few reviewers did not provide enough documentation to justify their ratings. In most cases, panel summaries aligned with the individual reviews and provided summaries of the science and the additional review criteria for each program. Unlike the individual reviews, the panel reviews consistently addressed Broader Impacts.</p> <p>While the two merit review criteria are supposed to have the same weight in the review process, the reality is not the case. On average, intellectual merit seemed to receive more attention in the reviews than broader impacts. The scope and metrics of success of suggested broader impacts are usually not very well understood by investigators submitting proposals as well as reviewers. The lack of attention to broader impacts in the review process is reflected by the brief comments, in particular in the individual reviews. For most proposals, the broader impact section uses fewer pages than the intellectual merit section. By not investing a lot of thinking about broader impacts, the proposers and reviewers do not seem to take it seriously, questioning the review process itself and how much importance is given to broader impacts. While it is the committee's understanding that broader impacts is currently under review, the question is a complex one and will require more attention and discussions.</p> <p>Data Source: Jackets, COV Databook Part I Question 2</p>	<p>YES</p>

<p align="center">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p align="center">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals?</p> <p>Comments:</p> <p>As expected, the quality and content of the reviews varies based on the reviewer. Most were reasonable-to-excellent quality. In some cases, reviewers provided a simple bulleted list of strengths and weaknesses, in other cases more substantial comments were provided.</p> <p>Data Source: Jackets</p>	<p>YES</p>
<p>4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)?</p> <p>Comments:</p> <p>The panel summaries consistently provided the rationale for the panel's recommendations. The summaries provided information about the strengths and weaknesses of each proposal, including an assessment of the Broader Impacts.</p> <p>The summaries were well-written, and accurately reflected the individual reviewer comments. The various PO's did an excellent job of shepherding the panelists to create a summary document. This ensured that the document contains complete sentences, correctly spelled words, and a comprehensive summary that both the PO and PI can use to understand why the reviewers reached the reported consensus. While a few of the panel summaries were perhaps too brief with short bullet points, which may not provide sufficient documentation for funding decisions, the summaries typically contained very substantive comments based on the consensus discussion and a combination of the various reviews.</p> <p>In some cases, differences of opinion from a consensus were noted and explained. In some cases, the panel summaries included recommendations for the PI which the PO followed up on with written responses to the PIs.</p> <p>Data Source: Jackets</p>	<p>YES</p>

<p>5. Does the documentation in the jacket provide the rationale for the award/decline decision?</p> <p>[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.]</p> <p>Comments:</p> <p>Most jackets contained clear rationale and supporting documentation for the award/decline decision. In most cases, the program officers did an impressive amount of deep analysis, coordinated with other Directorates, and when appropriate followed up with the PI about concerns raised by the panel. Additional information (e.g., clarifying correspondence with the PI) was included in Diary Notes or elsewhere. For decisions that were difficult to make, specifically well-ranked proposals that were not awarded, there was additional context to explain the details of the decision. Further the Diary Notes provided excellent detail about answers from the PI to outstanding issues raised by the panel, prior to awards.</p> <p>The Program Officer Review Analyses were generally of excellent quality, addressing the review criteria (Intellectual Merit, Broader Impacts, solicitation-specific criteria), citing specifics from the reviewer comments, and fairly representing the individual reviews and panel summaries. In a limited number of cases, the jackets were weak and sufficient documentation was not available to fully understand why the award/decline decision was made. But the general high quality of these Review Analyses reflects well on the Program Officers and the Office Director(s).</p> <p>Jackets that described proposals that were returned without review, or were not associated with a specific targeted solicitation, were more varied in the amount of information they contained. For proposals returned without review, in most cases the specific reason(s) were provided to PIs, however some PIs received only a standard form letter. The latter does not provide the PI with the information needed to correct errors or mistakes.</p> <p>Panel recommendations were generally followed by the program officers. Some exceptions exist, e.g., awards made to “low competitive” proposals or proposals that were declined despite receiving positive reviews. In the cases examined, these exceptions were not only justified but the COV supports the reasonable discretion allowed to program officers. For example, the PO brings additional information that would not be known or considered by panels (e.g., other similar awards or past performance information) and may use this to decline a proposal that was otherwise viewed positively. This appears to be done in a reasonable manner.</p> <p>Data Source: Jackets</p>	<p>YES</p>
<p>6. Does the documentation to the PI provide the rationale for the award/decline decision?</p>	<p>YES</p>

<p align="center">QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS</p>	<p align="center">YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE</p>
<p>[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]</p> <p>Comments:</p> <p>In general, the documentation to the PI is clear and provides an accurate rationale for the award/decline decision. The “returned without review” proposal responses contain different level of detail regarding the decision.</p> <p>Data Source: Jackets</p>	
<p>7. Additional comments on the quality and effectiveness of the program’s use of merit review process:</p> <p>The merit reviewer process is considered the ‘gold standard’ for federal agencies who fund academic research. Its use is essential in making sure the limited federal funds the agency has are well spent. The COV found that this process is working well within OAC and it needs to continue.</p> <p>Some proposals that were returned without review contain situations that are unfortunate with relatively minor errors. For example, one proposal neglected to include equipment quotes that were required by the solicitation. Another used the wrong title on the cover page which led to a conflict about which track the proposal was intended for. The institutions and PIs involved in these returned proposals may be relatively inexperienced in NSF proposal writing.</p> <p>The COV noted effective communication between the PO and PIs after the panel and prior to a final decision. In some cases, the program officer followed up on questions raised in the panel summary with the applicant and the program officer went back to the PI when a response was not sufficient. Also, in multiple jackets that were marked as awarded, the PO conducted a negotiation with the PI to address weaknesses the reviewers noted in their individual reviews. This allowed the PI to make slight modifications to the proposal which address these concerns.</p>	<p align="center">YES</p>

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

Table 4 - Selection of Reviewers

SELECTION OF REVIEWERS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>1. Did the program make use of reviewers having appropriate expertise and/or qualifications?</p> <p>Comments:</p> <p>The jackets sampled by the COV demonstrate the POs consistently assembled a competent set of reviewers with expertise in their field. For the most part, reviewers were from a broad spectrum of institutions, both large and small, with expertise in computer science and mathematics. For proposals from special programs such as EAGER and RAPID, qualifications of the internal reviewers were uniformly high-quality. Overall, the reviewer qualifications were consistently good.</p> <p>Data Source: Jackets, COV Databook Part II Question 1</p>	YES
<p>2. Did the program recognize and resolve conflicts of interest when appropriate?</p> <p>Comments:</p> <p>Yes, when jackets identified COIs, the COI issues were documented and resolved appropriately. Several jackets in the sample contained a request for a COI determination on a potential COI to allow a qualified reviewer to participate when there was a possible appearance of conflict. These requests were thoughtfully made and resolved well.</p> <p>Data Source: Jackets, COV Databook Part II Question 2</p>	YES

SELECTION OF REVIEWERS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
<p>3. Additional comments on reviewer selection:</p> <p>In general, members of the COV were impressed by the breadth of reviewers that NSF program officers recruited for evaluating the proposals. Reviewers had to span the wide range of expertise required to evaluate diverse proposals, along with the desire for demographic diversity along multiple dimensions (geography, institution type, gender, ethnicity). The COV applauds OAC for their ability to recruit this breadth of reviewers.</p> <p>The geographic diversity of reviewers appears to match the geographic diversity of the submissions. Amongst reviewers, the representation of females (~20%) and under-represented minorities (~3%) was low. See further discussion of diversity in Section IV, Question 9.</p>	

III. Questions concerning the management of the program under review. Please comment on the following:

Table 5 - Management of the Program Under Review

MANAGEMENT OF THE PROGRAM UNDER REVIEW
<p>1. Management of the program.</p> <p>Comments:</p> <p>The COV finds that the OAC programs are well managed and the responsible Program Officers are to be commended for managing this part of the program. The proposal review process is excellent in general. The information provided in the sample jackets demonstrates that the PO's have the skills needed to identify research topics (solicitations), identify compliant and non-compliant responses, identify reviewers with the necessary skills, manage and run review panels, and make decisions. All of this is done in accordance with NSF policies and standard procedures.</p> <p>Data Source: Jackets, COV Databook Part III Question 1</p>
<p>2. Responsiveness of the program to emerging research and education opportunities.</p> <p>Comments:</p> <p>In general, the COV's review of specific OAC solicitations throughout the COV review period demonstrates that OAC's focus on research areas is evolving as necessary to ensure that emerging areas of research and education are covered. The engagement of the program officers in strategic planning activities is impressive. We appreciate that OAC gathers external input by supporting workshops and through active engagement with the ACCI and ACCI working group output. As a result, OAC has incorporated emerging research and education opportunities into five community-informed blueprints and has played a key role in advancing NSF's 10 Big Ideas, especially Harnessing the Data Revolution. In several jackets, we also noticed PO's accommodating PI requests to rebudget toward education travel funds that were unused due to COVID. We appreciate the creation of mid-scale funding levels at OAC for awards.</p> <p>Data Source: Jackets, COV Databook Part III Question 2</p>

MANAGEMENT OF THE PROGRAM UNDER REVIEW

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

NSF is doing an excellent job in program planning and prioritization. The development of the portfolio seems to follow a program planning and prioritization process that meets OAC's mission. This has been accomplished by the use a combination of workshops, conference birds-of-a-feather such as at SC, CASC, and PEARC, individual outreach by the PO, townhalls, and community interactions in fora and working groups like the NITRD LSN IWG, and engagement with ACCI.

Across OAC, while some areas that have seen increases in success rates since 2017, overall the proposal funding and success rate has been flat over the COV timeframe. While new programs have been launched and old programs have terminated, overall the portfolio is flat in terms of budget.

Data Source: Jackets, COV Databook Part III Question 3

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

OAC provided appropriate responses to the prior COV's findings and recommendations. In general, the program was responsive to previous COV comments and recommendations where possible. The office has made great progress and the implementation of tools such as the COV data Sharepoint has greatly improved access to data.

The previous COV requested that software proposals needed to include sustainability plans. The COV noted that the solicitation and subsequent proposals incorporate that suggestion and hence was responsive.

The previous COV requested that more work be done to improve diversity. However, since a set of questions presented to this COV specifically calls out OAC diversity strategies for continued engagement with various communities (Part II) and the release of Blueprints, this suggests that while OAC has been responsive, the work needs to be continued.

The past COV identified concerns about the quality of the broader impact discussion. Management responded that it concurred with the assessment, but this COV was not clear about the specific action items that were taken to respond to the previous COV concern.

Data Source: Jackets, COV Databook Part III Question 4

IV. Questions about Portfolio. Please answer the following about the portfolio of awards made by the program under review.

Table 6 - Resulting Portfolio of Awards

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE
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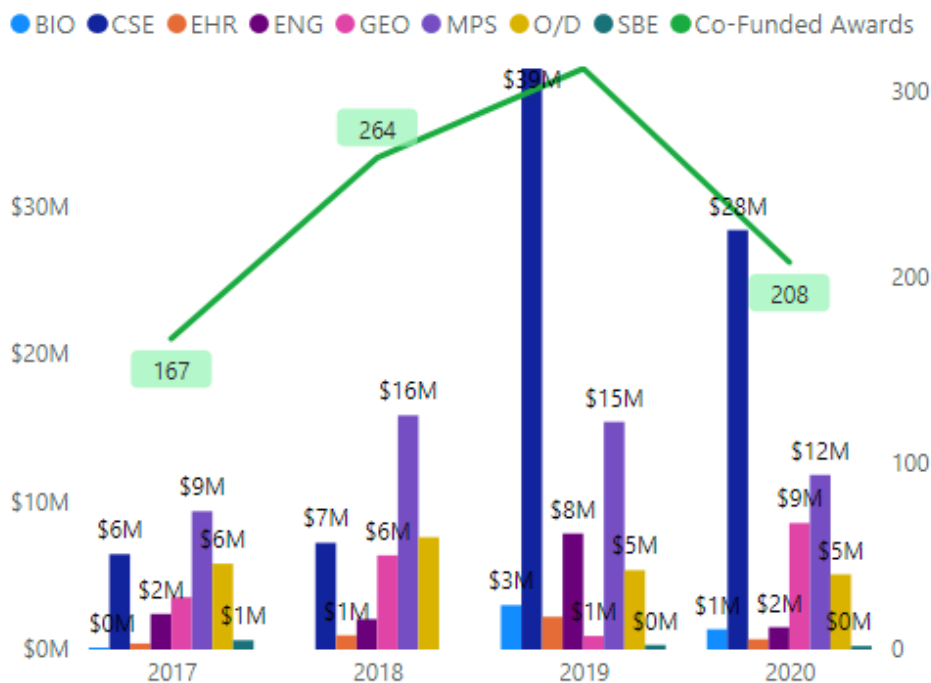
1. Does the program portfolio have an appropriate balance of awards across disciplines and sub-disciplines of the activity?

APPROPRIATE

Comments:

The COV databook provides information as shown below on the number of proposals and funding amounts that other NSF directorates used to co-fund proposals received by OAC (incoming) and that OAC used to co-fund proposals received by other NSF directorates (outgoing). OAC's total incoming funding FY17-20 was ~\$201M and outgoing funding FY17-20 was ~\$61M. All directorates are represented in both incoming and outgoing funding, with CISE dominating. Amounts to/from specific directorates varied substantially from year-to-year and are influenced by various solicitations and cross-directorate collaborations.

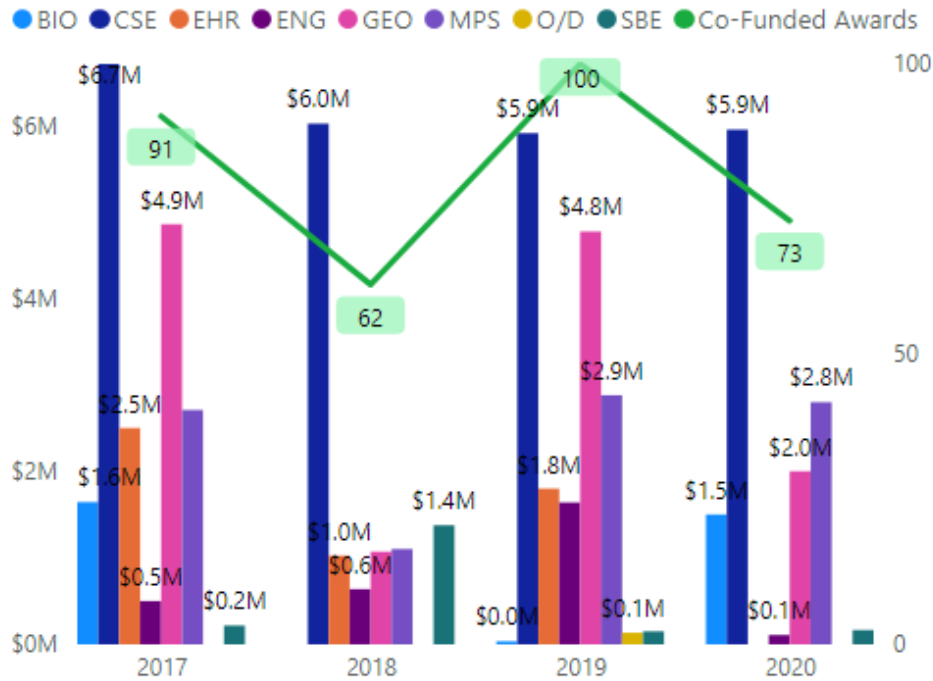
Incoming Co-Funding (Office-Wide)



RESULTING PORTFOLIO OF AWARDS

**APPROPRIATE,
NOT
APPROPRIATE,
OR DATA NOT
AVAILABLE**

Outgoing Co-Funding (Office-Wide)



Without more detailed analyses of the co-funded solicitations/awards, it is difficult to assess whether these levels of cross-funding are appropriate, or how each of these cross-directorate projects align with the missions of OAC and collaborating directorates. In at least one program element (Software Institutes), the awards seemed focused on MPS-related topics; this may have reflected the co-funding levels offered by MPS.

In general, it is a positive step that all directorates are represented in both incoming and outgoing funding, and we encourage OAC to continue to collaborate with other directorates to foster NSF's scientific mission.

Data Source: COV Databook Part IV Question 1

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>2. Are awards appropriate in size and duration for the scope of the projects?</p> <p>Comments:</p> <p>In general, award amounts and durations are consistent with NSF historical data.</p> <p>There are some fluctuations that are appropriate. For example, for the area of Advanced Computing, the average size and duration data is subject to small number statistics and wide non-normal distributions, especially for award size. The Frontera and Innovative HPC awards are very large compared to most awards, while the LCC awards for Blue Waters time were numerous and had no funding. The increase in mid-scale funding opportunities is appreciated.</p> <p>Data Source: COV Databook Part IV Question 2</p>	<p>YES</p>
<p>3. Does the program portfolio include awards for projects that are innovative or potentially transformative?</p> <p>Comments:</p> <p>Many of the awarded proposals were enthusiastically reviewed by community peers against criteria that explicitly ask about “creative, original, or potentially transformative concepts.” Their expert judgement strongly suggests that the portfolio meets this goal.</p> <p>Even though many awards represent “infrastructure,” some awards (e.g. MRIs and Innovative HPC) include novel hardware systems or environments and/or reach out beyond traditional computing communities. Many of the Leadership-Class computing awards for Blue Waters time represent innovative scientific research across various domains. In addition, Network Cyberinfrastructure awards support projects that add capacity and capabilities to campus and international science communities. These are important and essential activities that have a transformative impact on those institutions and scientists.</p> <p>Data Source: Jackets, COV Databook Part IV Question 3</p>	<p>YES</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>4. Does the program portfolio include inter- and multi-disciplinary projects?</p> <p>Comments:</p> <p>Many funded projects received co-funding from other directorates and OAC divisions. Overall, co-funding from the physical and computing directorates averaged around \$5M/year with steady commitments but not an increase in funding amounts.</p> <p>External co-funding is relatively low for Advanced Computing. As a program that provides infrastructure to be used across all science and engineering disciplines, lower co-funding amounts may be appropriate since external directorates view the program as a cross-cutting resource.</p> <p>Data Source: COV Databook Part IV Question 4</p>	<p>YES</p>
<p>5. Does the program portfolio have an appropriate geographical distribution of Principal Investigators?</p> <p>Comments:</p> <p>OAC appears to have done a good job engaging with the broader community. Proposals were received from institutions across nearly all states. For the most part the award rate for EPSCoR States has remained relatively flat, however, in advanced computing the awards to EPSCoR states are lower. This disparity does not necessarily imply a review bias against EPSCoR proposals, but likely reflects the dominance of infrastructure-related activities in non-EPSCoR states.</p> <p>Data Source: Enterprise Reporting, COV Databook Part IV Question 5</p>	<p>YES</p>

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>6. Does the program portfolio have an appropriate balance of awards to different types of institutions?</p> <p>Comments:</p> <p>With the NSF's open and competitive environment for its solicitations, the current balance of awards seems appropriate. For example, for all OAC, 23% of awards went to non-PhD granting institutions and 18% went to institutions in EPSCoR states.</p> <p>Most awards in areas such as networking and cyberinfrastructure were made to PhD granting institutions. Similarly, for advanced computing, the preponderance of awards over FY17-20 went to PhD granting institutions, 13.5% went to non-PhD granting institution and 13.5% to institutions in EPSCoR states. Not surprisingly, the top institutions to receive advanced computing awards, are those hosting NSF supercomputer centers (UIUC/NSCA, CMU/PSC, IU/PTI, UCSD/SDSC, UT/TACC).</p> <p>Data Source: Enterprise Reporting, COV Databook Part IV Question 6</p>	<p>YES</p>

YES

7. Does the program portfolio have an appropriate balance of awards to new and early-career investigators?

NOTE: A new investigator is an individual who has not served as the PI or Co-PI on any award from NSF (with the exception of doctoral dissertation awards, graduate or post-doctoral fellowships, research planning grants, or conferences, symposia and workshop grants.) An early-career investigator is defined as someone within seven years of receiving his or her last degree at the time of the award.

Comments:

The Databook shows that OAC awards are skewed to mid and late career PIs. Only about 20% of the proposals come from early-career PIs, and approximately 16% of the awards made in each year go to an early career PI. This may well be appropriate for projects whose focus is to create and sustain infrastructure to support the research community. Such projects can benefit from the management experience of later-stage PIs, whereas early-stage PIs reasonably devote much of their time to establishing their own research agenda.

OAC made a limited number of CAREER awards (5 per year in the period of review) explicitly supporting early-career researchers. Further, in the area of Special Projects, there appears to be strong effort to increase the number of new and early-career investigators, as evidenced by growth in the number of early career submissions in the 2017-2019 time period.

Investigator career stages are defined as follows:

- Early-Career = PhD received 0-7 years ago
- Mid-Career = PhD received 8-20 years ago
- Late-Career = PhD received over 20 years ago

Submissions by PI Career Stage (Special Projects & DD Reserve)



Awards by PI Career Stage (Special Projects & DD Reserve)



PI Details (Special Projects & DD Reserve)

	2017	2018	2019	2020
PI Avg Experience (Yrs)	22.30	19.03	16.98	21.76
PIs	10	146	308	33
Institutions	9	99	146	29
State/Territory	7	33	45	17

CI Professionals in professional staff positions are critical to the development and sustainability of CI. Appropriate support of this community of professionals, including early in their careers, is critical to the development and support of cyberinfrastructure and to the research mission.

Data Source: COV Databook Part IV Question 7

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>8. Does the program portfolio include projects that integrate research and education?</p> <p>Comments:</p> <p>The unique nature of CI means that funded projects provide both direct and indirect impacts on research and education. The Databook indicates there are thousands of students benefiting from OAC projects. The data provided in the Databook also indicates that, on average, 5 students (Post Docs, Graduate, or Undergraduate), are participants on a funded project. This provides these students with educational opportunities while working with peers and faculty advisors. Approximately half of these students are at the Graduate level followed closely by Undergraduates. However, funding for these students is quite low, around 2% of the average budget going to pay these students.</p> <p>During COVID many of the awards that we reviewed asked for a no-cost extension and/or rebudgeting to bring on either undergraduates or additional students. Recruiting was mentioned as a challenge during COVID.</p> <p>The learning and workforce development in its cybertraining is very exciting. The level of engagement by postdocs, grad students and undergraduates is encouraging.</p> <p>Data Source: Jackets, COV Databook Part IV Question 8</p>	<p>YES</p>

YES

9. Does the program portfolio have appropriate participation of underrepresented groups³?

Comments:

Similar to the comments of the past COV in 2017, there are challenges throughout the scientific community and especially the computing community to attract appropriate engagement from underrepresented groups. The majority of proposals for OAC come from white and Asian men and the majority of awards are made to this same demographic. It is worth pointing out, that the community continues to be focused on increasing participation of underrepresented groups, but we are still not there yet.

To address the question of appropriate participation of underrepresented groups within OAC, it is recognized that we first need to address the increase in engagement of underrepresented communities in the computing community.

From the data⁴ given in the Data Book across OAC for 2017 through 2020, we have the following data with respect to reviewers, submission PIs, award PIs:

OAC Reviewers

Gender	2017	2018	2019	2020
Do Not Wish To Provide	17.48%	14.37%	10.75%	10.70%
F	19.28%	20.32%	21.19%	19.84%
M	63.24%	65.31%	68.06%	69.45%

Disability Status	2017	2018	2019	2020
Do Not Wish To Provide	16.62%	16.33%	15.98%	17.81%
N	81.66%	82.91%	82.81%	78.95%
Y	1.72%	0.77%	1.21%	3.24%

Ethnicity	2017	2018	2019	2020
Do Not Wish To Provide		0.29%	0.81%	0.44%
Hispanic or Latino	8.09%	5.49%	7.28%	6.17%
Not Hispanic or Latino	91.91%	94.22%	91.91%	93.39%

³ NSF does not have the legal authority to require principal investigators or reviewers to provide demographic data. Since provision of such data is voluntary, the demographic data available are incomplete. This may make it difficult to answer this question for small programs. However, experience suggests that even with the limited data available, COVs are able to provide a meaningful response to this question for most programs.

⁴ *When compiling the data, "unknown" was treated as a null value and excluded from the results, whereas "do not wish to provide" was included as a separate category.*

Reviewer Race Description	2017	2018	2019	2020
American Indian or Alaska Native	0.31%	0.26%	0.26%	
Asian	29.85%	25.66%	30.91%	27.43%
Black or African American	3.08%	1.85%	2.08%	1.69%
Multiracial	1.23%	0.79%	0.52%	0.42%
White	65.54%	71.43%	66.23%	70.46%

OAC Submitting PIs

PI Gender	2017	2018	2019	2020
Do Not Wish To Provide	0.35%	0.27%	0.42%	0.41%
F	18.94%	21.68%	23.21%	16.36%
M	80.71%	78.05%	76.37%	83.23%

PI Disability Code	2017	2018	2019	2020
Do Not Wish To Provide	0.85%	0.79%	0.77%	1.64%
N	97.86%	99.05%	98.93%	97.42%
Y	1.28%	0.16%	0.31%	0.94%

PI Ethnicity	2017	2018	2019	2020
Do Not Wish To Provide	10.23%	10.21%	10.75%	10.12%
Hispanic or Latino	3.63%	4.36%	3.37%	4.76%
Not Hispanic or Latino	86.14%	85.43%	85.88%	85.12%

PI Race	2017	2018	2019	2020
American Indian or Alaska Native		0.28%	0.14%	
Asian	31.34%	29.03%	37.61%	39.10%
Black or African American	1.31%	2.36%	1.85%	2.70%
Multiracial	0.37%	1.39%	1.28%	0.67%
Native Hawaiian or Other Pacific Islander		0.14%	0.14%	
White	66.98%	66.81%	58.97%	57.53%

Awarded PIs

PI Gender	2017	2018	2019	2020
Do Not Wish To Provide			1.26%	0.51%
F	15.75%	25.36%	22.27%	15.82%
M	84.25%	74.64%	76.47%	83.67%

PI Disability Code	2017	2018	2019	2020
Do Not Wish To Provide	1.61%	1.35%	1.29%	1.15%
N	97.58%	98.65%	98.28%	98.85%
Y	0.81%		0.43%	

PI Ethnicity	2017	2018	2019	2020
Do Not Wish To Provide	10.97%	10.63%	13.11%	10.34%
Hispanic or Latino	3.23%	4.32%	3.37%	4.93%
Not Hispanic or Latino	85.81%	85.05%	83.52%	84.73%

PI Race	2017	2018	2019	2020
American Indian or Alaska Native		0.37%	0.41%	
Asian	23.53%	21.35%	31.54%	31.84%
Black or African American	0.74%	2.62%	0.83%	1.68%
Multiracial		1.50%	1.24%	0.56%
Native Hawaiian or Other Pacific Islander		0.37%		
White	75.74%	73.78%	65.98%	65.92%

Benchmark Data

In order to establish some benchmarks for gender/race diversity for the 'NSF/OAC community' of reviewers/PI/awardees, we have examined data from the 2019 Survey of Doctorate Recipients which include 'U.S. residing employed doctoral scientists and engineers.' We took the subset of doctorate recipients to be those working at 4-year educational institutions (All Fields). In addition, we have considered the further subset of 'Computer and Information Scientists (CIS)' within 4-year educational institutions. The results from this survey are:

	All Fields	CIS
Male	61.5%	80.8%
Female	38.5%	19.2%
White	69.7%	57.3%
Asian	20.0%	36.3%
Under-represented:	10.2%	6.4%
Hispanic or Latina	4.7%	2.8%
Black or African-Amer	4.0%	2.5%
Native American	0.2%	-
Other	1.3%	1.1%

Source: 2019 Survey of Doctorate Recipients (<https://ncses.nsf.gov/pubs/nsf21320>), Tables 43 (gender) and 44 (race)

There are significant variations between All Fields and CIS. OAC may have a broader mix of fields of study compared to CIS, and it is not clear that CIS is more appropriate than All Fields as a benchmark for the 'NSF/OAC

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>community.' This illustrates the challenge of establishing a benchmark, but one would like to see diversity within or above the range of these survey numbers.</p> <p>Results Comparing the percentage participation to the benchmark ranges from the 2019 Survey of Doctorate Recipients, the participation levels are generally within the benchmark range, especially when focused on CIS, resulting in the affirmative answer to this question. The percentages for females (~20%) are at the low end of the benchmark range of 19-38%. There is no benchmark readily available for persons with disabilities. The percentages for Hispanic/Latino ethnicity (~3-8%) are comparable to the benchmark range of 3-5%. However, the percentages for the combination of Hispanic or Latina, Black or African-American and Native American, (~5-7%) are also on the low end of the benchmark range of 6-10%.</p> <p>When comparing the demographics for the submitting PIs and award PIs, we find that for Black or African-Americans the percentage for awards is lower than that for submissions; it is recognized that these percentages are small. For the demographic of white, however, the percentage of awards is consistently higher than the percentage of submissions.</p> <p>Note that since NSF cannot require PIs to submit demographic data, most of the information and data the COV reviewed on demographics is either incomplete or difficult to extract.</p> <p>Data Source: Enterprise Reporting, COV Databook Part IV Question 9</p>	

<p style="text-align: center;">RESULTING PORTFOLIO OF AWARDS</p>	<p style="text-align: center;">APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE</p>
<p>10. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports.</p> <p>Comments:</p> <p>The program is highly relevant to national priorities, agency mission, relevant fields and consultant needs. Cyberinfrastructure occupies a unique role at the intersection of research service and support, and core computing research. This is reflected in the choice and scale of awards and their ability to advance the larger research community and meet programmatic goals. The PO's do an outstanding job of creating relevant programs and updating them on a regular basis to address changing national priorities and agency mission needs. The awards are relevant to national priorities and agency mission.</p> <p>An example is the shift that occurred to incorporate computational reproducibility as described in the 2019 National Academies report "Reproducibility and Replication in Science" (https://nap.nationalacademies.org/catalog/25303/reproducibility-and-replicability-in-science) and ACCI working group reports on open data, code, and reproducibility. In early March of 2020, just as the US was beginning to understand the urgency of the COVID-19 pandemic, OAC played a key role in an effort to combine computing resources, broadly from federal agencies, academic institutions, and industry, to better facilitate COVID-19 research. Specifically, OAC co-led the establishment of the COVID-19 High Performance Computing (HPC) Consortium (https://covid19-hpc-consortium.org), a revolutionary public-private consortium that provided computational resources at no cost to researchers. The OAC awarded XSEDE project serves as the hub of this consortium, providing a portal and associated services to match researchers to resources. By late March the consortium was accepting proposals and the first reviewed projects were underway. The rapid response of OAC, their ability to help organize and lead a large and now international consortium is a significant accomplishment. The leadership at OAC and at NSF is to be commended and thanked.</p> <p>During the period 2017-2020, NSF was very responsive, through OAC's leadership, to the Whitehouse OSTP report on the National Strategic Computing Initiative (NSCI) both directly and through targeted ACCI working group activities.</p> <p>Data Source: Jackets</p>	<p>YES</p>

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE
11. Additional comments on the quality of the projects or the balance of the portfolio:	

OTHER TOPICS

1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.
 - Data about and measurement of the demographic characteristics and career stage of the people working on projects
 - Data about and measurement of the research fields of awarded and declined projects
 - Access to (deidentified) micro data to better understand the small "n" problem
 - Program management tools
 - Broader impacts
 - Diversity, Equity, and Inclusion
 - Improved proposal and project management system integrated with appropriate data sources

4. Please provide comments on any other issues the COV feels are relevant.
 - A review of the data presented on the Part VI Appendix 1 page shows funding levels that were given to the community in the specific solicitation. That is the minimum and maximum amount of funds OAC would make available for awards. The graph also shows the amount of funds that were actually dispersed during the award process. An analysis of this data shows that over 50% of the time more funds were distributed to awardees than the maximum amount that was listed in the solicitation. While it is not clear what impact this action has, it is possible that repeatedly exceeding the solicitation funding maximum indicates that the program may not be setting the appropriate expectations for the community. It could also mean that the program officers are not setting the appropriate expectations for upper OAC management.

5. NSF would appreciate your comments on how to improve the COV review process, format and report template.
- NSF has recently introduced the on-line Databook to provide the COV members access to the data needed to evaluate the various programs. NSF is to be commended for taking these steps to develop this system and make it available to the COV review team. Minor issues with the Databook were shared with the COV staff. The COV staff were extremely responsive to providing additional data during the COV activities.
 - It appears that none of these issues has had an impact on the COV review process itself. These comments are included in an attempt to help the NSF Databook team improve the tools going forward.

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SIGNATURE BLOCK:

For the [Replace with Name of COV]
[Name of Chair of COV]
Chair