Computer and Information Science and Engineering (CISE): Core Programs

PROGRAM SOLICITATION
NSF 23-561

REPLACES DOCUMENT(S):
NSF 22-631

National Science Foundation

Directorate for Computer and Information Science and Engineering
Division of Computing and Communication Foundations
Division of Information and Intelligent Systems
Division of Computer and Network Systems
Office of Advanced Cyberinfrastructure

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

Proposals Accepted Anytime

SMALL Projects

Submission Window Date(s) (due by 5 p.m. submitter's local time):

October 01, 2023 - October 23, 2023

October 1 - October 23, Annually Thereafter

MEDIUM Projects

October 01, 2023 - October 23, 2023

October 1 - October 23, Annually Thereafter

OAC Core Projects

IMPORTANT INFORMATION AND REVISION NOTES

- The Core MEDIUM projects and OAC Core projects submission deadlines have been moved to October.
- The MEDIUM projects and OAC Core Projects submitted before December 23, 2022 do not count towards the limit on number of proposals per PI, co-PI or Senior Personnel.
- Although proposal submissions to the Small project class are “Accepted Anytime”, Research.gov requires a “due date” and displays one for you to select. You can choose the any listed deadlines in Research.gov from the Due Date drop down window to submit to the Small project class. There is no change to the Medium or OAC project classes.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) that is in effect for the relevant due date to which the proposal is being submitted. The NSF PAPPG is regularly revised and it is the responsibility of the proposer to ensure that the proposal meets the requirements specified in this solicitation and the applicable version of the PAPPG. Submitting a proposal prior to a specified deadline does not negate this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Computer and Information Science and Engineering (CISE): Core Programs

Synopsis of Program:

The NSF CISE Directorate supports research and education projects that develop new knowledge in all aspects of computing, communications, and information science and engineering, as well as advanced cyberinfrastructure, through the following core programs:

Division of Computing and Communication Foundations (CCF):

- Algorithmic Foundations (AF) program;
- Communications and Information Foundations (CIF) program;
- Foundations of Emerging Technologies (FET) program; and
- Software and Hardware Foundations (SHF) program.

Division of Computer and Network Systems (CNS):

- Computer Systems Research (CSR) program; and
- Networking Technology and Systems (NeTS) program.

Division of Information and Intelligent Systems (IIS):

- Human-Centered Computing (HCC) program;
- Information Integration and Informatics (III) program; and
- Robust Intelligence (RI) program.

Office of Advanced Cyberinfrastructure (OAC):

- OAC Core Research (OAC Core) program;

Proposers are invited to submit proposals in several project classes, which are defined as follows:

- Small Projects -- up to $600,000 total budget with durations up to three years: projects in this class may be submitted to CCF, CNS, and IIS only;
- Medium Projects -- $600,001 to $1,200,000 total budget with durations up to four years: projects in this class may be submitted to CCF, CNS, and IIS only; and
- OAC Core Projects -- up to $600,000 total budget with durations up to three years: projects in this class may be submitted to OAC only.

A more complete description of these project classes can be found in Section *II. Program Description* of this document.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Tracy J. Kimbrel, Point of Contact, Algorithmic Foundations (AF), telephone: (703) 292-8910, email: ccf-af@nsf.gov
- Phillip A. Regalia, Point of Contact, Communications and Information Foundations (CIF), telephone: (703) 292-8910, email: ccf-cif@nsf.gov
- Mitra Basu, Point of Contact, Foundations of Emerging Technologies (FET), telephone: (703) 292-8910, email: ccf-fet@nsf.gov
- Almadena Y. Chtchelkanova, Point of Contact, Software and Hardware Foundations (SHF), telephone: (703) 292-8910, email: ccf-shf@nsf.gov
- Marilyn M. Mcclure, Point of Contact, Computer Systems Research (CSR), telephone: (703) 292-5197, email: cns-csr@nsf.gov
- Ann C. Von Lehmen, Point of Contact, CNS Core (CNS Core), telephone: (703) 292-4756, email: cns-core@nsf.gov
- Dan R. Cosley, Point of Contact, Human-Centered Computing (HCC), telephone: (703) 292-8832, email: iis-hcc@nsf.gov
- Hector Munoz-Avila, Point of Contact, Information Integration and Informatics (III), telephone: (703) 292-4481, email: iis-iii@nsf.gov
- Jie Yang, Point of Contact, Robust Intelligence (RI), telephone: (703) 292-8930, email: iis-ri@nsf.gov
- Seung-Jong Park, Point of Contact, OAC Core Research (OAC Core), telephone: (703) 292-4383, email: oac-core@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 400 to 600

Anticipated Funding Amount: $280,000,000

Dependent upon the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Who May Serve as PI:

By the submission deadline, or for Small Projects, by the date of submission, any PI, co-PI, or other senior project personnel must hold either:

- a tenured or tenure-track position, *or*
- a primary, full-time, paid appointment in a research or teaching position

at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of US IHEs are not eligible.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 2

For the CISE: Core Programs, during any contiguous 12-month period, an individual may not participate as PI, co-PI, or Senior Personnel in more than two proposals across all project classes. This limit was applied beginning with NSF 20-591, and will continue to apply to this solicitation and future versions of this solicitation, unless noted otherwise.

The MEDIUM projects and OAC Core projects submitted before December 23, 2022 do not count towards the limit on the number of proposals per PI, co-PI or Senior Personnel.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. Any proposal that exceeds this limit at the time of submission for any PI, co-PI, or Senior Personnel will be returned without review. **No exceptions will be made.** Proposals that are withdrawn prior to commencement of merit review, or those that are returned without review by NSF, will not count against this proposal limit. Proposers are strongly encouraged to verify the dates of prior submissions to CISE: Core Programs for all personnel on their teams to avoid their proposals being deemed non-compliant.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
  - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  Not Applicable

- **Other Budgetary Limitations:**

  Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  Proposals Accepted Anytime

  SMALL Projects

  Submission Window Date(s) (due by 5 p.m. submitter's local time):

  October 01, 2023 - October 23, 2023

  October 1 - October 23, Annually Thereafter

  MEDIUM Projects

  October 01, 2023 - October 23, 2023

  October 1 - October 23, Annually Thereafter

  OAC Core Projects

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review criteria apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

The NSF Directorate for Computer and Information Science and Engineering (CISE) supports transformative research and education projects that develop new knowledge in all aspects of computing, communications, and information science and engineering, as well as advanced cyberinfrastructure, through multiple research programs across one office and three divisions:

The Division of Computing and Communication Foundations (CCF) supports research that studies the foundations of computing and communication.

The Division of Computer and Network Systems (CNS) supports research that studies novel or enhanced computing and/or networking, including using new

technologies or new ways to apply existing technologies, with a focus on systems.

The Division of Information and Intelligent Systems (IIS) supports research that studies the inter-related roles of people, computers, and information.

The Office of Advanced Cyberinfrastructure (OAC) supports translational research and education activities in all aspects of advanced cyberinfrastructure that lead to systems capable of transforming science and engineering research.

II. PROGRAM DESCRIPTION

This solicitation covers submission to the following CISE core programs. Please see the individual program webpages below for more information on what is within scope for these programs:

CCF:

- Algorithmic Foundations (AF) program [Program Webpage] supports potentially transformative projects in the theory of algorithms and computational complexity, characterized by algorithmic innovation and rigorous analysis;
- Communications and Information Foundations (CIF) program [Program Webpage] supports foundational research that addresses the theoretical underpinnings of information acquisition, transmission, and processing in communications and information processing systems;
- Foundations of Emerging Technologies (FET) program [Program Webpage] supports foundational research at the intersection of computing and biological systems, nanoscale science and engineering, quantum information science, and other promising disruptive technologies supporting novel computing/communication models; and
- Software and Hardware Foundations (SHF) program [Program Webpage] supports foundational research in the design, verification, operation, and evaluation of computer hardware and software through novel approaches, robust theories, high-leverage tools, and lasting principles;

CNS:

- Computer Systems Research (CSR) [Program Webpage] supports the advancement and holistic design and development of integrated software and hardware computing systems; and
- Networking Technology and Systems (NeTS) [Program Webpage] supports research that advances wired and wireless networking systems, develops a better understanding of the fundamental properties and tradeoffs involved, as well as the abstractions and tools used in designing, building, measuring and managing them.

IIS:

- Human-Centered Computing (HCC) program [Program Webpage] supports research in human-computer interaction, integrating across fields including computing, information, social, and behavioral sciences, to (re)design technologies that amplify human capabilities, and understand how human, technical, and contextual aspects of computing and communication systems shape their benefits, effects, and risks;
- Information Integration and Informatics (III) program [Program Webpage] supports research on computational approaches to the full data lifecycle to maximize the utility of information resources; and
- Robust Intelligence (RI) program [Program Webpage] supports computational research to understand and enable intelligent systems in complex, realistic contexts.

OAC:

- OAC Core Research (OAC Core) program [Program Webpage] supports translational research on the design, development, deployment, experimentation, and application of advanced research cyberinfrastructure (CI) to enable new frontiers of discovery and innovation.

PROJECT CLASSES

Proposals submitted to this solicitation must be consistent with one of three project classes defined below. Proposals will be considered for funding within their project classes.

- **SMALL Projects**

  SMALL projects are not accepted for the OAC Core Research program and will be returned without review if submitted to OAC Core.

  Small projects, with total budgets up to $600,000 for durations of up to three years, are well suited to one or two investigators (PI and one co-PI or other Senior Personnel) and at least one student and/or postdoctoral researcher. A Collaboration Plan (up to two pages) **may** be provided under Supplementary Documents. Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

- **MEDIUM Projects**

  Medium projects are not accepted for the OAC Core Research program and will be returned without review if submitted to OAC Core.

  Medium projects, with total budgets ranging from $600,001 to $1,200,000 for durations up to four years, are well suited to one or more investigators (PI, co-PI and/or other Senior Personnel) and several students and/or postdoctoral researchers. Medium project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts is known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, **a Collaboration Plan is required for any Medium project with more than one investigator**, even when the investigators are affiliated with the same institution. Up to two pages are allowed for Collaboration Plans and they must be submitted as a document under

Supplementary Documents. The length and level of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Collaboration Plans and proposed budgets should demonstrate that key personnel, and especially lead PIs, have allocated adequate time for both their individual technical contributions and the leadership of collaborative activities necessary to realize the synergistic effects of larger-scale research. **If a Medium project with more than one investigator does not include a Collaboration Plan, that proposal will be returned without review.** Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

- **OAC Core Projects**

  OAC Core projects, with total budgets up to $600,000 for durations of up to three years, are well suited to one or two investigators (PI and one co-PI or other Senior Personnel) and at least one student and/or postdoctoral researcher. A Collaboration Plan (up to two pages) **may** be provided under Supplementary Documents. Please see *Proposal Preparation Instructions* Section V.A for additional submission guidelines.

BROADENING PARTICIPATION IN COMPUTING

CISE has long been committed to Broadening Participation in Computing (BPC). The underrepresentation of many groups—including women, persons with disabilities, Blacks and African Americans, Hispanics and Latinos, American Indians, Alaska Natives, Native Hawaiians, and Other Pacific Islanders—in computing deprives large segments of the population of the opportunity to be creators of technology instead of only consumers. Ending underrepresentation will require a range of measures, including institutional programs and activities as well as culture changes across colleges, departments, classes, and research groups.

With this solicitation, CISE is continuing the BPC effort started in 2018 that encourages the research community to engage in meaningful BPC activities. The CISE BPC effort builds on many of the programs, research, and resources created through CISE's past and ongoing investments in BPC, and it aligns with the recommendations of the Strategic Plan for Broadening Participation produced by the CISE Advisory Committee in 2012. Specifically: **Each Medium project must include a BPC plan** (see details in Proposal Preparation). CISE encourages the use of the resources available at the NSF-funded BPCnet Resource Portal (https://bpcnet.org). BPCnet provides BPC project and departmental plan templates, suggested activities, opportunities for consultant services, and publicly available data to support PIs and Departments in creating their BPC Plans. *CISE encourages PIs to leverage departmental plans verified by BPCnet to coordinate efforts within their institution.* BPC plans must include roles for all PIs and co-PIs and be included as a Supplementary Document, following the guidelines as described in the Proposal Preparation Instructions.

A meaningful BPC plan can answer positively to the following five elements:

1. Goal and Context: Does the plan describe a goal and the data from your institution(s) or local community that justifies that goal?
2. Intended population(s): Does the plan identify the characteristics of participants from an underrepresented group listed above, including school level (e.g., African American undergraduates or female high-school students)?
3. Strategy: Does the plan describe activities that address the stated goal(s) and intended population(s)?
4. Measurement: Is there a plan to measure the outcome(s) of the activities?
5. PI Engagement: Is there a clear role for each PI and co-PI? Does the plan describe how the PI is prepared (or will prepare or collaborate) to do the proposed work?

All PIs and co-PIs are expected to participate in BPC activities in a manner aligned with their personal contexts, interests, and skills. More information regarding the BPC effort can be found at https://www.nsf.gov/cise/bpc.

PROPOSALS FOR CONSIDERATION BY MULTIPLE CISE PROGRAMS

Proposals that intersect more than one CISE research program are welcome. In such cases, PIs must identify the most relevant programs in the proposal submission process; for information about submission and how to identify such proposals, see *Proposal Preparation Instructions* later in this document. In these cases, PIs should also ensure that their proposals follow the program-specific guidelines for all research programs identified. CISE Program Officers will consider co-reviewing these proposals as appropriate.

CLOUD COMPUTING RESOURCES

Proposals may request cloud computing resources to use public clouds such as Amazon Web Services (AWS), Google Cloud Platform (GCP), IBM Cloud, and Microsoft Azure. Cloud computing resources described in proposals may be obtained through an external cloud access entity (CloudBank) supported by NSF's Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access) program.

Proposers should describe this request in a Supplementary Document including: (a) which public cloud providers will be used; (b) anticipated annual and total costs for accessing the desired cloud computing resources, based on pricing currently available from the public cloud computing providers; and (c) a technical description of, and justification for, the requested cloud computing resources. The proposal budget should not include the costs for accessing public cloud computing resources via CloudBank. Also, the total cost of the project, including the cloud computing resource request, may not exceed the budget limit described in this solicitation.

For example, a proposal submitted to the Small size class, has a total proposal budget limit of $600,000. If a PI wishes to request $20,000 in cloud computing resources through CloudBank, then the proposal budget should not exceed $580,000. The remaining $20,000 for cloud computing resources should be specified in the Supplementary Document. If a proposal is a collaborative project with two PIs from two different organizations, then each PI may request cloud computing resources separately through independent Supplementary Documents as long as the total budget (on the budget pages plus the amount requested for cloud computing resources in the Supplementary Documents) does not exceed $600,000 for a small project, or $1.2 million for a medium project.

If incorporating this request into the proposal, a proposer should include “CloudAccess” (one word without spaces) as a keyword on the Project Summary page, at the end of the Overview section (before the section on Intellectual Merit). Proposers may contact CloudBank (see https://www.cloudbank.org/faq) for consultation on estimating the costs for using cloud computing resources.

See Section V.A. Proposal Preparation Instructions, Supplementary Documents, for more information on how to describe the cloud computing resource request as well as the associated budget.

REPRODUCIBILITY AND SHARING

In the interest of completeness and transparency, PIs must describe, as part of their Data Management Plans, how they will provide access to well-documented datasets, modeling and/or simulation tools, and codebases to support reproducibility/replicability of their methods and results for a reasonable time beyond the end of the project lifecycle.

EVALUATION

PIs should include a plan to evaluate the approaches developed as part of the Project Description. Appropriate methods will depend on the research area, topic, size and scope of the proposed project. Examples include, but are not limited to, peer review of developed theories and proofs, controlled experiments on appropriate simulators/emulators/testbeds, user studies, or prototype deployments. The plan should be appropriate for the size and scope of the project.

For proposers to the CSR and NeTS programs, a plan to evaluate the approaches developed as part of the Project Description is **required**.

Proposers to the OAC Core program are **required** to include either a validation or transition-to-practice plan for their proposed research in the Project Description. A validation plan may include setup, mechanisms, metrics, and exploration of leading-edge production systems (or equivalent simulated, emulated, or experimental systems). Transition-to-practice entails planning for incorporation of research results into production research cyberinfrastructure.

ACCESS TO EXPERIMENTAL RESEARCH CYBERINFRASTRUCTURE

PIs are encouraged to consider utilizing NSF-supported research infrastructure (such as the Platforms for Advanced Wireless Research, FABRIC, Chameleon, and CloudLab) when formulating their research plans and submitting proposals. Descriptions of the capabilities of each system and their availability can be found at their websites: https://advancedwireless.org/, https://fabric-testbed.net/, https://www.chameleoncloud.org/, https://cloudlab.us/.

For projects requiring access to high-performance computing resources, data infrastructure, or advanced visualization resources at scales beyond what is available locally, PIs are encouraged to consider production scale and testbed advanced research cyberinfrastructure, such as those supported by the ACSS Program, the Frontera Leadership-class system, the Partnership to Advance Throughput Computing (PATh), and others. Access to the broadening array of advanced cyberinfrastructure systems is coordinated through the ACCESS program. Descriptions of such infrastructure can be found at the following websites: https://www.nsf.gov/awardsearch/advancedSearchResult?ProgEleCode=7619&BooleanElement=Any&BooleanRef=Any&ActiveAwards=true, https://www.tacc.utexas.edu/systems/frontera, https://path-cc.io/, and https://access-ci.org/.

More information about high-performance computing resources available to NSF PIs can be found in the PAPPG Chapter II.E.7.

FAIRNESS, ETHICS, ACCOUNTABILITY, AND TRANSPARENCY

Issues of fairness, ethics, accountability, and transparency (FEAT) are important considerations for many core topics in computer and information science and engineering. In projects that generate artifacts ranging from analysis methods to algorithms to systems, or that perform studies involving human subjects, PIs are encouraged to consider the FEAT of the outputs or approaches. CISE is also interested in receiving proposals whose *primary* foci are on methods, techniques, tools, and evaluation practices as means to explore implications for FEAT. In the exploration and use of FEAT concepts, PIs are strongly encouraged to select and articulate their own disciplinary or interdisciplinary approaches consistent or aligned with these concepts.

START DATES

Organizations are discouraged from seeking project start dates between July 2 and September 30 of a given year to avoid overdue reports blocking award actions during the end of a federal fiscal year. Awardee organizations may incur allowable pre-award costs within the 90-day period immediately preceding the start date of the grant (see PAPPG Chapter X.A.2.b); this will allow support for students or other relevant activities to begin over this period.

EMBEDDED REU SUPPLEMENTS

The Research Experiences for Undergraduates (REU): Sites and Supplements program solicitation provides instructions for embedding requests for REU supplements in a proposal. Proposers are invited to request REU supplements, through a supplementary document, for up to $8,000 per student per year, and up to two students per PI/co-PI. The amount of the REU supplement request does not count against the budget limitations of the project size classes described in this solicitation. Proposers should provide brief summaries of the various tasks that the REU students are expected to conduct along with the processes for recruiting eligible REU students, as noted in the REU program solicitation and the additional CISE-specific guidance in NSF 23-035.

III. AWARD INFORMATION

Up to $280 million each year will support up to 600 awards, pending the availability of funds.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Who May Serve as PI:

By the submission deadline, or for Small Projects, by the date of submission, any PI, co-PI, or other senior project personnel must hold either:

- a tenured or tenure-track position, *or*
- a primary, full-time, paid appointment in a research or teaching position

at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of US IHEs are not eligible.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 2

For the CISE: Core Programs, during any contiguous 12-month period, an individual may not participate as PI, co-PI, or Senior Personnel in more than two proposals across all project classes. This limit was applied beginning with NSF 20-591, and will continue to apply to this solicitation and future versions of this solicitation, unless noted otherwise.

The MEDIUM projects and OAC Core projects submitted before December 23, 2022 do not count towards the limit on the number of proposals per PI, co-PI or Senior Personnel.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. Any proposal that exceeds this limit at the time of submission for any PI, co-PI, or Senior Personnel will be returned without review. **No exceptions will be made.** Proposals that are withdrawn prior to commencement of merit review, or those that are returned without review by NSF, will not count against this proposal limit. Proposers are strongly encouraged to verify the dates of prior submissions to CISE: Core Programs for all personnel on their teams to avoid their proposals being deemed non-compliant.

Additional Eligibility Info:

For IHEs and non-profit, non-academic organizations with international branch campuses, this solicitation restricts eligibility to research activities using the facilities, equipment, and other resources of the campuses located in the US only.

Further, subawards are not permitted to international branch campuses of US-based proposing organizations eligible to submit to this solicitation.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via Research.gov. PAPPG Chapter II.E.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.D.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

Proposal Titles:

Proposal titles should begin with an acronym that indicates the most relevant core program. Select a **bolded acronym** from the following list determined by the most relevant core program area (if more than one area is relevant, please see instructions below):

CCF:

- Algorithmic Foundations (**AF**) program;
- Communications and Information Foundations (**CIF**) program;

- Foundations of Emerging Technologies (**FET**) program; and
- Software and Hardware Foundations (**SHF**) program;

CNS:

- Computer Systems Research (**CSR**) program; and
- Networking Technology and Systems (**NeTS**) program;

IIS:

- Human-Centered Computing (**HCC**) program;
- Information Integration and Informatics (**III**) program; and
- Robust Intelligence (**RI**) program.

OAC:

- OAC Core Research (**OAC Core**) program;

The acronym should be followed by a colon, then the project class followed by a colon, then the title of your project. For example, if you are submitting a Small proposal to the CSR program, then your title would be **CSR: Small: Title**.

Proposals from PIs in institutions that have RUI (Research in Undergraduate Institutions) eligibility should have a proposal title that begins with the program acronym followed by a colon, then the project class followed by a colon, then "RUI" followed by a colon, and then the title, for example, **SHF: Small: RUI: Title.**

PIs submitting GOALI (Grant Opportunities for Academic Liaison with Industry) proposals should select the "GOALI" type of proposal in Research.gov or Grants.gov. The proposal title should begin with "GOALI" followed by a colon, then the program acronym followed by a colon, then the project class followed by a colon, and then the title, for example, **GOALI: HCC: Small: Title**. Please note that Research.gov will automatically insert "GOALI" at the beginning of the proposal title when the "GOALI" type of proposal is selected in the proposal setup wizard in Research.gov. For additional information and guidance about GOALI proposals, see PAPPG Chapter II.F.

Proposals that extend beyond the scope of one CISE core program or area are welcome. In such cases, PIs should identify the acronym for the **most relevant** core program or area, followed by any other relevant program acronym(s) separated by colons, for example, **CSR: AF: Medium: Title**. In this example, the proposal would be submitted to the CNS CSR program and would be considered by both the CSR and AF programs. CISE Program Officers will work with their NSF colleagues to ensure that these proposals are appropriately reviewed and considered for funding.

Project Summary:

The Project Summary consists of an overview, a statement on the intellectual merit of the proposed activity, a statement on the broader impacts of the proposed activity, and a set of keywords.

All proposals must include 3-6 keywords that describe the general area(s) of the investigation, to assist in identifying reviewers with appropriate knowledge and expertise to review the proposal. *The list of keywords should be the last paragraph of the Overview section of the Project Summary.*

The keywords should describe the main scientific/engineering areas explored in the proposal. Keywords should be prefaced with "Keywords" followed by a colon and each keyword set should be separated by semicolons. Keywords should be of the type used to describe research in a journal submission and may include technical areas of expertise necessary to review the proposal. For example, they might appear as, **Keywords: energy-aware computing; formal logic; graph theory; qubits; information visualization; privacy**.

If cloud computing resources are being requested from CloudBank, then the keyword “CloudAccess” (one word without space) should be included at the end of the Overview section (before the section on Intellectual Merit) on the Project Summary page.

Project Description:

In addition to the guidance contained in the PAPPG, please refer to Section II, Program Description for additional information and instructions on preparing this section of the proposal.

Budget:

The total budget of the project, including any cloud computing resource request from CloudBank, may not exceed the budget limits for the respective project classes described in this solicitation. The total cost of the cloud computing resources requested from Cloudbank should not be included in the NSF budget, and should be specified only in the associated supplementary document (see below for additional instructions).

Data Management Plan*:*

In addition to the guidance contained in the PAPPG, information on the Dissemination and Sharing of Research Results is available at: https://www.nsf.gov/bfa/dias/policy/dmp.jsp.

For specific guidance for Data Management Plans submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: https://www.nsf.gov/cise/cise_dmp.jsp.

See also the guidance on Reproducibility and Sharing in the Program Description section above.

Supplementary Documents:

In the Other Supplementary Documents section, upload the following information where relevant:

A list of Project Personnel and Partner Organizations (required) (Note: In collaborative proposals, the lead organization should provide this information for all participants):

Provide current, accurate information for all personnel and organizations involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list **must** include all PIs, co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and

project-level advisory committee members. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

- Mary Smith; XYZ University; PI
- John Jones; University of PQR; Senior Personnel
- Jane Brown; XYZ University; Postdoctoral Researcher
- Bob Adams; ABC Community College; Paid Consultant
- Susan White; DEF Corporation; Unpaid Collaborator
- Tim Green; ZZZ University; Subawardee

Cloud Computing Resources (if applicable):

- If requesting cloud computing resources, include a description of the request (not to exceed two pages) as a supplementary document that includes: The title of the proposal and the institution name followed by the following information: (a) specific cloud computing providers that will be used; (b) anticipated annual and total costs for accessing the desired cloud computing resources, along with a description of how the cost is estimated; and (c) a technical description of, and justification for, the requested cloud computing resources.
- The NSF Budget should not include any costs for accessing cloud computing resources via CloudBank. The total cost of the project, including this cloud computing resource request, may not exceed the budget limits for the chosen project class, as described in this solicitation. Proposers should include "CloudAccess" (one word without space) as a keyword on the Project Summary page, at the end of the Overview section (before the section on Intellectual Merit).

Collaboration Plans for Medium projects (if applicable):

Note: In collaborative proposals, the lead organization should provide this information for all participants.

- Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, **all Medium proposals that include more than one investigator must include a Collaboration Plan of up to two pages**, even when the investigators are affiliated with the same institution. The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Where appropriate, the Collaboration Plan might include: 1) the specific roles of the project participants in all organizations involved; 2) information on how the project will be managed across all the investigators, organizations, and/or disciplines; 3) identification of the specific coordination mechanisms that will enable cross-investigator, cross-organization, and/or cross-discipline scientific integration (e.g., yearly conferences, graduate student exchange, project meetings at conferences, videoconferences, software repositories, etc.); and 4) specific references to the budget line items that support collaboration and coordination mechanisms. **If a Medium proposal with more than one investigator does not include a Collaboration Plan of up to two pages, that proposal will be returned without review.**

Broadening Participation in Computing (BPC) Plans:

Each Medium project must include a BPC plan as a supplementary document at the time of submission. Each plan should begin with the heading "Broadening Participation in Computing (BPC) Plan –" followed by either "**Standalone" or "Connected"**.

- A **Standalone BPC Plan** does not include Departmental BPC Plans. Instead, the BPC activities of all PIs are listed in a single document that is up to 3 pages for the whole project and specifically addresses all five elements of a BPC plan: (1) the goal and context of the proposed activity, (2) intended population(s), (3) strategy, (4) measurement, and (5) PI engagement. *This option must be used if one or more of the collaborating institutions do not have a Departmental BPC Plan verified by BPCnet*.

- A **Connected BPC Plan** may be used when each PI and co-PI will engage in an activity listed in a Verified Departmental BPC Plan from their institution. Note that the (1) goal and context, (2) intended population, (3) strategy, and (4) measurement are already addressed in Verified Departmental BPC Plans. Therefore, a **Connected BPC Plan** is a document that only has to address the following, organized as:

- up to 2 pages that describe (5) what strategies in the departmental plan the PI and co-PIs will focus on, their specific roles, and their preparation for their work;

- followed by the verified Departmental BPC Plans from each institution.

The BPC plans should be submitted as one document (including departmental plans for Connected BPC plans) under the "Supplementary Documents" section by the lead institution. The BPC plan should not be utilized as a space to elaborate on other broader impact activities unrelated to addressing members of groups underrepresented in computing.

Any organizational resources that support BPC activities should also be described in the Facilities, Equipment and Other Resources section of the proposal (for additional information about Facilities, Equipment and Other Resources, see PAPPG Chapter II.D.2) if not already described in a linked departmental plan.

Documentation of collaborative arrangements of significance to the proposal through Letters of Collaboration (if applicable):

There are two types of collaboration, one involving individuals/organizations that are included in the budget, and the other involving individuals/organizations that are not included in the budget. Collaborations that are included in the budget should be described in the Project Description. Any substantial collaboration with individuals/organizations not included in the budget should be described in the Facilities, Equipment and Other Resources section of the proposal (see NSF PAPPG Chapter II.D.2). In either case, whether or not the collaborator is included in the budget, a letter of collaboration from each named participating organization *other than the submitting lead, non-lead, and/or subawardee organizations* should be provided at the time of submission of the proposal. Such letters should explicitly state the nature of the collaboration, appear on the organization's letterhead and be signed by the appropriate organizational representative. These letters must not otherwise deviate from the format provided in the NSF PAPPG Chapter II.D.2.

Please note that letters of support may not be submitted. Such letters do not document collaborative arrangements of significance to the project, but primarily convey a sense of enthusiasm for the project and/or highlight the qualifications of the PI or co-PI. **Reviewers will be instructed not to consider these letters of support in reviewing the merits of the proposal.**

Embedded REU Supplement Documentation (if applicable):

Requests for single-year or multi-year REU supplement as part of a proposal should include a description of the REU activity (follow the guidance in the REU program solicitation and NSF 23-035) as a supplementary document, not to exceed three pages. Include the budget for the REU activity in the project budget in section F (Participant Support Costs). As part of the Budget Justification, provide a separate explanation of the REU supplement request, with the proposed

student costs itemized and justified.

Other specialized information (if applicable):

RUI Proposals: PIs from predominantly undergraduate institutions should include a Research in Undergraduate Institutions (RUI) Impact Statement and Certification of RUI Eligibility in this section.

GOALI proposals: PIs submitting GOALI proposals should include signed industry-university agreement letters on intellectual property in this section.

Single Copy Documents:

Suggested reviewers (optional):

To increase the diversity of the reviewer pool, CISE actively encourages each proposer to include a list of suggested reviewers (including email addresses and organizational affiliations) whom they believe are especially well qualified to review the proposal and are not conflicted with project personnel. Suggestions for reviewers from groups underrepresented in computing are especially encouraged. Proposers should follow the guidance in PAPPG Chapter II.D.1.

Submission Checklist:

In an effort to assist proposal preparation, the following checklists are provided as a reminder of the items that should be checked before submitting a proposal to this solicitation. These are a summary of the requirements described above. For the items marked with (RWR), the proposal will be returned without review if the required item is noncompliant at the time of proposal submission. Note that there are multiple lists: (1) for all proposals, unique to this solicitation; (2) additional requirements for Small and OAC Core proposals; and (3) additional requirements for Medium proposals.

- *For all proposals, regardless of size:*
  - The last line of the Overview section of the Project Summary must consist of the word “Keywords” followed by a colon and between 3-6 keyword sets, separated by semi-colons.
  - If REU supplements are requested, then a supplementary document describing the REU activity must be included, and REU supplement costs must be specified in the Participant Support Costs section of the proposal budget.
  - The proposal title should comply with the requirements under Proposal Preparation Instructions above.
  - If requesting public cloud resources through CloudBank, a supplementary document of up to two pages must be provided, and the ‘CloudAccess’ keyword should be specified in the Project Summary.
- *For Small proposals and OAC Core proposals:*
  - (RWR) The total budget **must not** exceed $600,000, excluding funds for any embedded REU supplements. For separately-submitted collaborative proposals, this is the total across all participating organizations.
  - (RWR) For proposals submitted to the OAC Core Research program only, the Project Description should include a validation or transition-to-practice plan.
  - For proposals submitted to the CSR and NeTS programs only, the Project Description should include an evaluation plan.
  - A Collaboration Plan (up to two pages) **may** be provided as a Supplementary Document. If provided, the Collaboration Plan should include all organizations participating, not a separate plan for each organization.
  -
- *For Medium proposals:*
  - (RWR) The total budget **must** be $600,001 to $1,200,000, excluding funds for any embedded REU supplements. For separately-submitted collaborative proposals, this is the total across all participating organizations.
  - For proposals submitted to the CSR and NeTS programs only, the Project Description should include an evaluation plan.
  - (RWR) If there is more than one investigator, a collaboration plan (up to two pages) **must** be provided as a Supplementary Document, even if all investigators are affiliated with the same organization. The Collaboration Plan should include all organizations participating, not a separate plan for each organization.
  - (RWR) A BPC plan is required as a Supplementary Document with a title clearly identifying it as such. Collaborative proposals should submit one BPC plan, as described in the proposal preparation instructions.

Proposals that do not comply with the requirements marked as RWR will be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  Proposals Accepted Anytime

  SMALL Projects

  Submission Window Date(s) (due by 5 p.m. submitter's local time):

  October 01, 2023 - October 23, 2023

  October 1 - October 23, Annually Thereafter

  MEDIUM Projects

  October 01, 2023 - October 23, 2023

October 1 - October 23, Annually Thereafter

OAC Core Projects

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: https://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to Research.gov for further processing.

Proposers that submitted via Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

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 the 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.D.2.d(i). 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.D.2.d(i), 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?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan, Postdoctoral Researcher Mentoring Plan, and the optional Broadening Participation in Computing Plan, as appropriate.

Additional Solicitation Specific Review Criteria

For Medium proposals, reviewers will be asked to:

- Comment on the extent to which the project scope justifies the level of investment requested, and the degree to which the Collaboration Plan (if required) adequately demonstrates that the participating investigators will work synergistically to accomplish the project objectives.
- Comment on whether key personnel, and especially lead PIs, have allocated adequate time for both their individual technical contributions and the leadership of collaborative activities necessary to realize the synergistic effects of larger-scale research.
- Comment on whether the Broadening Participation in Computing (BPC) plan meaningfully addresses the five elements of a BPC Plan: (1) the goal and context of the proposed activity, (2) intended population(s), (3) strategy, (4) measurement, and (5) PI engagement.

For all proposals reviewed by the CSR and NeTS programs, reviewers will be asked to consider how well the proposal describes an evaluation plan that assesses and, where appropriate, quantifies the research outcomes.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements or the Division of Acquisition and Cooperative Support for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by an NSF Grants and Agreements Officer. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Administrative and National Policy Requirements

Build America, Buy America

As expressed in Executive Order 14005, Ensuring the Future is Made in All of America by All of America's Workers (86 FR 7475), it is the policy of the executive branch to use terms and conditions of Federal financial assistance awards to maximize, consistent with law, the use of goods, products, and materials produced in, and services offered in, the United States.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), no funding made available through this funding opportunity may be obligated for an award unless all iron, steel, manufactured products, and construction materials used in the project are produced in the United States. For additional information, visit NSF's Build America, Buy America webpage.

Special Award Conditions:

Awardees will be required to attend any PI meetings and may be required to participate in a common evaluation.

CISE plans to conduct an evaluation of the BPC pilot. This evaluation may be conducted by a third-party, working in coordination with and on behalf of NSF. Awardees of Medium projects must participate in this evaluation and provide information about project outcomes to support it.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the

general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Medium projects awardees must report BPC activities and outcomes in the Special Reporting Requirements section of annual reports submitted to NSF.

That section of the annual report should include:

- A summary of what each PI and co-PI did, including any changes to the plan;
- Numbers of events, participants, and participant demographics (if there are barriers to collecting this data, describe those limitations and provide the best estimates possible); and
- A reflection (supported by data if available) on progress, any unexpected challenges or results, and anything planned.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Tracy J. Kimbrel, Point of Contact, Algorithmic Foundations (AF), telephone: (703) 292-8910, email: ccf-af@nsf.gov
- Phillip A. Regalia, Point of Contact, Communications and Information Foundations (CIF), telephone: (703) 292-8910, email: ccf-cif@nsf.gov
- Mitra Basu, Point of Contact, Foundations of Emerging Technologies (FET), telephone: (703) 292-8910, email: ccf-fet@nsf.gov
- Almadena Y. Chtchelkanova, Point of Contact, Software and Hardware Foundations (SHF), telephone: (703) 292-8910, email: ccf-shf@nsf.gov
- Marilyn M. Mcclure, Point of Contact, Computer Systems Research (CSR), telephone: (703) 292-5197, email: cns-csr@nsf.gov
- Ann C. Von Lehmen, Point of Contact, CNS Core (CNS Core), telephone: (703) 292-4756, email: cns-core@nsf.gov
- Dan R. Cosley, Point of Contact, Human-Centered Computing (HCC), telephone: (703) 292-8832, email: iis-hcc@nsf.gov
- Hector Munoz-Avila, Point of Contact, Information Integration and Informatics (III), telephone: (703) 292-4481, email: iis-iii@nsf.gov
- Jie Yang, Point of Contact, Robust Intelligence (RI), telephone: (703) 292-8930, email: iis-ri@nsf.gov
- Seung-Jong Park, Point of Contact, OAC Core Research (OAC Core), telephone: (703) 292-4383, email: oac-core@nsf.gov

For questions related to the use of NSF systems contact:

- NSF Help Desk: 1-800-673-6188
- Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed

via this mechanism. Further information on Grants.gov may be obtained at https://www.grants.gov.

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The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

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- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

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  or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

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The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See System of Record Notices, NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Policy Office, Division of Institution and Award Support
Office of Budget, Finance, and Award Management
National Science Foundation
Alexandria, VA 22314