NSF 23-589: Community Infrastructure for Research in Computer and Information Science and Engineering (CIRC)

Program Solicitation

Document Information

Document History

- **Posted:** May 15, 2023
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View the program page

National Science Foundation
Directorate for Computer and Information Science and Engineering
Division of Computer and Network Systems
Division of Computing and Communication Foundations
Division of Information and Intelligent Systems

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

September 08, 2023

September 13, 2024

Second Friday in September, Annually Thereafter

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Important Information And Revision Notes

Important Information

In each annual competition, an individual may participate in at most two Exploratory Development, Medium, or Grand proposals, and at most one Planning-C or Planning-M proposal as PI, co-PI, or Senior/Key Personnel.

Revision Notes

This is a revision of NSF 22-509. The revisions include:

1. The program name changed from CISE Community Research Infrastructure (CCRI) to Community Infrastructure for Research in CISE (CIRC) to avoid confusion with another program with a similar acronym.
2. PI limits increased to 2 for Medium and Grand projects.
3. Clarity on applying for Enhance/Sustain (ENS) awards based on receiving NSF funding for a prior research infrastructure award.
4. The Grand infrastructure category now includes the option to request Research related infrastructure with reference to NSF solicitation 22-519 on Internet Measurement Research (IMR); see https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf22519
5. Added cooperative agreement as a possible award type for CIRC awards.
6. The number of collaboration letters is now limited to five for CIRC.
7. Added a new Exploratory Development Track to help to enable future transformative community research infrastructure.

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:

Community Infrastructure for Research in Computer and Information Science and Engineering (CIRC)

Synopsis of Program:

The Community Infrastructure for Research in Computer and Information Science and Engineering (CIRC) program drives discovery and learning in the core disciplines of the three participating CISE divisions [Computing and Communication Foundations (CCF), Computer and Network Systems (CNS), and Information and Intelligent Systems (IIS)] of the Directorate for Computer and Information Science and Engineering (CISE) by funding the creation and enhancement of world-class research infrastructure. This research infrastructure will specifically support diverse communities of CISE researchers pursuing **focused research agendas in computer and information science and engineering**. This support involves developing the accompanying user services and engagement needed to attract, nurture, and grow a robust research community that is actively involved in determining directions for the infrastructure, as well as management of the infrastructure. This should lead to research infrastructure that can be sustained through community involvement and community leadership, and that will enable advances not possible with existing research infrastructure. Further, through the CIRC program, CISE seeks to ensure that researchers from a diverse range of institutions of higher education (IHEs), including minority-serving and predominantly undergraduate institutions, as well as researchers from non-profit, non-academic organizations, have access to such infrastructure.

The CIRC program supports four classes of awards:

- **Planning Community Infrastructure (Planning)** awards support planning efforts to engage research communities to develop new CISE community research infrastructures. Such an infrastructure could be eventually funded through the CIRC program **(Planning-C)** or the NSF Mid-scale Research Infrastructure (MsRI) program **(Planning-M)**. For the scope of Mid-scale RI proposals, see the Mid-scale RI-1 and Mid-scale RI-2 program pages.
- **Exploratory Development (Dev)** awards support activities that involve the validation of one or more unproven infrastructure designs and/or technologies, which, if validated, could enable transformative community research infrastructure in the future. Successful projects are expected to provide the technical foundations necessary to pursue subsequent CIRC (**New** or **Grand**), Mid-scale RI-1, or Mid-scale RI-2 projects.
- **Medium Community Infrastructure (Medium)** awards support the creation of new CISE community research infrastructure or the enhancement of existing CISE community research infrastructure with integrated tools, resources, user services, and research community outreach to enable innovative CISE research opportunities to advance the frontiers of the CISE core research areas. The **Medium** award class includes **New (New)** and **Enhance/Sustain (ENS)** awards.
- **Grand Community Infrastructure (Grand)** awards support projects involving significant efforts to develop new CISE community research infrastructure or to enhance and sustain an existing CISE community research infrastructure to enable world-class CISE research opportunities for broad-based communities of CISE researchers that extend well beyond the awardee organization(s).

Each CIRC **Medium or Grand** award may include support for operation of the infrastructure, ensuring that the awardee organization(s) is (are) well positioned to provide a high quality of service to CISE community researchers expected to use the infrastructure to realize their research goals.

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.

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- Jason O. Hallstrom, Program Director CISE/CNS, telephone: (703) 292-8950, email: jhallstr@nsf.gov
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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 or Cooperative Agreement

Estimated Number of Awards: 10 to 25

With up to 10 **Planning** awards, up to 3 **Dev** awards, up to 12 **Medium** awards, and up to 3 **Grand** awards in each competition. **Planning** awards will be for up to one and one-half years and in the $50,000 - $100,000 range per award for Planning-C category and up to two years in the $100,001 - $250,000 range per award for Planning-M category. **Dev** awards will be for up to two years and $250,001 - $750,000 range per award. **Medium** awards will be for up to three years and in the $750,001 - $2,000,000 range per award. **Grand** awards will be for up to five years and in the $2,000,001 - $5,000,000 range per award.

Anticipated Funding Amount: $24,000,000

annually, subject to 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, any PI, co-PI, or other senior project personnel must hold either a tenured or tenure-track position, or a primary appointment in a research 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:

In each annual competition, an individual may participate in at most two Exploratory Development, Medium, or Grand proposals as PI, co-PI, or Senior/Key Personnel. Note that any proposals submitted to the Planning-C or Planning-M tracks will not be counted against this limit. Beyond the limit noted above, a PI may submit at most one Planning proposal, whether it is Planning-C or Planning-M.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first proposal received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

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. submitting organization's local time):

  September 08, 2023

  September 13, 2024

  Second Friday in September, Annually Thereafter

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.

I. Introduction

Since its inception, the National Science Foundation (NSF) has supported the development of research infrastructure in order to advance the frontiers of science and engineering. These research infrastructure investments enable an academic science and engineering research enterprise that continues to be among the world's best. Similarly, CISE has a tradition of supporting research infrastructure to enable transformative research at the frontiers of core CISE research disciplines and to provide unique opportunities for current and future generations of CISE researchers. The CIRC program draws on the rapidly evolving nature of the CISE disciplines, and the unique infrastructure needs of CISE researchers to explore and extend the boundaries of CISE research frontiers.

II. Program Description

With its CIRC program, CISE drives discovery and learning in the core CISE disciplines covered by the three participating CISE divisions (CCF, CNS, and IIS) by enabling the creation and enhancement of world-class research infrastructure with integrated suites of tools, resources, user services, and research community outreach. The supported infrastructure will specifically support diverse communities of CISE researchers pursuing focused research agendas in computer and information science and engineering. Further, through the CIRC program, CISE seeks to ensure that individuals from a diverse range of institutions of higher education (IHEs), including minority-serving and predominantly undergraduate institutions, have access to such infrastructure and community outreach opportunities.

CIRC awards provide infrastructure, tools, resources, and user services to support the associated research community in pursuing innovative research ideas. This could include equipment, testbeds, software, and data repositories needed to push the limits of computing, communications, and information systems. The team managing the infrastructure is expected to:

a. enable unique and compelling research opportunities otherwise inaccessible to the CISE research community,

b. provide robust user services and support to the community that the infrastructure seeks to serve, and

c. implement a robust engagement plan that incorporates effective research community outreach and periodically evaluates the needs of the research community and assesses resources in order to determine the future needs for enhancements and to plan for sustainability.

Through the CIRC program and MsRI programs (Mid-scale RI-1 and Mid-scale RI-2), CISE is able to support the creation of CISE research infrastructure projects at all project scales. The CIRC program supports projects up to $5M in total budget, while the MsRI programs support budgets from $4M and up to $100M.

A. Project Classes

Cognizant of the diversity of research infrastructure needs in the CISE research community, the CIRC program supports four classes of projects as defined below.

A.1 Planning Community Infrastructure

This project class supports two types of planning activities:

a. Planning-C: grants from $50,000-$100,000 for durations up to one and one-half years to support planning activities and community outreach to develop a full CIRC **Grand** or **Medium – New** proposal;

b. Planning-M: grants from $100,001 up to $250,000 for durations of up to two years to support planning activities and community outreach to develop a mid-scale research infrastructure proposal; see the Mid-scale RI-1 and Mid-scale RI-2 solicitations for additional information.

Planning Community Infrastructure (Planning) projects must have a clear research vision as well as a robust set of planning activities centered on that vision and the research to be enabled by the planned infrastructure. **Planning** projects must include significant community engagement to determine community needs, priorities, and support for the proposed infrastructure and to provide input into the design and development of a **Grand** or **Medium – New** infrastructure project, or a Mid-scale RI project.

A.2 Exploratory Development of Community Infrastructure

This solicitation introduces a new category of grants to support activities that involve the validation of one or more unproven infrastructure designs and/or technologies, which, if validated, could enable transformative community infrastructure in the future. This award category supports exploratory design, prototyping and validation activities that are not supported through other CIRC categories, but which are necessary to demonstrate the feasibility of high-risk, high-reward designs and/or technologies that could enable future community infrastructure with transformative potential. Successful projects are expected to provide the technical foundations necessary to pursue subsequent CIRC (**New** or **Grand**), Mid-scale RI-1, or Mid-scale RI-2 projects. Proposals must clearly demonstrate the high-risk, high-reward nature of the work, and its potential to enable transformative community infrastructure – enabling infrastructure that would otherwise not be possible.

Exploratory Development Track: grants from $250,001 to $750,000 for durations of up to two years to support exploratory design, prototyping and validation activities for potentially transformative future research infrastructure.

A.3 Medium Community Infrastructure

Each **Medium Community Infrastructure (Medium)** award supports the creation of **new CISE community research infrastructure or the enhancement of existing CISE community research infrastructure, and the accompanying user services and outreach to the associated CISE research community.** This class could also be used to fully develop an existing resource that has not received any funding from the prior CISE Research Infrastructure (CRI) or CCRI programs, other than a CRI or CCRI planning award. Projects must include substantial involvement of CISE researchers and enable projects with a **clear research focus** related to the core CISE disciplines.

Support for CIRC **Medium** projects is provided in two award categories: New (New) and Enhance/Sustain (ENS).

- **New:** grants of $750,001 to $2,000,000 for up to three years to develop new, focused CISE research infrastructure and user services to facilitate research in emerging areas of CISE research, and to engage the associated research community as part of the development and testing. **New** projects should also include community outreach to attract diverse groups of CISE researchers. Infrastructure funded under this category may be eligible to compete for CIRC **ENS** awards during or after the final year of funding. Existing CISE community infrastructure resources, regardless of the source of the initial funding used to establish them, are ineligible to submit proposals to the **New** track.

- **ENS:** grants of $750,001 to $2,000,000 for up to three years to support significant enhancement of existing CISE-supported research infrastructure from various programs to meet research community needs and directions, outreach to broaden and diversify the associated user research community, and implementation of a plan to attain long-term community operation of the infrastructure after the CIRC funding ends. **ENS** projects should enhance not only the infrastructure itself, but also user services and an integrated suite of tools and resources to benefit user research capabilities and productivity.

A.4 Grand Community Infrastructure

Each Grand Community Infrastructure (Grand) award provides $2,000,001 to $5,000,000 for a duration of up to five years to develop significant new, innovative CISE community research infrastructure or enhance and sustain existing CISE community research infrastructure that will enable a diverse community of CISE researchers to pursue a focused, innovative research agenda. **Grand** projects develop or enhance testbeds and platforms with an integrated set of user services that enable CISE researchers to conduct research experiments, test and validate methodologies and systems, and evaluate research results. **Grand** projects include well-designed plans for involving the related CISE research communities in the design, development, testing, and oversight of the infrastructure, as well as to guide future enhancements to ensure that they meet the needs and priorities of the participating community of researchers. **Grand** projects promote bold, emerging research directions, build infrastructures that catalyze CISE research, and provide leadership and support to develop robust, diverse research communities capable of advancing CISE research frontiers. Funds for years four and five of **Grand** awards will depend on a successful site visit, reverse site visit, or external reviews in year three of the project and the development of a sustainability plan for operations beyond the five-year period of the award.

NSF solicitation 22-519 (Internet Measurement Research: Methodologies, Tools, and Infrastructure (IMR)) refers to Internet Measurement related infrastructure, with the goal of supporting the creation of infrastructure for hosting Internet measurement tools and data. The funded infrastructure will make data available to the research community, including curating the data, ensuring an appropriate level of privacy protection, and developing necessary exchange formats, tools, and mechanisms across different components of the Internet, including core, access, wired, and wireless networks. PIs may submit such infrastructure requests to this CIRC solicitation as part of a **Grand** community infrastructure proposal. On the other hand, any planning activities towards such infrastructures may be submitted as **Planning-C** proposals.

ENS and Grand proposals that involve enhancement to an existing CISE-supported research infrastructure for various programs must show clear evidence of:

- Success of the initial implementation of the infrastructure;
- Usage by a diverse population of CISE researchers that extends well beyond the organizations that have developed and are managing the infrastructure;
- Need for and benefits of the proposed enhancements;
- Evidence of engagement and outreach to a diverse community of CISE researchers;
- Plans for an integrated set of user services, tools, and other resources to enhance the usability and impact of the infrastructure to the research community;
- CISE community support for the enhancement; and
- A realistic plan to achieve sustainability at the end of the CIRC funding.

B. Expectations of a CIRC project

Each CIRC project must provide compelling new research opportunities ***for a broad-based community of CISE researchers that extends well beyond the awardee organization(s) and that are not limited to a small, closed group of universities*.** These communities may vary in the number of researchers, and the infrastructure may support building up a research community for the given research area. Furthermore, each CIRC award may support the operation of such infrastructure, ensuring that the awardee organization(s) is (are) well positioned to provide a high quality of service to CISE community researchers expected to use the infrastructure to realize their research goals. Each CIRC project should include a vision for future long-term community sustainability and operation of the infrastructure. Each CIRC project should have a project management plan, including timeline, costs, and personnel. Proposals must define metrics relevant to the proposal goals and address measurement and evaluation of the infrastructure. Possible metrics to consider include infrastructure utilization, usability of infrastructure by researchers, diversity of users, and publications that report experiments done on the infrastructure (especially by researchers other than the PIs).

Each CIRC project must include substantial involvement of CISE researchers and enable a **focused research agenda** related to the core CISE disciplines. Proposals must provide compelling evidence that a diverse community of investigators will find the proposed infrastructure valuable to their research endeavors. Each **Medium** and **Grand** project must include provisions for a Community Advisory Board drawn from the user community, to help guide the development and future directions of the infrastructure to best meet the needs of the associated research community. Community Advisory Board members must be drawn from the broader user community and shall not be from the organizations receiving the CIRC award, nor be collaborators of the PIs or co-PIs of the CIRC award. Funds may be allocated for a Community Advisory Board; however, **potential community advisory board members should not be approached prior to award or identified in the proposal**.

Outreach to the associated research community is an essential component of all CIRC awards. This includes dissemination of services to ensure that the infrastructure is readily available to other researchers, as well as research community involvement in the overall organization and management of the infrastructure. It includes significant outreach to build and nurture a robust and diverse user community. CIRC proposals must contain clear plans to build a diverse community of active CISE researchers. Outreach must focus on the research community. Other outreach activities that focus on undergraduate students and K-12 students and teachers are possible, but these should not be the primary outreach activities aligned with a CIRC proposal.

Each **ENS** and **Grand** award must designate an individual well-connected to the related research community as the **Community Outreach Director**. Each Grand award is also expected to have a project manager. The lead PI on a single-institution proposal and the lead PI of a collaborative proposal cannot serve as the Community Outreach Director. The Community Outreach Director will lead a team that has responsibility for the overall outreach and engagement of the associated research community related to the development, use, and enhancement of the infrastructure. The Community Outreach Director must be a faculty member who will be directly involved with the project and provide visible leadership within the research community. Award budgets should provide for expenses for community participation and outreach commensurate with the size of the award. **ENS** and **Grand** projects are expected to devote substantial portions (approximately 20-25%) of their budgets to community and user engagement and outreach activities. Grand projects are expected to include contingency in their budget as part of an overall risk mitigation plan.

For **Dev** projects, the proposers should consider hiring professional staff to ensure that a high-quality, well-tested prototype is shovel-ready for a future research infrastructure request. Exploratory Development projects must include significant community engagement to determine community needs, priorities, and support for the proposed infrastructure and to provide input into the design and development.

CIRC provides the funding needed to create and enhance research infrastructure. CIRC proposals should only include individuals as PIs, co-PIs, and senior/key personnel who have direct roles in the CIRC project. **With the exception of Planning proposals, CIRC project descriptions must include a workplan table** that shows how team members will share the responsibility for implementing the CIRC project, clearly defining the role of each collaborating organization and each PI or co-PI within each organization.

Recent years have seen the emergence of many community resources and testbeds supporting CISE research funded through prior CISE research infrastructure programs and other sources. For example, cloud computing resources such as Chameleon and CloudLab, along with the collection of cloud resources beyond those supported by NSF, offer excellent opportunities for investigations and data management that do not require significant additional infrastructure investments. Other examples are the FABRIC and Platforms for Advanced Wireless Research (PAWR) testbeds, which offer opportunities for testing of advanced networking and wireless communications. All CIRC proposals must therefore clearly demonstrate that the requirements of the proposed research agenda demand the new or enhanced infrastructure requested in the CIRC proposal and cannot be accomplished using other existing community resources.

PIs are encouraged to consider utilizing NSF-supported research infrastructure (such as PAWR testbeds, FABRIC, Chameleon, CloudLab, and EduceLab) when formulating their research plans and submitting proposals. These resources are available to researchers to conduct experimental research at no cost. 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/, and https://educelab.engr.uky.edu/.

In addition, proposals may include requests for cloud computing resources through an external cloud access entity supported by NSF's Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access) program, namely CloudBank (https://cloudbank.org/).

Experience has shown that a successful CIRC project will:

- Provide infrastructure that enables research with a **clear intellectual focus** related to the CISE core disciplines supported by the three participating CISE divisions (CCF, CNS, and IIS). A clear research agenda that is enabled by the implementation of the infrastructure is the central element of a successful CIRC project. In particular, each CIRC project should result in infrastructure that supports a research agenda associated with a group of researchers with expertise in one or more CISE sub-disciplinary focus areas.
- Involve participation by a group of CISE-focused researchers, with leadership by CISE disciplinary researchers. Projects may enable other faculty and interdisciplinary groups, but clear CISE participation, involvement, and interest in the research is essential.
- Require teams of researchers, often across collaborating organizations, with the synergistic expertise needed to develop all aspects of the project.
- Include a well-designed and integrated suite of ancillary resources and user services that facilitate optimal use of the infrastructure and enhance its value to the community.
- Make use of state-of-the-art project planning tools and resource-sharing modules.
- Catalyze CISE research that would be difficult or impossible without the infrastructure, and that advances CISE research frontiers.
- Give the research community a voice in the future directions and management of the infrastructure, including regular community meetings and Community Advisory Boards for **Grand** and **Medium** projects.

All projects supported by the CIRC program must participate in the PI meetings, while also informing the broader CISE research community about CIRC community infrastructure resources available for use in their research. Awarded projects will need to supply and keep up-to-date information about their resources and community outreach meetings for the CIRC-VO web site.

C. Additional Information

Infrastructure resources that have received funding from an NSF Research Infrastructure program may submit proposals to the CIRC **ENS** track. Resources that have received **CI-SUSTAIN** awards from the CRI program are not eligible to receive funding from the CIRC program.

While educational benefits are also desirable elements of successful projects, projects that do not focus on and primarily enable CISE disciplinary research are not responsive to the CIRC solicitation. The primary motivations and outcomes from CIRC funding must be related to potential research outcomes rather than potential educational benefits.

CIRC seeks projects that support focused, compelling research agendas related to the CISE core disciplines. CIRC does not support the development or enhancement of fundamental tools that are intended to mostly benefit the non-CISE research community.

Organizations may submit proposals without having previously received **Planning** grants. However, it is expected that proposals involving new resources will benefit from a significant planning activity, which is the purpose of the CIRC **Planning** awards. (Note that receipt of a **Planning** grant does not guarantee support for a subsequent CIRC or Mid-scale RI proposal.)

Data have become increasingly important to research, and most scientific disciplines now rely on the development of validated datasets that can be used to test research models. The CIRC program supports creation or curation of datasets needed for CISE research, including benchmark datasets for driving CISE systems and testbeds for verification and measurement purposes. It does not support development of data resources that primarily support research in other non-

CISE disciplines. Researchers from other disciplines wishing to develop data resources for their research communities might consider discipline-specific programs offered by other directorates/offices.

CIRC awards are not meant to support resources used by only a single investigator, a single organization, or a closed group of organizations pursuing a common research agenda. Individual investigators or small groups of investigators may wish to consider embedding expenses for modest research equipment, datasets, or resources within their CISE research proposals. Computing departments seeking to upgrade or enhance their departmental computing infrastructure may wish to submit a Major Research Instrumentation (MRI) proposal.

NSF infrastructure programs more appropriate for researchers in other disciplines using computational science and/or data science include those offered by the NSF Office of Advanced Cyberinfrastructure (OAC), such as Campus Cyberinfrastructure (CC*) and Cyberinfrastructure for Sustained Scientific Innovation (CSSI), as well as the Major Research Instrumentation (MRI) program or the Mid-scale RI programs.

III. Award Information

Subject to the availability of funds, up to 10 **Planning** awards, up to 3 **Dev** awards, up to 12 **Medium** awards, and up to 3 **Grand** awards in each competition. **Planning** awards will be for up to one and one-half years and in the $50,000 - $100,000 range per award for Planning-C category and up to two years and in the $100,001 - $250,000 range per award for Planning-M category. **Dev** awards will be for up to two years and in the $250,001 - $750,000 range per award. **Medium** awards will be for up to three years and in the $750,001 - $2,000,000 range per award. **Grand** awards will be for up to five years and in the $2,000,001 - $5,000,000 range per award.

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, any PI, co-PI, or other senior project personnel must hold either a tenured or tenure-track position, or a primary appointment in a research 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:

In each annual competition, an individual may participate in at most two Exploratory Development, Medium, or Grand proposals as PI, co-PI, or Senior/Key Personnel. Note that any proposals submitted to the Planning-C or Planning-M tracks will not be counted against this limit. Beyond the limit noted above, a PI may submit at most one Planning proposal, whether it is Planning-C or Planning-M.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first proposal received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

Additional Eligibility Info:

Infrastructures that have received CI-SUSTAIN awards from the CISE Research Infrastructure (CRI) Program are not eligible for funding from the CIRC program. Those resources must either be transitioned to long-term community sustainment or seek other sources of funding at the end of the CI-SUSTAIN funding.

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.

The following supplements guidance found in the PAPPG and/or NSF Grants.gov Application Guide.

Proposal Type: Please note that the Planning proposals described in this solicitation are a solicitation-specific project category and are separate and distinct from the type of proposal described in Chapter II.F.1 of the PAPPG. When preparing a Planning proposal in response to this solicitation, the "Research" type of proposal should be selected.

Proposal Titles: Proposal titles must begin with **CIRC** followed by a colon, followed by the project class of **CIRC** proposal being submitted. Select a project class from the following list: **Grand, New, ENS, Planning-C, Planning-M, and Dev and then the title of the project**. For example: **CIRC: Grand: Project Title**.

Collaborative proposals submitted as separate submissions from multiple organizations should start with "Collaborative Research:" followed by a colon, then CIRC, followed by a colon, then the CIRC project class, followed by a colon and then the title. For example: **Collaborative Research: CIRC: ENS: Project Title**.

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

Provide 3-6 high-level keyword descriptors for the project at the end of the overview in the Project Summary. Include descriptors of the CISE core discipline(s) that is (are) most closely related to the intellectual focus of the research that the infrastructure will enable. CISE personnel will use this information in implementing the merit review process. Keywords should be prefaced with "Keywords" followed by a colon and should be separated by semi-colons. Include IMR as a keyword if you intend to submit a Grand proposal related to NSF 22-519.

Project Description: PIs are encouraged to read the following instructions carefully when preparing their proposals. For example, please note that the preparation instructions for Planning, **New,** and **ENS** Infrastructure proposals are different. As required by the PAPPG, the Project Description for all proposals must contain a separate section labeled "Broader Impacts."

For Planning proposals, within the **10 pages** allocated for the Project Description, describe the following:

- Research infrastructure envisioned, whether it is new infrastructure to be created or existing infrastructure to be enhanced, and the rationale and need for the infrastructure;
- Compelling new CISE research opportunities enabled by the infrastructure;
- CISE sub-disciplines that will benefit from the infrastructure and CISE-centric research groups that will use the infrastructure;
- For the Planning-M category, discuss why the planned infrastructure is of national importance, and how it addresses the goals of the Mid-scale Research Infrastructure program;
- Existing related resources along with a justification that the proposed research cannot be accomplished with these resources at the organization or elsewhere;
- Planning activities and timeline, and details of community engagement in the planning process;
- Ways in which the related CISE research community will be involved in the design and creation of the infrastructure;
- Clear identification of individuals involved in the planning process and associated community interactions;
- Qualifications and expertise of the PI, co-PI, and other members of the project team to manage the planning activities and connect with the appropriate CISE research communities, including involvement in the planning project and its activities; and
- Plans for a future New proposal (Medium or Grand) or Mid-scale Research Infrastructure proposal.

For Exploratory Development (Dev) proposals, within the **15 pages** allocated for the Project Description, describe the following:

- Rationale and need for the infrastructure, and the accompanying research vision;
- **Infrastructure Description** (**these proposals must have a section with this title and the specific subsections below)**:
    1. **Fundamental infrastructure:** describe what is to be developed;
    2. **Tools and resources:** describe ancillary resources to be designed and prototyped during the exploratory development; proposals should indicate items that will be developed by the initial award, along with a

vision for infrastructures this work will enable;

3. **Community engagement**: describe how the community will be engaged in the design, development, and management of the infrastructure, including plans for a Community Advisory Board;
4. **Community outreach:** describe plans for ongoing outreach to develop a diverse user community led by the Community Outreach Director (required for **Grand** proposals) and the outreach team:

- Compelling new infrastructures that would be enabled by the exploratory development, including research opportunities enabled by the potential infrastructure;
- Examples of focused research projects or use cases that this development will eventually enable, beyond the research of the PIs and co-PIs (note that the novelty and innovative aspects of the research must be evident, along with clear evidence that the proposed infrastructure development is essential to moving CISE research frontiers forward);
- Description of the CISE research community and sub-disciplines that will use and benefit from the infrastructure development; evidence that there is community support for the infrastructure, such as preliminary community activities and/or plans for its use;
- Relationship of the proposed infrastructure development to any similar existing resources, along with a justification for why the proposed research cannot be accomplished with existing resources;
- Means by which success of the exploratory development can be assessed;
- Plans for outreach to ensure that a broad community of potential users is engaged;
- Qualifications of the PI, co-PIs, and other members of the project team to manage the exploratory development;
- Project management plan, including a timeline, that outlines major steps to be undertaken during this development; this plan should include a workplan that shows roles and responsibilities of each PI and co-PI in the CIRC proposal (note roles and responsibilities chart required in Supplementary Documents); and
- Commitment to share resources, participate in CIRC Virtual Organization, and CIRC community PI meetings.

For New proposals and Grand proposals that involve the creation of new infrastructure, within the **15 pages** allocated for the Project Description, describe the following:

- Rationale and need for the infrastructure, and the accompanying research vision;
- **Infrastructure Description** (**these proposals must have a section with this title and the specific subsections below)**:
    1. **Fundamental infrastructure:** describe what is to be developed;
    2. **Tools, resources, and datasets:** describe ancillary resources to be developed and integrated into the infrastructure system; Medium proposals should indicate items that will be developed by the initial award, along with a vision for possible tools that might be appropriate for future enhancements;
    3. **User services:** describe services to be integrated into the infrastructure, including mechanisms by which researchers will gain access to the infrastructure;
    4. **Community engagement**: describe how the community will be engaged in the design, development, and management of the infrastructure, including plans for a Community Advisory Board;
    5. **Community outreach:** describe plans for ongoing outreach to develop a diverse user community led by the Community Outreach Director (required for **Grand** proposals) and the outreach team:
- Compelling new CISE research opportunities enabled by the proposed infrastructure, including a description of the steps taken to identify the research opportunities enabled by the infrastructure, as well as evidence that a diverse community of users plan to use the capabilities provided;
- Examples of focused research projects or use cases that the infrastructure will enable, beyond the research of the PIs and co-PIs (note that the novelty and innovative aspects of the research must be evident, along with clear evidence that the proposed infrastructure is essential to moving CISE research frontiers forward);

- Description of the CISE research community and sub-disciplines that will use and benefit from the infrastructure; evidence that there is community support for the infrastructure, such as preliminary community activities and/or plans for its use;
- Relationship of the proposed infrastructure to any similar existing resources, along with a justification for why the proposed research cannot be accomplished with existing resources at the organization or elsewhere;
- Means by which infrastructure utilization and user satisfaction will be evaluated and used to refine and improve subsequent infrastructure operations;
- Plans for outreach to ensure that a broad community of users is engaged (**Grand** proposals must contain a detailed Community Engagement plan covering all years of the award and a plan for engaging a Community Advisory Board);
- Community plans to provide long-term sustainability of the infrastructure;
- Qualifications of the PI, co-PIs, and other members of the project team to manage the creation or enhancement and operations of the research infrastructure in support of its users;
- Detailed project management plan, including a timeline, that outlines all steps to be undertaken to acquire, develop, and/or operate the research infrastructure, and that identifies the parties responsible for each major task; this plan should include a workplan that shows roles and responsibilities of each PI and co-PI in establishing or enhancing the infrastructure associated with the CIRC proposal (note roles and responsibilities chart required in Supplementary Documents); and
- Commitment to share resources, participate in CIRC Virtual Organization, and CIRC community PI meetings.

A Supplementary Document identifying budget items for operational expenses and budget items related to community outreach for each year must also be included for New proposals and Grand proposals that involve the creation of new infrastructure.

For ENS and Grand proposals that involve enhancement of existing infrastructures, within the **15 pages** allocated for the Project Description, describe the following:

- Rationale and need for the infrastructure and accompanying research vision (i.e., vision for new research that will be enabled by the enhancements);
- **Infrastructure Description** (**proposals must have a section with this title and the specific subsections listed below)**:
    - **Existing infrastructure**;
    - **Plan for enhancement/sustainment of the infrastructure**;
    - **Tools, resources, and datasets:** describe supporting resources to be developed and/or enhanced and integrated into the infrastructure system;
    - **User services:** describe user services to be added or enhanced and integrated into the infrastructure, including mechanisms by which researchers will gain access to the infrastructure;
    - **Community engagement:** describe ongoing community engagement in the design, development, and management of the enhancements and implementation of the sustainability plan, as well as plans for creating and engaging a Community Advisory Board (if none present); and
    - **Community outreach:** describe plans for ongoing outreach to broaden and diversify the user community:
- Current user population; current and past community involvement in development, management, and community leadership of the resource, including usage statistics over the lifetime of the resource and listing of key community outreach meetings and activities during initial infrastructure development;
- Evidence of resource utilization and community satisfaction with the resource and community support for the proposed enhancements; prior research and education contributions enabled by the infrastructure, and the

researchers, educators and students it served [evidence of prior contributions may include innovative research results, refereed publications and theses that used the infrastructure, use by courses, courseware developed, software tool development, dissemination and use statistics (e.g., numbers of users, citations, etc.), technology transfer, and other government or industry support, etc.];

- Commitment to share resources, participate in the CIRC Virtual Organization, and participate in CIRC community PI meetings;
- Qualifications of the PIs, co-PIs, and other members of the project team to manage the enhancement project and the implementation of the sustainability plan, including demonstration of significant CISE faculty leadership and involvement in the project;
- A workplan that shows roles and responsibilities of each PI and co-PI in enhancing the infrastructure associated with the CIRC proposal; and
- Community plans to provide long-term sustainability of the infrastructure, including a sustainability plan to be implemented during the CIRC funding; this should appear in a clearly labeled section called **Sustainability Plan**.

Each CIRC proposal should also include a well-reasoned budget justification that clearly distinguishes the costs to (1) acquire, develop, and deploy the new or enhanced infrastructure; (2) operate the proposed infrastructure, and (3) provide outreach to the user community. (**Note that NSF will only support operations at levels not to exceed $250,000 each year.**)

Supplementary Documents: In the Supplementary Documents Section, upload the following information:

1. *Project roles and responsibilities (required)*

Provide a table with entries for each participating organization showing all PIs, co-PIs, and Senior/Key Personnel, and the specific role of each person. A column for each year of funding should be included in the chart.

2. *List of individuals providing letters of collaboration (required)*

This list should include the names of the individuals followed by their affiliations for the letters included in item-5 below.

3. *Community outreach documentation (required)*

Provide a table with the community outreach and community participation activities for each year, along with the budgetary expenses that accompany each community outreach item.

4. *Data Management and Sharing Plan (required)*

Proposals must include a supplementary document of no more than two pages labeled "Data Management and Sharing Plan." This supplementary document should describe how the proposal will conform to NSF policy on the dissemination and sharing of research results.

For additional information see: https://www.nsf.gov/bfa/dias/policy/dmp.jsp.

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

5. *Documentation of collaborative arrangements of significance to the proposal through Letters of Collaboration*

Letters of collaboration should be limited to stating the intent to collaborate and the nature of the collaboration and should not contain endorsements or evaluation of the proposed project.

A letter of collaboration from each named participating organization must be provided at the time of submission of the proposal. Such letters must explicitly state intent to collaborate and the nature of the collaboration, appear on the organization's letterhead and be signed by the appropriate organizational representative. Letters are not needed from organizations submitting linked collaborative proposals. Letters of collaboration should have the title "Letter of Collaboration" in the title and should be no longer than one page. Note that Letters of

Collaboration should have the collaboration details and should not simply contain only the collaboration letter template found in the PAPPG.

The number of letters of collaboration is limited to five.

No other supplementary documents, except as permitted by the NSF PAPPG, are allowed.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

The CIRC program funds the development and implementation of CISE-centric research infrastructure and an integrated ensemble of user services, tools, and resources, as well as significant community engagement and outreach. CIRC does not fund the associated research that is subsequently enabled by the infrastructure. CIRC provides modest funds for faculty directly related to faculty involvement in the development and implementation of the infrastructure. CIRC provides funds for graduate students and other technical support essential to the development and operation of the infrastructure.

All CIRC **Grand**, **Dev**, **New**, and **ENS** project budgets must contain funds each year for the PI to travel to the annual CIRC PI community meeting in the Washington, DC area. Participation in CIRC PI community meetings is optional for PIs of CIRC **Planning** awards. CIRC **Planning** award PIs wishing to attend the annual CIRC community PI meeting should include funds to travel to the CIRC PI meeting in their **Planning** award budgets.

Grand and **Medium** projects should have modest funding for Community Advisory Boards that will help steer the development of the infrastructure and the community involvement and outreach. This may include a modest honorarium and travel to one annual meeting with the project team.

Community outreach expenses must be clearly identified in the Budget Justification:

- For **Grand** projects, 20-25% of the overall budget must be for community outreach and engagement. There should also be funding for community engagement in years 1 and 2 to seek community feedback on the development of the resource, and in testing and evaluation of the resource. There should be increasing funding in years 3-5 for community engagement and outreach to attract a broad and diverse user community.
- For **Medium** projects, 20-25% of the budget must be for community outreach. Medium projects should have increasing funds each year to engage the community in the design and development of the infrastructure and to provide community outreach to develop the user community.
- **Planning** and **Dev** projects should have clearly identified community outreach funds to engage the community in the design and development of a new community infrastructure project to meet community needs and priorities.

The CIRC program will ***not*** provide support for the following items:

- General-purpose personal computing equipment, office equipment, software, databases, etc.;
- Renovation of buildings or labs to accommodate the infrastructure;
- Funding of for-profit industry collaborators;
- Individual research enabled by the infrastructure; or
- Travel to present research results.

C. Due Dates

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

September 08, 2023

September 13, 2024

Second Friday in September, Annually Thereafter

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/ProposalPreparationanc 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.

The NSF Grants.gov Proposal Processing in Research.gov informational page provides submission guidance to applicants and links to helpful resources including the NSF Grants.gov Application Guide, Grants.gov Proposal Processing in Research.gov how-to guide, and Grants.gov Submitted Proposals Frequently Asked Questions. Grants.gov proposals must pass all NSF pre-check and post-check validations in order to be accepted by Research.gov at NSF.

When submitting via Grants.gov, NSF strongly recommends applicants initiate proposal submission at least five business days in advance of a deadline to allow adequate time to address NSF compliance errors and resubmissions by 5:00 p.m. submitting organization's local time on the deadline. Please note that some errors cannot be corrected in Grants.gov. Once a proposal passes pre-checks but fails any post-check, an applicant can only correct and submit the in-progress proposal in Research.gov.

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 other underrepresented groups 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 and Sharing Plan and the Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Within the context of the Intellectual Merit and Broader Impacts criteria, reviewers will be asked to consider the following issues when preparing their reviews:

For Planning proposals:

- Is there a well-designed planning process and set of activities that will engage the relevant communities and lead to sound designs for a new community infrastructure?
- Does the proposal provide convincing evidence that the proposed infrastructure will result in compelling new CISE research and education opportunities?
- How well does the research focus that the proposed infrastructure enables fit with CISE core disciplines? Are CISE researchers involved in an integral way in the CIRC project, particularly in leadership positions?
- Does the proposal provide evidence of community need for the infrastructure as well as impending community involvement in the design and implementation of the infrastructure?
- For the Planning-M category, will this infrastructure be of *national importance*, and does it address the goals of the mid-scale research infrastructure program?
- Is there a sound project management plan, including timeline and personnel?
- Are there well described metrics to document the success of the infrastructure (e.g., utilization, usability)?

For Exploratory Development proposals:

- Is there a well-designed set of activities that will design, prototype, and validate approaches toward building a future potentially transformative research infrastructure? Is this effort likely to result in a future, shovel-ready research infrastructure request?
- Is exploratory design, prototyping, and validation necessary for the proposed infrastructure, or will existing methods or technologies be sufficient to create the proposed infrastructure?
- Is there a well-designed set of activities that will engage the relevant communities and lead to sound designs for a new community infrastructure?
- Does the proposal provide convincing evidence that the proposed infrastructure will result in compelling new CISE research and education opportunities?
- How well does the research focus that the proposed infrastructure enables fit with CISE core disciplines? Are CISE researchers involved in an integral way in the CIRC project, particularly in leadership positions?
- Does the proposal provide evidence of community need for the infrastructure as well as impending community involvement in the design and implementation of the infrastructure?
- Is there a sound project management plan, including timeline and personnel?
- Are there well described metrics to document the success of the infrastructure (e.g., utilization, usability)?

For New proposals:

- Is there an innovative or compelling CISE-centric research agenda that the infrastructure will enable and support? Is the infrastructure essential for the research agenda to move forward?
- Does the proposal contain examples of multiple research projects that will be enabled by the research infrastructure, beyond the research of the PIs and Co-PIs?
- Is there a sound plan for an integrated set of user services and tools to enable use of the infrastructure by the research community?
- How well does the proposed research focus fit with CISE core disciplines? Are CISE researchers involved in an integral way?
- Is there existing similar infrastructure that is available to the community? If so, how is this infrastructure different, and is development of the new infrastructure justified with respect to other existing infrastructure available to the community?
- Have the PIs convincingly demonstrated that the project team has the skills necessary to acquire, develop, and/or operate community research infrastructure so as to provide a high level of service and support for a broadly-based community of users?
- Is the project management plan, including timeline, costs, and personnel, realistic? Do the roles and responsibilities presented in the Project Roles and Responsibilities document reasonably justify the contribution of all the participating institutions and personnel who are funded by this project?
- Has the team demonstrated community support for the infrastructure and plans for community involvement in the development and future use of the infrastructure?
- Are there quality community outreach activities to build a diverse community of users?
- Are there well described metrics to document the success of the infrastructure (e.g., utilization, usability)?

For ENS proposals:

- How will the proposed enhancements benefit the community? Are the enhancements well-justified and appropriate? Are the proposed enhancements to the user services, tools, and resources appropriate? Do these enhancements best meet the needs of the user community? Are these enhancements fully integrated into the infrastructure system?
- Does the proposal provide convincing evidence that the existing research infrastructure has resulted in compelling new research and education opportunities?
- How well does the proposed research focus fit with CISE core disciplines? Are CISE researchers involved in an integral way?
- Have the PIs convincingly demonstrated that the project team has the skills necessary to acquire, develop, and/or operate community research infrastructure so as to provide a high level of service and support for a broadly-based community of users?
- Is the project management plan, including timeline, costs, and personnel, realistic? Do the roles and responsibilities presented in the Project Roles and Responsibilities document reasonably justify the contribution of all the participating institutions and personnel who are funded by this project?
- To what extent have the PIs convincingly demonstrated that they have provided a high level of user support for a broad-based research and education community?
- To what extent is there a diverse user community actively using the infrastructure?
- To what extent has the research community been involved in the design and development of the infrastructure and was it involved in and supports the proposed enhancements?
- To what extent will the research community be involved in the sustainability plans and decisions about the long-term viability and sustainment of the infrastructure?
- To what extent does the proposal include examples of how the current infrastructure has been utilized by the community? Does the proposal contain examples of research projects that could be expanded by the proposed

enhancement?

- Is there a credible plan for achieving long-term community sustainability at the end of the CIRC funding? Are the steps in the plan realistic and appropriate?
- Are there sound plans to assemble a Community Advisory Board to help oversee the directions of the infrastructure and make sure that it meets community needs? Will the Community Advisory Board be involved in shaping community outreach plans and support?
- Are there well described metrics to document the success of the infrastructure (e.g., utilization, usability)?

For Grand proposals:

- Is there a research vision for the project that is innovative and bold and that could lead to advancing CISE research frontiers? How well does the proposed research focus fit with CISE core disciplines?
- Does the proposal contain examples of multiple research projects that will be enabled by the research infrastructure, beyond the research of the PIs and Co-PIs?
- How robust is the overall infrastructure, including the basic infrastructure and the accompanying suite of user services, tools, resources, and community outreach plans? Will this infrastructure have significant value to the CISE research community?
- Does the proposing have the expertise and community recognition needed to lead a **Grand** community effort and help shape the resource to meet community needs?
- Is there a sound set of community engagement and outreach activities that will involve the research community in the design, development, and evaluation of the infrastructure? Are there quality community outreach activities to build a diverse community of users?
- Is existing similar infrastructure available to the community? If so, how is this infrastructure different, and is development of the new infrastructure or enhancement justified with respect to other existing infrastructure available to the community?
- Is the project management plan, including timeline, costs, and personnel, realistic? Do the roles and responsibilities presented in the supplementary document reasonably justify the contribution of all the participating institutions and personnel? Are CISE researchers involved in an integral way, particularly in leadership positions?
- For projects involving enhancements to existing community research infrastructure, to what extent:
    - Do the PIs convincingly demonstrate that they have provided a high level of user support for a broad-based research and education community?
    - Is there a diverse user community actively using the infrastructure?
    - Has the research community been involved in the design and development of the infrastructure and was it involved in and supportive of the proposed enhancements?
    - Will the research community be involved in the sustainability plans and decisions about the long-term viability and sustainment of the infrastructure?
- Is there a vision for long-term community sustainment of the infrastructure?
- Are there sound plans to assemble a Community Advisory Board to help oversee the directions of the infrastructure and make sure that it meets community needs? Will the Community Advisory Board be involved in shaping community outreach plans and support?
- Are there well-described metrics to document the success of the infrastructure (e.g., utilization, usability)?

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:

Funds for years four and five of **Grand** awards will depend on: a) a successful site visit in year three of the project and, b) approval by the cognizant NSF Program officer, by the end of year three, of a sustainability plan for operations beyond the five-year period of the award.

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 annual project report, and a project outcomes report for the general public.

Failure to provide the required annual or final annual 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 annual 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.

Additional reporting criteria include community usage and involvement. Reports must document metrics relevant to the proposal goals and address measurement and evaluation of the infrastructure. Possible metrics to consider are usability of infrastructure for researchers, diversity of users, publications that report experiments done on the infrastructure (especially by researchers other than the PIs). For Medium and Grand awards, all project reports should include usage data such as the number of external users, diversity of experimenters, percentage of facility utilization, publications (both by the PI team and external users) that used the infrastructure for research.

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:

- Deepankar (Deep) Medhi, Program Director CISE/CNS, telephone: (703) 292-2935, email: dmedhi@nsf.gov
- Mimi McClure, Program Director, CISE/CNS, telephone: (703) 292-8950, email: mmcclure@nsf.gov
- Tatiana D. Korelsky, Program Director, CISE/IIS, telephone: (703) 292-8930, email: tkorelsk@nsf.gov
- Damian Dechev, Program Director CISE/CCF, telephone: (703) 292-8910, email: ddechev@nsf.gov
- Jason O. Hallstrom, Program Director CISE/CNS, telephone: (703) 292-8950, email: jhallstr@nsf.gov
- Nicholas Goldsmith, Assistant Program Director CISE/CNS, telephone: (703) 292-8950, email: nicgolds@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.

About The National Science Foundation

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports

cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.F.7 for instructions regarding preparation of these types of proposals.

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.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.
To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at https://www.nsf.gov

- **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:**
  - Send an e-mail to: nsfpubs@nsf.gov
  - or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

Privacy Act And Public Burden Statements

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:

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