Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining)

PROGRAM SOLICITATION
NSF 22-574

REPLACES DOCUMENT(S):
NSF 19-524

National Science Foundation

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

Directorate for Engineering
    Division of Chemical, Bioengineering, Environmental and Transport Systems
    Division of Civil, Mechanical and Manufacturing Innovation

Directorate for Geosciences

Directorate for Education and Human Resources
    Division of Graduate Education

Directorate for Mathematical and Physical Sciences
    Division of Astronomical Sciences
    Division of Chemistry
    Division of Materials Research
    Division of Physics

Directorate for Social, Behavioral and Economic Sciences

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

May 16, 2022

January 19, 2023

Third Thursday in January, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

The revisions are as follows:

- Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in Important Notice No. 147 . In support of these efforts, research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov, and may not be prepared or submitted via FastLane.
- A third solicitation goal has been added and the Program Description has been updated to introduce a new project class on "CI Professionals" that targets that solicitation goal. This solicitation welcomes *Pilot, Implementation (Small or Medium)*, and *CI Professional (CIP) project proposals*.
- The *Large-scale Project Conceptualization* project class has been eliminated.
- A new "CI Professional Mentoring and/or Professional Development Plan" requirement has been introduced.
- The programmatic areas of interest have been updated with the current priorities of the participating directorates and divisions.
- The list of additional solicitation specific review criteria has been updated. Proposals should address a subset of these criteria according to the project class and one or more of the chosen goal(s) of the solicitation.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 22-1), which is effective for proposals submitted, or due, on or after October 4, 2021.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining)

Synopsis of Program:

This program seeks to prepare, nurture, and grow the national scientific *research* workforce for *creating, utilizing*, and *supporting* advanced cyberinfrastructure (CI) to enable and potentially transform fundamental science and engineering (S&E) research and education and contribute to the Nation's overall economic competitiveness and security. The goals of this solicitation are to **(i) ensure *broad adoption* of CI tools, methods, and resources by the research community in order to catalyze major research advances and to enhance researchers' abilities to lead the development of new CI; (ii) integrate core literacy and discipline-appropriate advanced skills in advanced CI as well as computational and data-driven methods for advancing fundamental research, into the Nation's undergraduate and graduate educational *curriculum/instructional materials*; and (iii) build communities of research CI professional staff to deploy, manage, and collaboratively support the effective use of research CI, as well as establish career paths for those staff within and across institutions and science and engineering (S&E) disciplines.** Proposals responding to the *Pilot* and *Implementation* project classes defined in this solicitation may target one or both of the first two solicitation goals, while proposals responding to the *CIP* project class must address the third goal. For the purpose of this solicitation, advanced CI is broadly defined as the set of resources, tools, methods, and services for advanced computation, large-scale data handling and analytics, and networking and security for large-scale systems that collectively enable potentially transformative fundamental S&E research and education.

This solicitation calls for innovative, scalable training, education, and curriculum/instructional materials, along with deeper incorporation of CI professionals into the research enterprise — targeting one or more of the solicitation goals — to address emerging needs and unresolved bottlenecks in S&E research workforce development, from the postsecondary level to active researchers to CI professionals. The funded activities, spanning targeted, multidisciplinary communities, should lead to transformative changes in the state of research workforce preparedness for advanced CI-enabled research in the short- and long-term. This solicitation also seeks to broaden CI access and adoption by (i) increasing adoption of advanced CI and of computational and data-driven methods to a broader range of *S&E disciplines and institutions*; (ii) enhancing the incorporation of CI professionals into the research enterprise – highlighting the value of those professionals in S&E research; and (iii) effectively utilizing the capabilities of individuals from a diverse set of underrepresented groups. Proposals from, and in partnership with, the aforementioned communities are especially encouraged.

There are three project classes as defined below:

- *Pilot* Projects: up to $300,000 total budget with durations up to two years;
- *Implementation* Projects: *Small* (with total budgets of up to $500,000) or *Medium* (with total budgets of up to $1,000,000) for durations of up to four years; and
- *CI Professional (CIP)* Projects: up to two full-time equivalents (FTEs) per institution and four FTEs total with durations up to five years.

Section II. Program Description provides a more complete description of the project classes. Section V.A. Proposal Preparation Instructions describes the proposal elements required for the various project classes in order to address the suitable set of solicitation-specific review criteria.

The CyberTraining program is led by the Office of Advanced Cyberinfrastructure (OAC) in the Directorate for Computer and Information Science and Engineering (CISE) and has participation from other NSF directorates/divisions as described in Section II. Program Description, *Programmatic Areas of Interest*. Not all directorates/divisions are participating at the same level and some have specific research and education priorities. The appropriate contact for the CyberTraining program in any directorate/division is the Cognizant Program Officer (PO) for the respective directorate/division/office/program listed below.

All projects are expected to clearly articulate how they address important community needs, will provide resources that will be widely available to and usable by the research community, and will broaden participation from underrepresented groups. **Prospective principal investigators (PIs) are *strongly encouraged* to contact the Cognizant Program Officers in CISE/OAC *and* in the participating directorate/division relevant to the proposal to ascertain whether the focus and budget of their proposed activities are appropriate for this solicitation.** Such consultations should be completed at least one month in advance of the submission deadline. PIs should include the names of the Cognizant Program Officers consulted in a Single Copy Document as described in Section V.A. Proposal Preparation Instructions. The intent of the CyberTraining program is to encourage collaboration between CI and S&E domain disciplines. (For this purpose, units of CISE other than OAC are considered domain disciplines.) To ensure relevance to community needs and to facilitate adoption, those proposals of interest to one or more domain divisions **must** include at least one PI/co-PI with expertise relevant to the targeted research discipline. All proposals shall include at least one PI/co-PI with expertise relevant to OAC.

Prospective PIs contemplating submissions that primarily target communities relevant to directorates/divisions that are not participating in this solicitation are directed to instead explore the education and workforce development programs of the respective directorates/divisions.

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.

- Ashok Srinivasan, Program Director, CISE/OAC, telephone: (703) 292-8970, email: asriniva@nsf.gov
- Alan Sussman, CISE/OAC, telephone: (703) 292-7563, email: alasussm@nsf.gov
- Juan (Jenny) J. Li, CISE/OAC, telephone: (703) 292-2625, email: jjli@nsf.gov
- Almadena Y. Chtchelkanova, CISE/CCF, telephone: (703) 292-8910, email: achtchel@nsf.gov
- Deepankar Medhi, CISE/CNS, telephone: (703) 292-2935, email: dmedhi@nsf.gov
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- Victor P. Piotrowski, EHR/DGE, telephone: (703) 292-8670, email: vpiotrow@nsf.gov
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- Bogdan Mihaila, MPS/PHY, telephone: (703) 292-8235, email: bmihaila@nsf.gov
- Nigel A. Sharp, MPS/AST, telephone: (703) 292-4905, email: nsharp@nsf.gov
- Daryl W. Hess, MPS/DMR, telephone: (703) 292-4942, email: dhess@nsf.gov
- Richard Dawes, MPS/CHE, telephone: (703) 292-7486, email: rdawes@nsf.gov
- Joseph M. Whitmeyer, SBE/SES, telephone: (703) 292-7808, email: jwhitmey@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement

Estimated Number of Awards: 12 to 18

Up to 4 *Pilot*, 8 *Small* and 3 *Medium Implementation*, and 3 *CIP* awards are anticipated.

Anticipated Funding Amount: $21,500,000

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

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

Who May Serve as PI:

To ensure relevance to community needs and to facilitate adoption, those proposals of interest to one or more domain divisions ***must include*** at least one PI/co-PI with expertise relevant to the targeted research discipline. All proposals shall include at least one PI/co-PI with expertise relevant to OAC.

Limit on Number of Proposals per Organization:

There are no restrictions or limits on Pilot or Implementation proposals. Institutions are limited to one CIP proposal per CyberTraining program competition. In the event that an institution exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission, i.e., the first proposal will be accepted, and the remainder will be returned without review. No exceptions will be made.

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

An individual may serve as PI, co-PI, or other senior personnel on only one *Pilot* or *Implementation* proposal submitted to the CyberTraining program per competition. *CIP* proposals are not included in this limit. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission, i.e., the first proposal 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. submitter's local time):

    May 16, 2022

    January 19, 2023

    Third Thursday in January, 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:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Advanced computing and data analytics are increasingly at the center of S&E innovation and economic prosperity. Access to advanced CI resources within a comprehensive and highly interoperable ecosystem is becoming commonplace. For example, ubiquitous cloud-based services can provide tailored access to application-specific heterogeneous resources, including resources for training, education, and research. The CyberTraining program addresses the emerging skills required for preparation and career growth of the *S&E research workforce* to support the innovation, development, maintenance, and utilization of such an *advanced CI ecosystem*.

The need for such research workforce development programs has been highlighted by a number of recent activities and reports, including (i) the National Strategic Computing Initiative (NSCI), which has been co-led by NSF and aims to advance the high-performance computing (HPC) ecosystem and develop the workforce essential for scientific discovery and was updated in 2019; (ii) the 2020 National Science and Technology Council Subcommittee on Future Advanced Computing Ecosystem (SC-FACE) that developed a strategic plan, Pioneering the Future Advanced Computational Ecosystem: A Strategic Plan that identified

research workforce development as a key concern and major area of investment across all federal agencies; (iii) the 2020 Cyberinfrastructure Development Workshop 2020: Building the research innovation workforce that had as a primary goal exploring challenges, strategies, and solutions to address the need for an advanced CI research innovation workforce, specifically focusing on issues related to the CI Professional workforce; and (iv) the Federal BigData Research and Development Strategic Plan, which seeks to expand the community of data-empowered experts across all domains. As envisioned by the NSCI Strategic Plan and reinforced by the SC-FACE Strategic Plan, for advanced CI to be effective it must be easily accessible to, and usable by, a broad range of researchers. This requires skills training and outreach to new users, coupled with applications and a variety of innovative technologies as well as creative approaches, to ensure that overall productivity of an advanced CI-enabled S&E ecosystem is maximized and sustained. The 2017 Request for Information on Future Needs for Advanced Cyberinfrastructure to Support Science and Engineering Research (NSF CI 2030) also resulted in a substantial number of responses identifying the need for training, education, and curricular updates related to advanced CI. Finally, NSF recently released a holistic and forward-looking blueprint for Cyberinfrastructure Learning and Workforce Development that focuses on broadening participation across all relevant communities of concern including CI contributors, CI users, and CI Professionals, along with their institutions.

The goals of this solicitation are to (i) ensure *broad adoption* of CI tools, methods, and resources by the research community in order to catalyze major research advances and to enhance researchers' abilities to lead the development of new CI; (ii) integrate core literacy and discipline-appropriate advanced skills in advanced CI as well as computational and data-driven methods for advancing fundamental research, into the Nation's undergraduate and graduate educational *curriculum/instructional materials*; and (iii) build communities of research CI professional staff to deploy, manage, and collaboratively support the effective use of research CI, as well as establish career paths for those staff within and across institutions and S&E disciplines. In the short term, projects must either catalyze potentially transformative fundamental research in specific NSF-supported disciplines with innovative, scalable, informal/formal training and educational activities; result in curriculum/instructional material that is integrated into undergraduate and graduate courses, serving as templates for adoption by other institutions and informing best practices and institutional and disciplinary curriculum/instructional material; and/or support CI professionals in not only a research support role, but rather in an integral role that centers on partnering with research projects within the institution and across institutions on shared research goals. In the long term, projects should contribute to the larger goals of an educational and research ecosystem that enables computational and data-driven science for all scientists and engineers, with an understanding of computation as the third pillar and data-driven science as the fourth pillar of the scientific discovery process (Future Directions for NSF Advanced Computing Infrastructure to Support U.S. Science and Engineering in 2017-2020), in addition to the traditional first and second pillars of theory and experimentation, respectively. Furthermore, in the long term, projects should contribute toward ubiquitous educational infrastructure for online, dynamic, personalized lessons, and certifications in CI and other multidisciplinary areas that enable broad use by the NSF research communities of advanced CI tools and resources and catalyze potentially transformative fundamental research (NSF Advisory Committee for Cyberinfrastructure Task Force on Cyberlearning and Workforce Development Report, Chapter 1, Continuous Collaborative Computational Cloud in Higher Education, 2011), while also helping to create a diverse and sustainable community of skilled CI professionals and broadening CI contributions and adoption from underrepresented groups.

The CyberTraining program focuses on three overlapping scientific communities, and projects should target one or more of these communities:

1. *CI Professionals*: This is the community of research CI and professional staff who deploy, manage, and collaboratively support effective use of research CI. A **CI Professionals**-related project can address technical and research CI professional skills and more generally career development of current and future *CI Professionals*, including undergraduate and graduate students, postdoctoral fellows, and research scientists. However, a **CI Professionals**-specific project would target integration of current *CI Professionals* into research projects and the institutional support of long-term career paths for *CI Professionals*.
2. *CI Contributors*: This is the community of computational, data, and domain scientists and engineers who research and develop new CI capabilities, approaches, and methods. A **CI Contributors**-specific project is for contributor-level CI skills and advanced domain skills development; the target population spans graduate and undergraduate students, postdoctoral fellows, and researchers who are current and future *CI Contributors*.
3. *CI Users*: This is the community of domain scientists and engineers who effectively exploit advanced CI capabilities and methods for research. A **CI Users**-specific project is for user-level core literacy in advanced CI as well as computational and data-driven S&E skills; the target population spans undergraduate and graduate students, postdoctoral fellows, and researchers who are current and future *CI Users*.

CI Professionals include the information technology professionals, scientists, and engineers who work closely with the computational and data-enabled scientific and engineering researchers at colleges and universities, supercomputing and other centers, and other research institutions. Examples of *CI Professionals* include CI system administrators, CI research support staff, research software engineers, and CI facilitators, and may also include computational research scientists and engineers and non-tenure-track faculty.

CI Contributors include both computing as well as domain faculty and research scientists and engineers, including their undergraduate and graduate students and postdoctoral fellows, who develop new knowledge in the design, development, and utilization of robust research CI. *CI Contributors* explore all aspects of advanced CI including new scalable models and simulations as well as architecture and middle ware for extreme-scale systems, scalable algorithms and applications, software at various levels of the scientific software stack, and a robust advanced CI ecosystem to enable major advances in potentially transformative fundamental research.

CI Users include the large, diverse group of domain S&E faculty and researchers, including their undergraduate and graduate students and postdoctoral fellows, who are the current and potential users of new advanced CI capabilities for their research activities.

NSF anticipates proposals for informal/formal training and education, including retraining and cross-training, or for curricular activities, on topics related to use of methods and resources for advanced CI as well as computational and data-driven S&E. NSF also anticipates proposals to create or strengthen communities that support CI professionals as they contribute to the research enterprise, providing technical expertise, leadership, and engagement at the institutional level in research and educational pursuits. Training and education proposals are anticipated to span all levels, from basic literacy to advanced, and focus on addressing the emerging needs of fundamental research communities and resolving outstanding bottlenecks, while CIP proposals are anticipated to provide support for CI professionals to participate in the research enterprise and for institutions to establish long-term career paths for those professionals. CIP proposals can engage such professionals within a single institution or across multiple institutions, and/or can focus on a single S&E discipline or span multiple disciplines. The activities can include retraining and cross-training of the faculty mentors and course instructors themselves to keep up with the dynamic knowledge landscape, as one of the ways for obtaining a multiplier effect. For student training and education, a key concern is not to increase the time to degree. For CIP proposals, a key goal is to build long-term sustainable career paths within and across institutions.

II. PROGRAM DESCRIPTION

NSF invites proposals that identify the emerging and outstanding community needs in training, education, and career development that require significant innovations and will result in transformative changes. NSF also seeks proposals that will pioneer innovative solutions to the challenge of broadening CI access and adoption by those disciplines and institutions with low CI adoption as well as increasing participation from underrepresented groups. Proposals should

engage the relevant set of partners required as investigators, collaborators, expert advisors, resource providers, or early adopters, and include plans for effective outreach to stakeholder communities.

For projects targeting the first goal of the solicitation, potentially eligible activities range from training (e.g., workshops, summer schools) for researchers on the role of CI in addressing fundamental knowledge gaps and enabling CI tools and concepts; training and education that give students the foundation to understand the key research challenges in a given field and how they would use CI to effectively advance new knowledge; or training and education for CI professionals on the role of CI in advancing fundamental research and how to facilitate effective collaborations between researchers and CI experts. Such projects are expected to demonstrate a strong collaboration between CI experts and domain scientists to enable a specific research community to advance the frontiers of knowledge in that field.

For projects targeting the second goal of the solicitation, key challenges to be addressed include how to design or update relevant curriculum/instructional materials so that they will receive buy-in from a broad community of stakeholders, ensuring that the materials are of high quality and widely adoptable, and being informed by best practices for producing institutional and disciplinary curriculum/instructional materials. Such proposals should articulate well-designed programs with potential for significant impacts, including serving as templates and providing curriculum/instructional materials that can be adopted by other institutions, communities, or disciplines.

For projects targeting the third solicitation goal, key challenges include identifying the roles of CI professionals in the institutional (or cross-institutional, for multi-institution projects) research enterprise, and establishing sustainable career paths to embed such professionals in the research community. Proposals targeting this goal should define a long-term vision for enabling CI professionals to employ their skills to maximize the productivity of advanced CI in S&E research. Such proposals will articulate how collaboration between CI professionals and domain experts will enable research institutions to recognize all the benefits that advanced CI can provide to the entire research enterprise, within and/or across disciplines.

Prospective principal investigators are *encouraged* to engage the relevant stakeholders, to the extent possible, by forging alliances and forming backbones employing "collective impact" or an alternative strategy; this is necessary for projects addressing the second goal of the solicitation in order to inform forward-looking curriculum/instructional material development for the Nation's S&E workforce (John Kania & Mark Kramer, "Collective Impact," *Stanford Social Innovation Review*, 2011). PIs may seek public and private partnerships to increase relevance, enrichment, sustainability, and pursuit of national and international dimensions. Stakeholders may include colleges and universities (e.g., educators, researchers, and professional staff); supercomputing centers and related entities; professional/disciplinary associations; non-governmental organizations responsible for curriculum/instructional material development, accreditation, or professional examinations; public and private institutions; government and industry research labs; industry; authors and publishers; and federal, state, and local agencies. Stakeholders may also include international partners (note that NSF funds may only be used to support U.S.-based researchers). In addition, **each Implementation project must have a board of expert advisors or a network of funded/unfunded collaborators that is representative of the stakeholder communities** to provide periodic guidance and help refine the project methods or the curriculum/instructional material, or to help inform professional associations and non-governmental organizations responsible for curriculum, accreditation, or professional examination.

As investigators conceive of novel training and educational activities or curriculum/instructional materials, they are challenged to explore one or more of the following aspects for short-term impacts: (i) preparing a better scientific research workforce for advanced CI-enabled research, enhancing research productivity and enabling NSF researchers to effectively address complex societal problems; (ii) broadening adoption and accessibility both as users and contributors of institutional, regional, and national shared computing and data resources by various disciplines, categories of institutions, and underrepresented groups; (iii) developing or updating curriculum/instructional material to feed into undergraduate and graduate courses, and in collaboration with key stakeholders, strategically advancing the goal of informing disciplinary or general education core curriculum/instructional material, or informing discipline-appropriate curriculum/instructional material for advancing skill sets in CI and computational and data-driven S&E that will enable major advances in fundamental research; (iv) creating alliances and backbones for "collective impact"or alternative strategies; (v) providing on-demand, personalized accessibility; (vi) exploring innovative ways of drawing students into computational studies ("X+Computing" and "Computing+X"); and (vii) leveraging and contributing to NSF-funded CI projects (e.g., eXtreme Science and Engineering Discovery Environment (XSEDE), Partnership to Advance Throughput Computing (PATh), Leadership-Class Computing Facility (LCCF)), S&E research projects (e.g., NanoHub, Natural Hazards Engineering Research Infrastructure (NHERI)), and NSF Major Facilities (e.g., Laser Interferometer Gravitational-wave Observatory (LIGO), National Ecological Observatory Network (NEON)).

In the longer term, investigators should explore how their project contributes to one or more of the following program goals: (i) lead to an educational ecosystem enabling computational and data-driven science for all scientists and engineers; (ii) lead to re-envisioning the advanced CI ecosystem as an integral and enabling element of a broader, richer, and more dynamic scientific and engineering research enterprise; (iii) establish deeper engagement with and impact on various disciplines, institutions, and underrepresented groups; (iv) establish clear career pathways, career development and employment opportunities for the scientific and engineering research communities of concern; (v) result in a ubiquitous and scalable educational and training infrastructure for online, dynamic, personalized lessons, and certifications; and (vi) create a diverse and sustainable community of skilled CI professionals.

Investigators may explore various training modes and informal education models, in addition to formal classroom education models. Examples of informal methods include but are not limited to: (i) summer institutes hosting participants for a few weeks employing logistics similar to Research Experiences for Undergraduates (REU) Sites (note that the CyberTraining solicitation will not accept submissions for REU Sites); (ii) intensive, short-duration training workshops; (iii) workshop and conference training/tutorial tracks; (iv) massive open online courses, small private online courses, and online self-paced training; (v) collaboratively taught courses with remote and local instruction; and (vi) programming and other competitions and awards.

The overall quality of the recruitment and selection processes for the trainees and trainers for Implementation and Pilot projects will be important. The recruitment plan should include the types of institutions from which trainees will be recruited, along with a plan to engage with individuals from disciplines and institutions with lower levels of CI adoption as well as from underrepresented groups. The quality of recruitment and retainment processes, and of career development paths, for professionals will be important for CIP projects.

CIP proposals should describe science-driven needs and the resulting potential impact of sustained access to and engagement of CI Professionals within and/or across institutions. Proposals should describe planned engagement activities in specific and multiple S&E research projects within and/or across institutions, including plans to leverage existing institutional CI. Proposals should describe and justify the structure and make-up of the proposed set of CI Professionals, including the approach to its engagement, interactions, and partnerships with S&E research as well as education and training activities, along with efforts to broaden participation from underrepresented groups. CIP proposals may request up to two FTEs per institution and four FTEs total for up to five years. It is expected that CI Professionals funded by this program will be part of institution-wide units rather than individual project groups, laboratories, etc. Proposals must address institutionalization of positions and activities by the CI Professionals in the longer term through discussion of a sustainability plan. Proposals are encouraged to consider how the CI Professionals will interact with national CI entities (such as the RCD-Nexus CI Center of Excellence Pilot, the Campus Research Computing Consortium (CaRCC) and the US Research Software Engineer Association (US-RSE)), collaborators, participating institutions, and scientific virtual organizations where relevant. While single institution CIP proposals are encouraged, proposals are also encouraged from multi-institution teams to serve the advanced CI needs of institutions within a designated region of the U.S. or within one or more scientific or engineering disciplines.

CIP proposals should also include plans to interface with the awardee of the Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS) program end user support services (Track 2), as described in the ACCESS program page and solicitation (NSF 21-555). CIP projects must support

the ACCESS program end user support services track goal of developing and fostering the Computational Science Support Network (CSSN) that will assimilate and coordinate the human capital, funded by NSF, at the national, regional and campus levels. Therefore, CIP projects are required to commit 20% of the time of funded CI Professionals to support the research activities of the broader computational science community outside the proposing institutions, coordinated by the ACCESS Track 2 awardee. It is expected that funded CI professionals will contribute to the CSSN by actively assisting prospective, new, and current users of national shared CI resources through activities ranging from institution-level, one-on-one user engagements to regional and national community events organized by the ACCESS Track 2 awardee.

Evaluation of a project is another crucial element. A project should include plans to evaluate its success, including the attainment of planned short- and long-term goals. The PI team should identify the expected competencies, curriculum/instructional material, outcomes, impact on CI professionals, etc., along with measures of success and an evaluation timetable. There must be mechanisms for regular feedback from **an independent evaluator**, trainees, advisors, CI professionals, and early adopters to the PI team and for feedback to inform further project progress. Proposers may consult The 2010 User-Friendly Handbook for Project Evaluation for guidance on the elements of a good evaluation plan.

Project Classes

Proposals submitted to this solicitation must be consistent with one of the project classes defined below. Proposals will be considered for funding within their project classes. The project classes are based on the scope and effort required and the level of impact intended. Section V.A. Proposal Preparation Instructions describes the components required for various project classes to address the additional solicitation specific review criteria.

- *PILOT* **Projects**
  Pilot projects, with total budgets of up to $300,000 and with durations of up to two years, are exploratory activities that may lead to *Implementation* projects.
- *IMPLEMENTATION* **Projects**
  Implementation projects can be either *Small* (with total budgets of up to $500,000) or *Medium* (with total budgets of up to $1,000,000) for durations of up to four years. Implementation projects make CI training and educational activities or curriculum/instructional materials broadly accessible to a significant portion of a community for one or more disciplines. These projects collaborate with other CyberTraining awards and with other appropriate NSF-funded projects. *Medium Implementation* projects also foster a community to catalyze the adoption of advanced CI methods or incorporate training resources and materials into the curriculum.
- *CIP* **Projects**
  CIP projects can fund up to two FTEs per institution and four FTEs total, with durations up to five years. CIP projects will support the S&E research needs of one or more institutions and/or one or more disciplines and can collaborate both with other CyberTraining awards and with other appropriate NSF-funded projects, to foster the long-term sustainability of the CI professional workforce.

Programmatic Areas of Interest

The CyberTraining program includes the Office of Advanced Cyberinfrastructure (OAC — lead for the program) and Divisions of Computer and Network Systems (CNS), Computing and Communication Foundation (CCF) and Information and Intelligent Systems (IIS) within the Directorate for Computer and Information Science and Engineering (**CISE**); Divisions of Chemical, Bioengineering, Environmental and Transport Systems (CBET) and Civil, Mechanical and Manufacturing Innovation (CMMI) within the Directorate for Engineering (**ENG**); Division of Graduate Education (DGE) within the Directorate for Education and Human Resources (**EHR**); Directorate for Geosciences (**GEO**); Divisions of Astronomical Sciences (AST), Chemistry (CHE), Materials Research (DMR), and Physics (PHY) within the Directorate for Mathematical and Physical Sciences (**MPS**); and Division of Social and Economic Sciences (SES) within the Directorate for Social, Behavioral, and Economic Sciences (**SBE**). All projects must advance CI training and education goals for CI-enabled fundamental research, in addition to addressing specific domain needs. Not all directorates/divisions/programs are participating at the same level, and some have specific research and education priorities as described below.

OAC supports all three communities of *CI Professionals*, *CI Contributors*, and *CI Users*, both current and future generations. OAC encourages proposals on technical and research CI professional skills development, career development, and sustaining the community of *CI Professionals*. These include technical skills such as network engineering, cybersecurity of advanced research CI and scientific workflows, and software installation and maintenance, as well as research support skills such as porting legacy scientific research software and workflows to HPC and cloud platforms, advanced visualization, supporting scientific gateways, and required domain knowledge. OAC also encourages proposals, relevant to the domain directorates, for training as well as cross-training of the computational and data scientists and engineers who are current and future *CI Contributors* in contributor-level CI topics such as scalable algorithms and scientific software development, big data analytics methods, modeling and simulation, and computer architecture and middleware, and in advanced domain topics such as domain-specific tools, datasets, and models. OAC is also interested in the larger goal of preparing the Nation's scientific and engineering research workforce — well-versed in basic CI and computational and data-driven S&E literacy — with an understanding of computation as the third pillar and data-driven science as the fourth pillar of the scientific discovery process. This *CI User* workforce preparation starts with undergraduate students across all disciplines, and continues to graduate students and postdoctoral fellows, particularly in disciplines and areas with low levels of CI adoption, while also addressing broadening participation from underrepresented groups. OAC also encourages relevant proposals of overlapping concerns with other OAC programs such as Big Data Regional Innovation Hubs (BD Hubs), Campus Cyberinfrastructure (CC*), Cyberinfrastructure for Sustained Scientific Innovation (CSSI), and Cybersecurity Innovation for Cyberinfrastructure (CICI) programs.

CISE's Division of Computer and Network Systems (CNS) supports research and education projects in core areas of computer systems and networking technologies. CNS welcomes proposals that support communities of CI Professionals, CI Contributors, and CI Users *that focus on* designing, building, analyzing, and measuring future computing and networked systems.

CISE's Division of Computing and Communication Foundations (CCF) supports research and education projects that develop new knowledge in four core programs: Algorithmic Foundations; Communications and Information Foundations; Foundations of Emerging Technologies; and Software and Hardware Foundations. CCF is not highlighting specific areas in the context of this solicitation. Rather, it welcomes proposals that broadly enhance the CCF-relevant communities of CI Professionals, CI Contributors, and CI Users in consultation with the Cognizant Program Officer.

CISE's Division of Information and Intelligent Systems (IIS) supports research and education in artificial intelligence, data science, human-computer interaction, and computer graphics. IIS is not highlighting specific areas in the context of this solicitation. Rather, it welcomes proposals that broadly enhance the IIS-relevant communities of CI Professionals, CI Contributors, and CI Users in consultation with the Cognizant Program Officer.

EHR supports the development of a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators. EHR is interested in engaging the CI and education research communities to use advanced CI and other approaches to analyze, visualize, and harness data to better understand issues of workforce development in S&E. Topics of particular interest include preparation of the workforce in areas of data security and privacy in connection with EHR's investment in the CyberCorps(R): Scholarships for Service (SFS) and Secure and Trustworthy Cyberspace (SaTC) programs, as well as the other aspects associated with preparation of the technical workforce for proficiency in using advanced CI, which is supported by EHR's Advanced Technological Education (ATE) program. In this context, EHR is interested in supporting: (a) innovations in formal/informal educational settings that lead to the

broadest participation by all learners; (b) advances in pedagogical curricular design, and introduction of research and internship opportunities; and (c) assessments of training, learning and program evaluation. EHR especially welcomes proposals that will pair well with the efforts of NSF INCLUDES to develop STEM talent from all sectors and groups in our society. Collaborations are encouraged between CyberTraining proposals and existing INCLUDES projects, provided these collaborations strengthen both the CyberTraining and INCLUDES projects. Prospective PIs may wish to also submit substantially different proposals to the EHR Core Research (ECR) program, which welcomes proposals seeking to advance fundamental research on the learning of challenging CI content in formal/informal settings, exploring the evaluation of models for broadening participation such as *collective impact*, and studying the development of the STEM professional workforce.

ENG's Division of Chemical, Bioengineering, Environmental and Transport Systems (CBET) has a special interest in proposals focused on (i) developing multi-scale models that enable fundamental understanding of the relationships between molecular-level and macroscopic chemical, biological, and physical phenomenon; (ii) establishing workflows and/or best practices for data generation, analysis, and storage that address the long-standing issues of reproducibility and uncertainty quantification; and (iii) effective implementation of advanced computational methods (e.g., machine learning) toward solving relevant engineering problems.

ENG's Division of Civil, Mechanical and Manufacturing Innovation (CMMI) encourages proposals on any topics that would enable the research community to more effectively use CI to make new advances in potentially transformative fundamental research in any CMMI-funded fields or to lead in the development of new CI to catalyze major research discoveries in CMMI-funded fields. CMMI supports the integration of modeling, computation, data analysis and interdisciplinary research partnerships and perspectives to advance fundamental knowledge. CMMI seeks proposals for training that open pathways for discovering, developing, accessing, sharing, understanding, and using powerful CI tools, data, platforms and ecosystems to enhance CMMI researchers' productivity and impact. The division is particularly interested in proposals that will enable the CMMI community to use CI to develop new modes of discovery and to lead in CI development. For additional information on CMMI CI priorities, please see https://www.nsf.gov/eng/cmmi/about.jsp.

GEO supports fundamental research that advances the frontiers of knowledge and drives technological innovation while improving our understanding of the many processes that affect the global environment. GEO is interested in atmospheric and geospace science, Earth science, ocean science, and all areas of polar science. GEO is interested in proposals that would provide training, education, and career development to enable GEO research communities to more effectively access and adopt CI, including in the following research areas:

GEO's Division of Atmospheric and Geospace Sciences (AGS) is interested in answering fundamental science questions related to atmospheric and geospace research, including a wide variety of important processes that impact humans and society, such as space weather, tropospheric weather, physical and dynamic meteorology, climate, and air quality.

GEO's Division of Earth Sciences (EAR) is interested in improving our understanding of the structure, composition, and evolution of the Earth, the life it supports, and the processes that govern its behavior. EAR interests include research in terrestrial and solid-earth sciences.

GEO's Division of Ocean Sciences (OCE) is interested in activities that advance understanding of all aspects of the global oceans and ocean basins, including their interactions with people and the integrated Earth system.

GEO's Office of Polar Programs (OPP) supports all areas of research in and about the Arctic and Antarctic regions; polar proposals are encouraged to consider the recommendations made in the 2013 NSF-funded "Cyberinfrastructure for Polar Sciences" workshop report.

When making investments, **GEO** seeks broad representation of PIs and institutions in its award portfolio, including a geographically diverse set of institutions (including those in EPSCoR jurisdictions) and PIs who are women, early-career researchers, members of underrepresented minorities, veterans, and persons with disabilities. GEO is not highlighting specific areas in the context of this solicitation. Rather, it welcomes proposal that broadly enhance the GEO-relevant communities of CI Professionals, CI Contributors, and CI Users in consultation with the Cognizant Program Officer.

MPS's Division of Astronomical Sciences (AST) welcomes proposals, in all classes, that emphasize wide utility and demonstrate a broad base of community support.

MPS's Division of Chemistry (CHE) recognizes the value of CI and CI Professionals to a broad range of existing and emerging scientific areas relevant to fundamental chemical research. CHE encourages proposals in all classes that will enhance CI-enabled capabilities and community engagement. Support from CHE will aim to increase CI expertise among chemists of all levels, from undergraduates to professors.

MPS's Division of Materials Research (DMR) is interested in supporting Pilot and Implementation projects that would train the materials research community at career levels from undergraduate to independent researcher in activities that support CyberTraining in the use, development, and implementation of CI across fundamental materials research. Important is training in the creative and innovative application of community CI to advance fundamental materials research and/or its translation to societal impact. Of particular interest is CI training related to data-intensive and computational CI, and CI that enables or enhances the integration of data with experiment, computation, and theory in support of the Materials Genome Initiative, as envisioned in Designing Materials to Revolutionize and Engineer our Future (DMREF). Mechanisms may include: workshops, conferences, and summer institutes designed to address specific needs of DMREF or the materials research community more broadly, as well as other training activities to promote adoption, use, and creation of CI. Educational materials developed in the context of CyberTraining should be advertised, findable, accessible, and available for reuse across the materials research community. DMR encourages mechanisms to evaluate the effectiveness of the activity.

MPS's Division of Physics (PHY) is interested in supporting workshops and summer schools focused on training students and postdoctoral fellows in computational methods on advanced computing architectures. High-performance computing and data analytics methods are to be introduced in the context of specific scientific applications relevant to the MPS communities. Lectures must be accompanied by problem sessions and hands-on activities on the actual machines. Online sharing of workshop materials and recorded presentations on dedicated websites is strongly encouraged.

SBE supports rigorous methods to discover fundamental principles of human behavior at levels ranging from cells to society, from neurons to neighborhoods, and across space and time. The SBE directorate supports research that advances computational social science and analytic methods using social network, sensor, text, video, administrative, and other big data. SBE seeks proposals that will advance training for research communities of CI Professionals, CI Contributors, and CI Users. SBE welcomes proposals that address research training challenges, such as educating SBE scientists in computational tools and skills for understanding and promoting economic opportunity, security, civic and political engagement, health, and well-being in different regions and populations, many of which require interdisciplinary sociotechnical collaborations and team science.

Investments through this solicitation at the undergraduate and graduate levels complement NSF's Improving Undergraduate STEM Education (IUSE) and graduate education strategic frameworks, respectively. IUSE is NSF's comprehensive, Foundation-wide framework for an integrated vision of the agency's investments in undergraduate STEM education. Similarly, NSF has published a Strategic Framework for Investments in Graduate Education.

III. AWARD INFORMATION

Up to 4 *Pilot*, 8 *Small* and 3 *Medium Implementation*, and 3 *CIP* awards are anticipated. The number of awards will be based on quality of proposals, availability of funds, and responsiveness to the priorities of the participating directorates/divisions. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

Who May Serve as PI:

To ensure relevance to community needs and to facilitate adoption, those proposals of interest to one or more domain divisions ;***must*** include at least one PI/co-PI with expertise relevant to the targeted research discipline. All proposals shall include at least one PI/co-PI with expertise relevant to OAC.

Limit on Number of Proposals per Organization:

There are no restrictions or limits on Pilot or Implementation proposals. Institutions are limited to one CIP proposal per CyberTraining program competition. In the event that an institution exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission, i.e., the first proposal will be accepted, and the remainder will be returned without review. No exceptions will be made.

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

An individual may serve as PI, co-PI, or other senior personnel on only one *Pilot* or *Implementation* proposal submitted to the CyberTraining program per competition. *CIP* proposals are not included in this limit. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission, i.e., the first proposal will be accepted, and the remainder will be returned without review. No exceptions will be made.

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.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.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 provides additional guidance beyond that contained in the PAPPG or NSF Grants.gov Application Guide.

Title: The projects will have a short informative title that begins with "CyberTraining: Pilot:", "CyberTraining: Implementation: Small:", "CyberTraining: Implementation: Medium:", or "CyberTraining: CIP:" based on the project class chosen.

Project Summary (1-page limit): 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. The overview includes a summary description of the project, including the need for the activity and its short- and

long-term goals for training, education, and research workforce development; broadening CI access and adoption goals, or curriculum/instructional material goals; innovative aspects; size and nature of target CI communities; and estimated number of students. The overview also includes **6-7 keywords** that specify the CI community (i.e., Professionals, Contributors, Users), level of students, disciplines, topics, and themes targeted. The Project Summary should be written in a manner that will be informative to STEM professionals working in the same or related fields, and understandable to a scientifically literate lay reader.

Project Description (15-page limit): The project description should explicitly address a subset of the following additional items, according to the project class, with emphasis suitable to the proposed work and chosen goal(s) of the solicitation (note that this information will also be employed as additional solicitation-specific review criteria; see Section VI.A. for details):

1. Challenges for Research Workforce Development;
2. Solicitation Goal(s) Targeted (at least one of the first two goals for *Pilot* and *Implementation* proposals, and the third goal for *CIP* proposals):
    2.1 Broadening Adoption of Advanced CI; or
    2.2 Integration of CI Skills into Curriculum/Instructional Material Fabric; or
    2.3 Building a community of CI Professionals;
3. Scalability and Sustainability;
4. Recruitment and Evaluation;
5. "Collective Impact" Strategy: Coordination network and Backbone organization (or an alternative strategy);
6. Fostering Community;
7. Integration with the Computational Science Support Network (CSSN).

Pilot projects must address items 1 and 2. *Small Implementation* projects must address items 1-5, *Medium Implementation* projects must address items 1-6 and *CIP* projects must address items 1-7.

Please note that, per guidance in the PAPPG, the Project Description must contain a separate section labeled "Broader Impacts."

Supplementary Documents

If submitting via Research.gov, the Data Management Plan should be uploaded to the Data Management Plan section and the Postdoctoral Research Mentoring Plan should be uploaded to the Postdoctoral Mentoring Plan section. Both documents should be included as Other Supplementary Documents in Grants.gov.

Please note that Research.gov currently can only accept one file for Other Supplementary Documents. If submitting via Research.gov, please combine all documents designated as Other Supplementary Documents into one PDF.

In addition to the Data Management Plan (please follow the CISE Data Management Plan Guidance available at http://www.nsf.gov/cise/cise_dmp.jsp) and the Postdoctoral Research Mentoring Plan (if required), the following items are the only items permitted as supplementary documents:

1. **Management and Coordination Plan (2 pages):** Each proposal (optional for *Pilot* projects; required for *Implementation* and *CIP* projects) must contain a clearly-labeled Management and Coordination Plan that includes: 1) the specific roles of the PI, co-PIs, other Senior Personnel and paid consultants at all institutions involved; 2) how the project will be managed across institutions and disciplines; 3) identification of the specific coordination mechanisms; and 4) pointers to the budget line items that support these management and coordination mechanisms.

2. **CI Professional Mentoring and/or Professional Development Plan** (**1 page**, *if applicable*): Any proposal that requests funding to support a CI professional must upload a document titled "CI Professional Mentoring and/or Professional Development Plan" in the supplementary documentation section of Research.gov. CI Professionals are the professional staff who develop, deploy, manage, and support effective use of CI (e.g., research software engineers, programmers, IT professionals, data scientists, system administrators, CI facilitators, etc.) The document must describe the mentoring and professional development activities that will be provided for such individuals. In no more than one page, the planned activities must be described that are targeted specifically for CI professionals supported by the project, regardless of whether they reside at the submitting organization, any sub-recipient organization, or at any organization participating in a simultaneously submitted collaborative proposal. Proposers are advised that the professional development and mentoring plan must not be used to circumvent the 15-page Project Description limitation. The professional development and mentoring activities provided to CI professionals supported on the project will be evaluated under the Broader Impacts review criterion. Examples of professional development and mentoring activities include, but are not limited to: career counseling; training in preparation of and opportunities to prepare grant proposals, publications and presentations; guidance on finding opportunities for professional training and career advancement: guidance on effectively collaborating with researchers and other professionals from diverse backgrounds and across multiple S&E disciplines; and providing information on and training in responsible professional practices.

3. **Letters of Collaboration:** Include documentation of funded or unfunded collaborative arrangements of significance to the proposal through letters of collaboration. Letters of collaboration should be limited to stating the intent to collaborate and should not contain endorsements or evaluation of the proposed project. The recommended format for letters of collaboration is as follows: "If the proposal submitted by [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal." Scan your signed letters of collaboration, containing only text similar to that above, and upload them into the Supplementary Documents section of Research.gov or Grants.gov, but do not send originals. Do *not submit letters of support*. For example, letters of endorsement and letters of a laudatory nature for the proposed project are not acceptable.

Single Copy Documents

(i) *Collaborators and Other Affiliations Information:*

Proposers should follow the guidance specified in Chapter II.C.1.e of the NSF PAPPG.

(ii) *Names of the Cognizant Program Officers consulted* prior to submission, pursuant to the guidance above.

No other items, emails, or appendices are to be included. Full proposals containing items other than those required above or by PAPPG will be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

A significant portion of the proposed budget for Pilot and Implementation projects should be allocated for training, instructional, curricular, and outreach activities, and these and other activities should be budgeted as "Participant Support" to the extent allowable (see PAPPG Chapter II.C.2.g(v). In addition, each awardee is expected to participate in annual PI meetings near NSF with travel costs supported by the award; these travel costs should be included in the proposed budget.

C. Due Dates

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

    May 16, 2022

    January 19, 2023

    Third Thursday in January, 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/ProposalPreparationandSubmission.html. For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. 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.C.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.C.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 Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Pilot, Implementation, and CIP proposals should explicitly address a subset of the following additional items according to the project class, with emphasis suitable to the proposed work and chosen goal(s) of the solicitation, through well-identified proposal elements:

1. Rationale for challenges identified for research workforce development;
2. Strength of project's plan to address one or more of the solicitation goals as stated in the Synopsis of Program above, namely to (a) broaden the use of CI methods and resources by the research community, (b) integrate CI skills into institutional and disciplinary curriculum/instructional material fabric, or (c) build a community of CI professionals (at least one goal for *Pilot* and *Implementation* proposals, and the third goal for *CIP* proposals);
3. Potential for scalability and sustainability;
4. Soundness of recruitment and evaluation plan;
5. Effectiveness of proposed "collective impact" strategy to establish a coordination network and a backbone organization (or of an alternative strategy);
6. Soundness of plans to foster a suitable community;
7. Rationale for plans to integrate with the Computational Science Support Network (CSSN).

Pilot projects must address items 1 and 2. *Small Implementation* projects must address items 1-5, *Medium Implementation* projects must address items 1-6, and *CIP* projects must address items 1-7.

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 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 a Grants Officer in the Division of Grants and Agreements. 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.

Special Award Conditions:

Awardees are expected to participate in annual PI meetings to be held in the Washington, DC, area with travel costs supported by the award.

Ensuring Adequate COVID-19 Safety Protocols

Any cooperative agreement awarded in response to this solicitation will contain the following term and condition:

(a) This clause implements Section 3(b) of Executive Order 14042, Ensuring Adequate COVID Safety Protocols for Federal Contractors, dated September 9, 2021 (published in the Federal Register on September 14, 2021, 86 FR 50985). Note that the Department of Labor has included "cooperative agreements" within the definition of "contract-like instrument" in its rule referenced at Section 2(e) of this Executive Order, which provides:

For purposes of this order, the term "contract or contract-like instrument" shall have the meaning set forth in the Department of Labor's proposed rule, "Increasing the Minimum Wage for Federal Contractors, " 86 Fed. Reg. 38816, 38887 (July 22, 2021). If the Department of Labor issues a final rule relating to that proposed rule, that term shall have the meaning set forth in that final rule.

(b) The awardee must comply with all guidance, including guidance conveyed through Frequently Asked Questions, as amended during the performance of this award, for awardee workplace locations published by the Safer Federal Workforce Task Force (Task Force Guidance) at https://www.saferfederalworkforce.gov/contractors/.

(c) *Subawards*. The awardee must include the substance of this clause, including this paragraph (c), in subawards at any tier that exceed the simplified acquisition threshold, as defined in Federal Acquisition Regulation 2.101 on the date of subaward, and are for services, including construction, performed in whole or in part within the United States or its outlying areas. That threshold is presently $250,000.

(d) *Definition*. As used in this clause, *United States or its outlying areas* means:

(1) The fifty States;

(2) The District of Columbia;

(3) The commonwealths of Puerto Rico and the Northern Mariana Islands;

(4) The territories of American Samoa, Guam, and the United States Virgin Islands; and

(5) The minor outlying islands of Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Islands, Navassa Island, Palmyra Atoll, and Wake Atoll.

(e) The Foundation will take no action to enforce this article, where the place of performance identified in the award is in a U.S. state or outlying area subject to a court order prohibiting the application of requirements pursuant to the Executive Order (hereinafter, "Excluded State or Outlying Area". A current list of such Excluded States and Outlying Areas is maintained at https://www.saferfederalworkforce.gov/contractors/.

C. Reporting Requirements

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

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

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

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

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:

- Ashok Srinivasan, Program Director, CISE/OAC, telephone: (703) 292-8970, email: asriniva@nsf.gov
- Alan Sussman, CISE/OAC, telephone: (703) 292-7563, email: alasussm@nsf.gov
- Juan (Jenny) J. Li, CISE/OAC, telephone: (703) 292-2625, email: jjli@nsf.gov
- Almadena Y. Chtchelkanova, CISE/CCF, telephone: (703) 292-8910, email: achtchel@nsf.gov
- Deepankar Medhi, CISE/CNS, telephone: (703) 292-2935, email: dmedhi@nsf.gov
- Wei Ding, CISE/IIS, telephone: (703) 292-8017, email: weiding@nsf.gov
- Victor P. Piotrowski, EHR/DGE, telephone: (703) 292-8670, email: vpiotrow@nsf.gov
- Li Yang, EHR/DGE, telephone: (703) 292-2677, email: liyang@nsf.gov
- Reha M. Uzsoy, ENG/CMMI, telephone: (703) 292-0000, email: ruzsoy@nsf.gov
- Ronald Joslin, ENG/CBET, telephone: (703) 292-7030, email: rjoslin@nsf.gov
- Shahab Shojaei-Zadeh, ENG/CBET, telephone: (703) 292-8045, email: sshojaei@nsf.gov Eva
- Zanzerkia, GEO, telephone: (703) 292-4734, email: ezanzerk@nsf.gov
- Allen J. Pope, GEO/OPP, telephone: (703) 292-8030, email: apope@nsf.gov

- Bogdan Mihaila, MPS/PHY, telephone: (703) 292-8235, email: bmihaila@nsf.gov
- Nigel A. Sharp, MPS/AST, telephone: (703) 292-4905, email: nsharp@nsf.gov
- Daryl W. Hess, MPS/DMR, telephone: (703) 292-4942, email: dhess@nsf.gov
- Richard Dawes, MPS/CHE, telephone: (703) 292-7486, email: rdawes@nsf.gov
- Joseph M. Whitmeyer, SBE/SES, telephone: (703) 292-7808, email: jwhitmey@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov
- 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.E.6 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

- **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:

Suzanne H. Plimpton
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