

Engineering Research Initiation (ERI)

PROGRAM SOLICITATION

NSF 22-595

REPLACES DOCUMENT(S):

NSF 21-574



National Science Foundation

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

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

October 11, 2022

September 15, 2023

IMPORTANT INFORMATION AND REVISION NOTES

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.

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:

Engineering Research Initiation (ERI)

Synopsis of Program:

The NSF Directorate for Engineering (ENG) seeks to build engineering research capacity across the nation by investing in new academic investigators who have yet to receive research funding from Federal Agencies. The Engineering Research Initiation (ERI) program will support new investigators as they initiate their research programs and advance in their careers as researchers, educators, and innovators. This funding opportunity aims to broaden the base of investigators involved in engineering research and therefore is limited to investigators that are not affiliated with "very high research activity" R1 institutions (according to the Carnegie Classification <https://carnegieclassifications.iu.edu/>).

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.

- Laurel C. Kuxhaus, CMMI, telephone: (703) 292-4465, email: eri@nsf.gov
- Kathryn Jablokow, CMMI, telephone: (703)292-7933, email: eri@nsf.gov
- Lawrence S. Goldberg, ECCS, telephone: (703) 292-8339, email: eri@nsf.gov
- Rosa A. Lukaszew, ECCS, telephone: (703)292-8339, email: eri@nsf.gov
- Carole J. Read, CBET, telephone: (703) 292-2418, email: eri@nsf.gov
- Shahab Shojaei-Zadeh, CBET, telephone: (703) 292-8045, email: eri@nsf.gov

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

- 47.041 --- Engineering

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 55

The number of awards will depend on the availability of funds and the quality of the proposals. The awards will be two-years in duration.

Anticipated Funding Amount: \$11,000,000

An ERI award, including indirect costs, must not exceed \$200,000 for a duration of 24 months. The award funds may be used for research expenses, trainee support (e.g., students and/or postdocs), Principal Investigator (PI) salary and may include modest equipment cost necessary for the successful initiation and conduct of the proposed research. ERI awards are eligible for supplemental funding as described in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG).

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) not currently classified as a Doctoral University with "Very High Research Activity" (R1 institutions) according to the 2021 Carnegie Classification update: <https://carnegieclassifications.iu.edu/>. These include two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Eligibility is based on Classification on the date of proposal submission deadline.

Who May Serve as PI:

PIs must hold a doctoral degree in a field supported by NSF. Postdoctoral researchers are not eligible to serve as PI on an ERI proposal.

At the time of the proposal submission deadline, the PI may not have been a PI, Co-PI or equivalent on any current or prior *awarded* NSF research grant (including subaward) or have had research support from any other Federal Agency (within the United States or abroad), with the following exceptions:

- Conference or travel awards;
- Doctoral dissertation improvement grants and any other award made while the PI was a student, including NSF Graduate Research Fellowships;
- Postdoctoral research fellowship awards that exclusively support pre-tenure-track activities;
- Major Research Instrumentation grants (NSF MRI or equivalent) as PI or Co-PI,
- REU or RET site awards;
- I-Corps, Phase I SBIR, or STTR awards;
- Awards that originated as Federal funds but were distributed locally without naming the submitting ERI PI in the Federal funding proposal (such as: NASA Space Grant Project.); and
- Awards that originated as Federal funds but were not for research purposes (this must be described in the Chair's letter.)

The PI of an ERI proposal must hold a doctoral degree in a field supported by NSF and must hold an appointment at an ERI-eligible institution. Postdoctoral fellow researchers are not eligible to serve as PI on an ERI proposal.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 1

An individual may serve as Principal Investigator (PI) or Senior Personnel on only one ERI proposal per deadline in response to this solicitation.

Only one PI per proposal is allowed. Co-Principal Investigators (Co-PI) are not allowed.

Separately submitted collaborative proposals (see PAPPG II.D.3 for definition) are not allowed.

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.
- o 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:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

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

October 11, 2022

September 15, 2023

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:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

NSF investments in engineering research and education are critical building blocks for the nation's future economic growth and prosperity. Engineering breakthroughs have addressed national challenges, enriched our understanding of natural systems, fostered new technologies, fortified the nation's infrastructure, and introduced the exciting possibilities of engineering to the next generation. The Directorate for Engineering (ENG) supports the development of a diverse engineering workforce versed in the forefronts of engineering research and promotes the success of new academic investigators in their careers as researchers, educators, and innovators. The goal of the ERI program is to broaden the base of scientists and engineers in academia who dedicate their careers to advancing engineering research and education in societally important fields relevant to ENG.

II. PROGRAM DESCRIPTION

The ERI program is part of the capacity-building strategy of the Directorate for Engineering to direct its investments in engineering research across the nation. This solicitation provides support for investigators who have yet to receive research funding from Federal Agencies to initiate their engineering research programs and to be in a more competitive position for future proposal submissions. Eligibility to apply to this program is limited to non-R1 Institutions of Higher Education (IHEs) accredited in, and having a campus located in the US. NSF encourages submission by new investigators in engineering fields from non-PhD awarding institutions, including community colleges.

ERI provides resources to enable impactful scientific work that will improve the research and scientific training environment at the institution through the conduct of fundamental research. Research activities may include efforts that catalyze new research partnerships, disseminate results, and/or lay a foundation to support preparation for future grant competitions.

NSF strongly encourages participation in this ERI program by PIs from all underrepresented groups in engineering, including gender identity and expression, race and ethnicity (Blacks and African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and Native Pacific Islanders), disability, LGBTQ+, veterans of the armed forces, first generation college and those from low socio-economic status. New investigators who are at Minority-Serving Institutions are especially encouraged to apply.

Proposers may submit proposals only in engineering research areas supported by programs within the participating Divisions of the Directorate for Engineering. The list of ERI-eligible ENG programs is provided in Section V.A, Proposal Preparation and Submission Instructions.

References:

[1] Building the Future Investing in Innovation and Discovery: NSF Strategic Plan 2018-2022. https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf18045.

[2] Charting a Course for Success: Americas' Strategy for STEM Education. 5-Year STEM Education Strategic Plan <https://www.energy.gov/sites/prod/files/2019/05/f62/STEM-Education-Strategic-Plan-2018.pdf>

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 55

Anticipated Funding Amount: \$11,000,000

An ERI award, including indirect costs, must not exceed \$200,000 for a duration of 24 months. The award funds may be used for research expenses, trainee support (e.g., students and/or postdocs), Principal Investigator (PI) salary and may include modest equipment cost necessary for the successful initiation and conduct of the proposed research. ERI awards are eligible for supplemental funding as described in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG).

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) not currently classified as a Doctoral University with "Very High Research Activity" (R1 institutions) according to the 2021 Carnegie Classification update: <https://carnegieclassifications.iu.edu/>. These include two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Eligibility is based on Classification on the date of proposal submission deadline.

Who May Serve as PI:

PIs must hold a doctoral degree in a field supported by NSF. Postdoctoral researchers are not eligible to serve as PI on an ERI proposal.

At the time of the proposal submission deadline, the PI may not have been a PI, Co-PI or equivalent on any current or prior *awarded* NSF research grant (including subaward) or have had research support from any other Federal Agency (within the United States or abroad), with the following exceptions:

- Conference or travel awards;
- Doctoral dissertation improvement grants and any other award made while the PI was a student, including NSF Graduate Research Fellowships;
- Postdoctoral research fellowship awards that exclusively support pre-tenure-track activities;
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- REU or RET site awards;
- I-Corps, Phase I SBIR, or STTR awards;
- Awards that originated as Federal funds but were distributed locally without naming the submitting ERI PI in the Federal funding proposal (such as: NASA Space Grant Project.); and
- Awards that originated as Federal funds but were not for research purposes (this must be described in the Chair's letter.)

The PI of an ERI proposal must hold a doctoral degree in a field supported by NSF and must hold an appointment at an ERI-eligible institution. Postdoctoral fellow researchers are not eligible to serve as PI on an ERI proposal.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 1

An individual may serve as Principal Investigator (PI) or Senior Personnel on only one ERI proposal per deadline in response to this solicitation.

Only one PI per proposal is allowed. Co-Principal Investigators (Co-PI) are not allowed.

Separately submitted collaborative proposals (see PAPPG II.D.3 for definition) are not allowed.

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.

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.

Proposal Contents

Program Solicitation Number: Research.gov Users: Select the ERI program solicitation number in Step 1 of the Prepare New Proposal Wizard (Funding Opportunity). Grants.gov users: The program solicitation will be pre-populated by Grants.gov on the NSF Grant Application Cover Page.

ENG Unit of Consideration: Research.gov users: Secondary units of consideration may be selected after the proposal is created by clicking on "Manage Where to Apply" in the proposal details section. Grants.gov users should refer to Section VI.1.2. of the NSF Grants.gov Application Guide for specific instructions on how to designate the NSF Unit of Consideration. For assistance in determining which program(s) to choose, refer to the list of ERI-eligible ENG Programs below:

CBET

- Catalysis
- Electrochemical Systems
- Interfacial Engineering
- Process Systems, Reaction Engineering, and Molecular Thermodynamics
- Biophotonics
- Biosensing
- Cellular and Biochemical Engineering
- Disability and Rehabilitation Engineering
- Engineering of Biomedical Systems
- Environmental Engineering
- Environmental Sustainability
- Nanoscale Interactions

- Combustion and Fire Systems
- Fluid Dynamics
- Particulate and Multiphase Processes
- Thermal Transport Processes

CMMI

- Advanced Manufacturing (AM)
- Biomechanics and Mechanobiology (BMMB)
- Civil Infrastructure Systems (CIS)
- Dynamics, Control and Systems Diagnostics (DCSD)
- Engineering for Civil Infrastructure (ECI)
- Engineering Design and System Engineering (EDSE)
- Foundational Research in Robotics (Robotics)
- Humans, Disasters, and the Built Environment (HDBE)
- Mechanics of Materials and Structures (MOMS)
- Mind, Machine and Motor Nexus (M3X)
- Operations Engineering (OE)

ECCS

- Electronics, Photonics and Magnetic Devices (EPMD)
- Communications, Circuits, and Sensing-Systems (CCSS)
- Energy, Power, Control, and Networks (EPCN)

Project Title: The Project Title must begin with "ERI" followed by a colon, and then an informative title.

Co-PIs: No co-PIs are permitted.

Project Description (10-page limit):

The Project Description should provide a well-argued and specific proposal for the activities that, over the course of a two-year period, will provide the foundation for a competitive, long-term, productive research program at the forefront of engineering research. PIs should pay careful attention to the Solicitation-specific Review Criteria listed in this solicitation and be sure to address these criteria in the Project Description. Reviewers will be asked to consider the potential of the research initiation activities to serve as the basis for sustained research contributions, consistent with the research goals of the PI.

The Project Description must have these section headers exactly. Please note that if submitting via Research.gov, the section header for Broader Impacts must be on its own line with no other text on that line.

Research Goals: Provide a brief description of the PI's overall research goals.

Research Project: Provide a clear outline of the general plan of work including the research questions or hypotheses, the broad design of activities to be undertaken, and, where appropriate, a clear description of experimental methods and procedures. The proposal should include the motivation for the research and a discussion of the novelty of the work in the context of existing literature. The project description should also discuss mechanisms and plans for assessing success of the proposed activities. The proposed single-PI activities may include activities to catalyze partnerships. The potential partner(s) must be named as Senior Personnel (see PAPPG II.C.2). Partnership activities may enable access to instrumentation or resources, activities that establish a working relationship such as formulating new and sound plans for larger-scale projects in emerging research areas, travel for the PI or trainees to strengthen the partnership, or other activities. Note that Subawards to R1 institutions are not permitted.

Proposals that include a request for equipment must follow the PAPPG (II.C.2.g.iii).

Broader Impacts: Provide a discussion of the broader impacts of 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, such as education activities.

ERI Criteria: Provide a brief description of how the proposed work addresses the solicitation-specific review criteria, as described in the "Additional Solicitation Specific Review Criteria" section below.

Supplementary Documents:

Supplementary documents are limited to the specific types of documents listed in the PAPPG, with the following exception: Department Chair/Dean's Letter (required).

Proposals must include a letter from an appropriate Department Chair or Dean describing how the proposed research plan is aligned with the department, school, or institution's goals. This letter should also describe how the PI's proposed ERI activities are aligned with the goals of the department or organization and how the department or organization is committed to the professional development of the PI. The letter must also certify that the PI meets the ERI eligibility criteria. If the PI has any non-institutional current or past support, the letter should succinctly indicate into which exempted category the support falls (see Eligibility Criteria.) Letters that do not meet these requirements will cause a proposal to be returned without review.

See PAPPG Chapter II.C.2.j for the full policy on supplementary documents.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

ERI proposals may include equipment costs necessary to conduct the proposed work. Proposers are encouraged to consider NSF's MRI solicitation for acquisition of a single well-integrated instrument with a cost of >\$100,000.

C. Due Dates

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

October 11, 2022

September 15, 2023

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

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

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.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

- To what extent will the project provide the foundation for sustained scholarly contribution to engineering research?
- To what extent will the proposed engineering research initiation activities enhance the PI's ability to maintain impactful research activities?

B. Review and Selection Process

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

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

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

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

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:

- Laurel C. Kuxhaus, CMMI, telephone: (703) 292-4465, email: eri@nsf.gov
- Kathryn Jablokow, CMMI, telephone: (703)292-7933, email: eri@nsf.gov
- Lawrence S. Goldberg, ECCS, telephone: (703) 292-8339, email: eri@nsf.gov
- Rosa A. Lukaszew, ECCS, telephone: (703)292-8339, email: eri@nsf.gov
- Carole J. Read, CBET, telephone: (703) 292-2418, email: eri@nsf.gov
- Shahab Shojaei-Zadeh, CBET, telephone: (703) 292-8045, email: eri@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 (FASSED) 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
 - or telephone: (703) 292-8143
- **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
 Reports Clearance Officer
 Policy Office, Division of Institution and Award Support
 Office of Budget, Finance, and Award Management
 National Science Foundation
 Alexandria, VA 22314

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