Engineering Research Visioning Alliance (ERVA): Future Research Directions for the Engineering Research Community

PROGRAM SOLICITATION
NSF 20-551

National Science Foundation

Directorate for Engineering
Emerging Frontiers and Multidisciplinary Activities

Letter of Intent Due Date(s) ***(required)*** (due by 5 p.m. submitter's local time):

July 08, 2020

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

August 12, 2020

IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 20-1), which is effective for proposals submitted, or due, on or after June 1, 2020.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Engineering Research Visioning Alliance (ERVA): Future Research Directions for the Engineering Research Community

Synopsis of Program:

The National Science Foundation Directorate for Engineering (NSF/ENG) invites the engineering research community to establish an organization that will serve to identify and develop bold and societally impactful new engineering research directions and thereby catalyze the engineering research community's pursuit of innovative, high-impact research. Specifically, NSF/ENG calls on the engineering research community to establish an Engineering Research Visioning Alliance (ERVA) that ENG will support to facilitate the articulation of compelling research visions that align with national and global challenges. This organization will be charged with obtaining and integrating input from all stakeholders with interest in engineering research, including academia, industry, societies, government agencies and the public. A reciprocal goal of the organization will be to communicate coordinated information on nascent opportunities and priorities in engineering research to these stakeholders. It is anticipated that through its activities the ERVA will strengthen connectivity across these diverse stakeholders, and increase coordination among engineering disciplinary communities.

The ERVA should have membership/representation of academic, industrial and other stakeholders, and should be inclusive of all engineering disciplines. Through its proposed activities, the ERVA should provide the engineering community with a process for identifying future research challenges and enable the engineering research community to speak with a unified voice.

FURTHER INFORMATION: An informational webinar will be presented on Wednesday, March 25th at 1:00pm Eastern to discuss the ERVA solicitation and answer questions. Details on how to join this webinar will be posted on the NSF/Engineering website (https://www.nsf.gov/dir/index.jsp?org=ENG).

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.

- Louise R. Howe, Program Director, ENG/EFMA, telephone: (703) 292-2548, email: lhowe@nsf.gov

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

- 47.041 --- Engineering

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

Anticipated Funding Amount: $5,000,000 to $8,000,000

NSF anticipates funding a single award for 5 years, subject to the availability of funds, with the funding for each year of the award in the range of $1,000,000 to $2,000,000, not to exceed $2,000,000 in any one year. Proposers are encouraged to take into consideration when developing their proposed budget that expenses necessary to effect and sustain the organization will likely increase from establishment through maintenance phases, consistent with an increasing scope of activities with time.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

Either the PI or a co-PI should hold a primary appointment at an institution of higher education. There is no constraint on the role of the Principal Investigator (PI) within the submitting organization. The proposal must document the PI's experience with leading and managing an organization involving and/or representing diverse constituents from the broad engineering community.

Limit on Number of Proposals per Organization: 1

An organization may submit only one ERVA proposal on which it is the lead institution.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via FastLane: *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

Letter of Intent Due Date(s) ***(required)*** (due by 5 p.m. submitter's local time):

July 08, 2020

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

  August 12, 2020

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:

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

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I. INTRODUCTION

The National Science Foundation Directorate for Engineering invites the engineering research community to establish an organization that will serve to identify bold and societally impactful engineering research directions that will place the U.S. in a leading position to realize a better future for all. NSF funds over 40% of fundamental engineering research at U.S. academic institutions. The Directorate for Engineering identifies and prioritizes programmatic directions through consultation with academic, federal, industrial and other stakeholders, and responds directly to national priorities. NSF/ENG now calls on the engineering community to establish an Engineering Research Visioning Alliance to provide mechanisms for ideation and communication across the public and private sectors, with expert input from industry and academia, that will generate coordinated information on nascent opportunities and priorities in engineering research. The ERVA will catalyze the engineering research community's pursuit of innovative, high societal impact research through identification and communication of compelling research visions responsive to pressing national and global challenges.

II. PROGRAM DESCRIPTION

The Directorate for Engineering calls on the engineering research community to establish an Engineering Research Visioning Alliance (ERVA). ENG will support the ERVA as a community proxy responsible for facilitating the identification of compelling research challenges and opportunities emerging at the interfaces of engineering disciplines and between engineering and other disciplines. The ERVA will enable rapid and efficient community response to

emerging opportunities and areas of national need. An important goal of the organization will be to communicate future research visions across stakeholders with interest in engineering research including academia, industry, societies, government agencies and the public. Through identification and communication of compelling research visions, the ERVA will enable rapid and efficient community response to emerging opportunities and areas of national need.

Several different potential models for achieving these goals were recently discussed by representatives from engineering societies, industrial research organizations, academia, and government (Engineering Research Framework Visioning Summit, Alexandria, VA; July 16-18, 2019; for Workshop Summary see https://engresearchvisioning.asee.org/wp-content/uploads/2019/11/ERFVS-Workshop-Summary-lo-res.pdf).

NSF/Engineering invites proposals to establish the Engineering Research Visioning Alliance. The ERVA will:

- Embrace all fields of engineering, including emerging areas and areas overlapping with other disciplines.
- Serve as a catalyst and enabler for the engineering community in identifying new opportunities and priorities in engineering research that have the potential to address national and societal needs.
- Consider issues, challenges and opportunities in engineering research, and source novel and unanticipated perspectives.
- Provide a resource for rapid response expert advice to help inform cross-cutting engineering research initiatives.
- Convene experts from academia, industry, engineering societies and other relevant stakeholder groups to consider issues, challenges, and opportunities in engineering research.
- Facilitate the generation of visions for engineering research, including both short and medium/long range visions.
- Communicate the research visions and their importance to a wide range of stakeholders including the research community, and government and industry stakeholders, as well as more broadly to the public.
- Provide input to the engineering research community and engage with advisory committees and groups consistent with law and regulations, as appropriate for a body that is not chartered under the Federal Advisory Committee Act (FACA).
- Evaluate ERVA outcomes including meetings and workshops, topics considered at these meetings, and effectiveness of communication and dissemination efforts.

Specific deliverables to be achieved with financial support provided under this solicitation include:

- Establishment of an organizational structure for providing leadership and oversight of the ERVA activities and outputs.
- Establishment and maintenance of a standing council with members from academia, industry and other relevant stakeholder groups that meets at least twice per year, and whose members can be called upon for advice and to support the selection, guidance, conduct, and oversight of rapid response studies.
- Operational support, staff and related expenses for management of logistics, the recruitment of experts, and communication of ERVA products.
- Management of task forces, workshops, a recurring symposium, and visioning meetings.
- Organization of "blue-sky" conference tracks to facilitate collection of out-of-the-box input from diverse contributors.
- Publication of meeting reports and white papers, and dissemination of these products to the engineering research community, government and industry stakeholders, and the public.
- Maintenance of a dedicated ERVA website with up-to-date information on accomplishments and activities and access to products.
- Development of an evaluation framework for assessing the impact of ERVA activities and communication strategies .

III. AWARD INFORMATION

NSF anticipates funding a single award for 5 years, subject to the availability of funds, with the funding for each year of the award in the range of $1,000,000 to $2,000,000, not to exceed $2,000,000 in any one year. The award will be funded as a Cooperative Agreement.

If a proposal involves multiple organizations, it must be submitted as a single proposal with sub awards: separately submitted collaborative proposals are not permitted.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

Either the PI or a co-PI should hold a primary appointment at an institution of higher education. There is no constraint on the role of the Principal Investigator (PI) within the submitting organization. The proposal must document the PI's experience with leading and managing an organization involving and/or representing diverse constituents from the broad engineering community.

Limit on Number of Proposals per Organization: 1

An organization may submit only one ERVA proposal on which it is the lead institution.

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

There are no restrictions or limits.

Additional Eligibility Info:

The submitting organization should be committed to the advancement of basic research and education in engineering. The PI from the lead institution should consider partnering with co-PIs from other institution types to ensure representation that includes institutions of higher education (with a strong track record in fundamental engineering research) and relevant private and public sector organizations, including industry and engineering societies. The submitting organization could be pre-existing or formed for the purpose of establishing the ERVA, but must be a legal entity eligible to receive federal funding.

Collaborative Proposals: If multiple organizations are involved in a proposal, it must be submitted as a single proposal with subawards. Collaborative proposals arranged as separate submissions from multiple organizations will not be accepted for this solicitation. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(required)*:

A Letter of Intent (LOI) is required for all proposals submitted to this solicitation. LOIs are used by NSF to gauge the level of effort for review. They will not be used as pre-approval mechanisms for the submission of proposals, and no feedback will be provided to the submitters. **Proposals submitted without Letters of Intent will be returned without review**.

The Letter of Intent should be submitted through FastLane no later than the deadline specified in this solicitation. The subject heading of the letter should include the title of the proposal and the name of the lead organization. Each LOI must include the following:

- **Project Title:** The title must begin with "ERVA".
- **Project Synopsis** (up to 500 words): Provide a brief summary of the project, including the organizational and management principles for the ERVA.
- **The Team:** 1) The name and departmental affiliation (if any) of the Principal Investigator (PI). 2) The name(s) and departmental affiliation(s) (if any) of the Co-PI(s) and all senior personnel. 3) The names(s) of any additional participating institutions or organizations, including all sub-awardees.

If multiple LOIs for a single project are submitted, the last one submitted before the deadline will be used. Each LOI is specific to the project, project title and PI.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is required when submitting Letters of Intent.
- A Minimum of 1 and Maximum of 4 Other Senior Project Personnel are permitted
- A Minimum of 0 and Maximum of 6 Other Participating Organizations are permitted
- Submission of multiple Letters of Intent is permitted

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & 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. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- 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.

For this solicitation, the following supplementary guidance is provided:

Collaborative Proposals: If multiple organizations are involved in a proposal, it must be submitted as a single proposal with subawards. Collaborative

proposals arranged as separate submissions from multiple organizations will not be accepted for this solicitation. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

Investigators and Institutions: The Principal Investigator and Lead Institution should be identical in the Letter of Intent and in the Full Proposal. However, additional personnel and participating institutions/organizations may be included in the Full Proposal that were not listed in the Letter of Intent.

Proposal Title: The title must include the prefix "ERVA". Minor alterations in title between Letter of Intent and Full Proposal are permitted.

Project Description: In addition to the guidance provided in the NSF PAPPG, the following sections should be included in the Project Description (included in the 15-page limit):

Organizational Structure and Project Staffing:

1. Describe the **ERVA's relationship to the proposing organization**.
2. Describe the expected **membership of the ERVA** and explain how it will be developed to ensure that the broad research interests of the engineering community are represented. Proposers are encouraged to engage the broadest range of stakeholders, including representatives of academia, industry, societies, and other groups with interest in engineering research. Membership should encompass diversity of discipline, demographics, geography and rank/career stage, and is expected to include all engineering disciplines. Inclusion of engineering ethicists and social scientists is encouraged.
3. Provide a **leadership and executive structure**. Describe the **selection process** for the executive leadership.
4. Discuss the **administrative and organizational structure of the ERVA**, including any necessary advisory, administrative and expert support activities.
5. Describe the **experience of the submitting institution** with managing projects of a similar nature.
6. Describe the **relevant qualifications of the PI, co-PI, and other senior personnel**.
7. Describe the **roles of sub-awardees and consultants** (if any).

ERVA Management Plan:

Provide a detailed management plan including schedule and milestones to establish the ERVA as an effective community proxy for the engineering community. Describe the approach and activities the ERVA will undertake to facilitate the visioning of bold and impactful future engineering research directions. Describe the planned strategies for achieving full participation of women and underrepresented minorities in all ERVA activities.

Communication Strategy:

Clearly articulate intended mechanisms for communicating ERVA-identified visions to all relevant stakeholders. Describe strategies for ensuring that visions are communicated broadly across discipline, demographics, geography and rank/career stage.

Evaluation Plan:

Describe the evaluation framework that will be used to assess the impact of ERVA activities and ERVA communication strategies. Include a description of proposed metrics that will be evaluated.

Budget and Budget Justification: It is anticipated that expenses necessary to effect and sustain this organization will increase from establishment through maintenance phases, consistent with an increasing scope of activities with time. Proposers are encouraged to take this into consideration when developing their proposed budget.

Facilities, Equipment and Other Resources: Describe physical space, resources and infrastructure that will be available to support the work of the ERVA, including office equipment, teleconference and communications capabilities, and institutional meeting space necessary to achieve project goals.

Supplementary Documents: 1) Provide, as a supplementary document, **letters of collaboration** for each partner who will participate in the ERVA. 2) Provide, as a supplementary document, a table that describes the following for each member of the management team, including all sub-awardees and consultants: Name, Administrative Position/Project Title, Activities Assigned, Proposed Level of Effort, Responsibilities for Achievement of Key Milestones and Outcomes.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. submitter's local time):

  July 08, 2020

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

  August 12, 2020

D. FastLane/Research.gov/Grants.gov Requirements

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at:

https://www.fastlane.nsf.gov/a1/newstan.htm. 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 FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. 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 FastLane or 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 underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

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

Additional Solicitation Specific Review Criteria

Reviewers will be asked to comment explicitly on the issues discussed below for each proposal:

- How well does the submitting organization represent the broad engineering research community, particularly academic and industry communities including the communities supported by the NSF Directorate for Engineering? Is the proposed organization sufficiently broad to play a community proxy role?
- Does the proposing team have the appropriate perspective on current engineering research activities and priorities?
- Is the organization and management structure sufficient to meet the project goals? Does the organizational structure involve the necessary stakeholder range? Does the submitting organization have experience with similar types of projects? How qualified are the PIs and other named personnel to meet the project goals? Are appropriate milestones and associated activities included?
- Are the proposed visioning approaches/activities well-positioned to catalyze the identification of bold and high-impact research directions?
- Does the submitting organization have access to appropriate physical space, resources and infrastructure to achieve the goals of the ERVA?
- Does the proposal include effective and timely mechanisms for gathering from the engineering research community and other stakeholders critical information and insights on future engineering research directions?
- Does the proposal include a clear and compelling plan for communicating future research visions to all relevant stakeholders?
- Does the proposal include a credible evaluation plan with appropriate metrics?

B. Review and Selection Process

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

The review process will employ a panel and may also employ ad hoc reviews and/or site visits or reverse site visits if they are needed to obtain additional information.

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.

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.

Additional Reporting Requirements:

The activities of the awardee organization will be monitored through brief monthly reports of financial and technical status, by regularly scheduled teleconferences and quarterly progress reports. Reports should account for the activities of the awardee, sub-awardees and major sub-contractors. In lieu of a fourth quarter report, an annual progress report including future plans will be submitted by the awardee to the cognizant Program Officer. NSF will provide the format for these reports within one month of the award date. Quarterly and annual reports must address progress of the ERVA regarding the responsibilities outlined in the Solicitation. The ERVA will be required to develop a set of management and performance indicators to use for reporting purposes.

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:

- Louise R. Howe, Program Director, ENG/EFMA, telephone: (703) 292-2548, email: lhowe@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.

Additional enquiries may be directed to:

- Sohi Rastegar, Office Head, ENG/EFMA, telephone: (703) 292-8305, email: srastega@nsf.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

  or telephone: (703) 292-7827
- **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
Office of the General Counsel
National Science Foundation
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