

Growing Convergence Research (GCR)

PROGRAM SOLICITATION NSF 19-551



National Science Foundation

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

May 08, 2019

February 03, 2020

First Monday in February, Annually Thereafter

February 01, 2021

First Monday in February, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Growing Convergence Research is a new NSF-wide program.

Important Information

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, 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:

GROWING CONVERGENCE RESEARCH (GCR)

Synopsis of Program:

In 2016, the National Science Foundation (NSF) unveiled a set of "Big Ideas", [10 bold, long-term research and process ideas that identify areas for future investment at the frontiers of science and engineering](#). The Big Ideas represent unique opportunities to position our Nation at the cutting edge of global science and engineering leadership by bringing together diverse disciplinary perspectives to support convergence research. As such, when responding to this solicitation, even though proposals must be submitted to the Office of Integrative Activities, once received, the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

Growing Convergence Research (GCR) at the National Science Foundation was identified as one of 10 Big Ideas. Convergence research is a means for solving vexing research problems, in particular, complex problems focusing on societal needs. It entails integrating knowledge, methods, and expertise from different disciplines and forming novel frameworks to catalyze scientific discovery and innovation.

GCR identifies [Convergence Research](#) as having two primary characteristics:

- *Research driven by a specific and compelling problem.* Convergence Research is generally inspired by the need to address a specific challenge or opportunity, whether it arises from deep scientific questions or pressing societal needs.
- *Deep integration across disciplines.* As experts from different disciplines pursue common research challenges, their knowledge, theories, methods, data, research communities and languages become increasingly intermingled or integrated. New frameworks, paradigms or even disciplines can form sustained interactions across multiple communities.

A distinct characteristic of convergence research, in contrast to other forms of multidisciplinary research, is that from the inception, the convergence paradigm *intentionally* brings together intellectually diverse researchers and stakeholders to frame the research questions,

develop effective ways of communicating across disciplines and sectors, adopt common frameworks for their solution, and, when appropriate, develop a new scientific vocabulary. Research teams practicing convergence aim at developing sustainable relationships that may not only create solutions to the problem that engendered the collaboration, but also develop novel ways of framing related research questions and open new research vistas.

This GCR solicitation targets multi-disciplinary team research that crosses directorate or division boundaries and is currently not supported by NSF programs, initiatives and research-focused Big Ideas. Proposers must make a convincing case that the research to be conducted is within NSF's purview and cannot be supported by existing NSF programs and multidisciplinary initiatives. Proposals involving convergence in areas covered by existing programs and solicitations will be returned without review.

The proposers should outline a five-year research plan delineated in two phases, Phase I: years 1-2, and Phase II: years 3-5. Successful proposals will be funded initially for two years and then each team's progress will be evaluated based on a report and presentation that the team will make to a panel of reviewers at NSF. Teams that show significant progress during the first two years will receive funding for an additional three years. Interested researchers may request up to \$1,200,000 total for the first two years and \$2,400,000 for the last three years.

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.

- Dragana Brzakovic, telephone: (703) 292-5033, email: dbrzakov@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.070 --- Computer and Information Science and Engineering
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources
- 47.079 --- Office of International Science and Engineering
- 47.083 --- Office of Integrative Activities (OIA)
- 47.084 --- NSF Technology, Innovation and Partnerships

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 10

Anticipated Funding Amount: \$12,000,000

\$12,000,000 pending availability of funds, to support the first two years of proposals selected for an award. The total amount awarded in future years will depend on the availability of funds and the number of awards advancing to years 3-5.

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:

The PIs must hold full-time appointments in research or teaching positions at US-based campuses/offices of eligible organizations.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

A PI or a co-PI may participate in only one proposal in response to this solicitation. They may not participate in any role in any other proposal. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission (i.e., the first compliant proposal received will be accepted and the others will be returned without review). No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

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

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable
- **Other Budgetary Limitations:**

Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):
 - May 08, 2019
 - February 03, 2020
 - First Monday in February, Annually Thereafter
 - February 01, 2021
 - First Monday in February, Annually Thereafter

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

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

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Convergence research is a critical mechanism for solving many vexing research problems, in particular, those stemming from complex social and/or scientific challenges. In recognition of this fact, **Growing Convergence Research (GCR)** at the National Science Foundation (NSF) was identified in 2016 as one of [10 Big Ideas for Future NSF Investments](#). The two primary characteristics of [Convergence Research](#) are:

- Research driven by a specific and compelling problem. Convergence Research is generally inspired by the need to address a specific challenge or opportunity, whether it arises from deep scientific questions or pressing societal needs.
- Deep integration across disciplines. As experts from different disciplines pursue common research challenges, their knowledge, theories, methods, data, research communities and languages become increasingly intermingled or integrated. New frameworks, paradigms or even disciplines can emerge from sustained interactions across multiple communities.

From its inception, the convergence paradigm intentionally brings together intellectually diverse researchers and stakeholders to frame the research questions, develop effective ways of communicating across disciplines and sectors, adopt common frameworks for their solution, and, when appropriate, develop a new scientific language.

II. PROGRAM DESCRIPTION

This GCR solicitation is a call for proposals addressing complex problems that require convergence paradigms to catalyze scientific discovery and innovation at the nexus of traditional disciplines. Consistent with the two primary characteristics of convergence research, the problem motivating the research should be rooted in a societal and/or scientific grand challenge and the research strategy should embrace deep integration across multiple disciplines. Particular interest is with those problems that have potential for further advancement of convergence research and sustained interactions beyond the period of the award.

This GCR solicitation targets multi-disciplinary team research that crosses directorate or division boundaries and is currently not supported by NSF programs, initiatives and other research-focused Big Ideas. *Proposers must make a convincing case that the research to be conducted cannot be supported by existing NSF programs and multidisciplinary initiatives. Proposals involving convergence in areas already covered by existing programs and solicitations will be returned without review.* In determining the relationship between submitted proposals and existing programs, NSF will employ text analysis software and technical expertise of program directors across the foundation. To ensure suitability (vs. other NSF programs) of their proposal, researchers are encouraged to send a very brief synopsis (not to exceed one page) of their proposal to gcrelig@nsf.gov for feedback at least 30 days before submission deadline.

The proposing team should be comprised of researchers and stakeholders from different disciplines that are crucial to catalyze the proposed scientific discovery and innovation. Involvement of Minority Serving Institutions as leads or partners is encouraged. Depending on the specific problem, stakeholders may be from industry, non-profit, community, and governmental organizations; schools; and/or other non-academic entities. Each of the team members should demonstrate a readiness to engage in convergence by committing time and effort throughout the project.

In shaping projects responsive to this call, PIs should consider strategies to intentionally bring together their research team and develop a convergence culture of discovery and communication. Proposals should specifically address how investigators will organize collaboration among members of their research project to promote team effectiveness and convergent outcomes. All project participants should recognize that readiness to engage in extensive interactions is essential for the success of the project. New training and learning experiences for participants at all levels, most importantly for post-docs and graduate students, is also an essential component of a convergence culture.

Important Program Characteristics

Project funds should be used to support efforts to achieve deep integration across disciplines and conduct transformative research with high-impact potential. The research problem should be designed to fit the five-year timeframe. The proposal should explain how the proposed activities connect to the societal and/or scientific grand challenges that inspired the proposal, a broader set of research problems, and how the team may sustain interactions beyond the project duration.

Proposals must include:

1. A description of a long-term scientific vision motivated by a societal and/or scientific grand challenge;
2. A rationale explaining proposal suitability for this solicitation;
3. A five-year research plan, divided into two phases (years 1-2 and years 3-5), that employs a convergence paradigm;
4. A convergence management plan outlining strategies and procedures for developing and sustaining convergence for the project duration and beyond.

Refer to the proposal preparation instructions below for more detail on each of these items.

III. AWARD INFORMATION

Anticipated Funding Amount: \$12,000,000 pending availability of funds, to support the first two years of proposals selected for an award. The total amount awarded in future years will depend on the availability of funds and the number of awards advancing to years 3-5.

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

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

The PIs must hold full-time appointments in research or teaching positions at US-based campuses/offices of eligible organizations.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

A PI or a co-PI may participate in only one proposal in response to this solicitation. They may not participate in any role in any other proposal. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission (i.e., the first compliant proposal received will be accepted and the others will be returned without review). No exceptions will be made.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

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

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

The following instructions supplement guidance in the PAPPG:

Special instructions for submitting to this Big Idea solicitation:

Research.gov Users: The Prepare New Proposal setup will prompt you for the program solicitation number (located on the first page of this document). Compliance with this requirement is critical to determining the relevant proposal processing guidelines. As stated previously, even though proposals must be submitted to Office of Integrative Activities, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

Grants.gov Users: The program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page, however you will need to locate the Division Code, Program Code, Division Name, and Program Name for the specific solicitation you are applying to by visiting <https://www.fastlane.nsf.gov/pgmannounce.jsp>. As stated previously, even though proposals must be submitted to Office of Integrative Activities, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

Proposal Preparation Instructions

Proposal Title: The title of the proposal must begin with **GCR** followed by colon. The rest of the title of the proposal should describe the project in concise, informative language so that a technically literate reader can understand what the project is about. The title should emphasize the science and engineering work to be undertaken and be suitable for use in the public press.

Project Description: Project Descriptions are limited to 15 pages in length.

In addition to the requirements of the PAPPG, the Project Description must include the following clearly labeled sections:

- *Vision driving the proposed research:* Describe a societal and/or scientific grand challenge being addressed, including its urgency, as well as a brief description of what is already known. Discuss the potential for sustaining convergence research beyond project duration.
- *Appropriateness for this solicitation:* Provide a rationale explaining proposal suitability for this solicitation (vs. other NSF programs) and explain why the stated problem requires a convergence approach. To ensure suitability of their proposals researchers are encouraged to send a very brief (not to exceed one page) synopsis of their proposal to gcrelig@nsf.gov for feedback at least 30 days before the submission deadline.
- *Research Plan: **The research plan should be written for five years.*** Frame the problem in the context of the existing scientific body of knowledge. Detail research questions, hypotheses, and gaps in science, engineering and/or education knowledge that the proposal is addressing. Provide a project plan and discuss the proposed approaches that will be utilized. Clearly delineate the activities in the two phases (years 1-2 and years 3-5) and specify goals at the end of each phase. Emphasize potential contributions towards changing the frontiers of science. Describe needed resources to accomplish stated objectives. Resources may include among others, facilities, data, professional development/training, and partnerships.

Supplementary Documents:

The proposal should include applicable supplemental documents as instructed in the PAPPG. The following items are to be provided as additional supplemental documents.

- **List of Project Personnel:** Each proposal must include a table that lists the PI, co-PIs, and all senior personnel. This table should list the following information for each individual in separate columns: Last Name, First Name, Middle Initial, Organizational Affiliation.
- **Convergence Management Plan (two pages)** Each proposal must contain a Management Plan that describes how the project will be managed across disciplines, institutions, and stakeholder entities over time. This plan should identify specific activities and convergence mechanisms that will enable cross-discipline and cross-sector integration of teams, describe mentoring and/or professional development/training to support convergent outcomes, and provide a timeline including principal tasks and associated interactions. The plan must also address the specific roles and responsibilities of the collaborating PI, Co-PIs, other Senior Personnel, paid consultants, and stakeholder participants, and describe the timing and how tasks will be integrated over the course of the project.
- **Letters of Collaboration:** If the project involves collaborative arrangements of significance, these arrangements should be documented through letters of collaboration. Letters of collaboration should be limited to stating the intent to collaborate and describe the nature of collaboration. The letters should not contain endorsements or evaluation of the proposed project or sections of the proposal. Refer to the PAPPG for specific formatting instructions. **Please note that letters of recommendation for the PI or other letters of support for the project are not permitted.**

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Proposals should include a five-year budget. The total budget for years 1 and 2 should not exceed \$1, 200,000, and the total for the remaining three years should not exceed \$2,400,000.

Budgets for all projects must include funding for all senior personnel to attend the two-day GCR Awardee meeting at the beginning of the project and the one-day evaluation meeting near the end of year two. PIs should assume that these meetings will be held each in the Washington, DC area.

C. Due Dates

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

May 08, 2019

February 03, 2020

First Monday in February, Annually Thereafter

February 01, 2021

First Monday in February, Annually Thereafter

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

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

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *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

In addition to above criteria reviewers will be asked to address the following questions:

- Is the vision motivating this proposal sufficiently compelling and ambitious to justify investment in developing a convergent research community? Is there potential to sustain convergence research beyond this project?
- Is the proposed research appropriate for this solicitation? Do the proposed ideas differ markedly from research supported by other NSF programs, initiatives, Big Ideas or other NSF funding mechanisms?
- Are the intended approaches to address the scientific and/or technological questions innovative, promising, and appropriate for growing convergence research?
- Is the proposed management plan appropriate to foster convergent team-formation and sustainability?
- Are the goals outlined for the two research plan phases ambitious enough to move the science toward addressing the problem that engendered the proposal?
- Is the assembled team of partner organizations and personnel appropriate and essential for the planned project? Are the partner organizations and participants meaningfully integrated?

B. Review and Selection Process

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

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned

to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

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

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

Administrative and National Policy Requirements

Build America, Buy America

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

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

Special Award Conditions:

GCR awards are made in the form of Cooperative Agreements. The Cooperative Agreements will have a section of Special Conditions relating to the period of performance, statement of work, awardee responsibilities, NSF responsibilities, joint NSF-awardee responsibilities, funding and funding schedule, reporting requirements, senior personnel, and other conditions. Within the first 90 days of the Award, senior personnel will be required to participate in a two-day meeting at NSF. In addition, senior personnel will be required to attend an evaluation meeting at NSF near the end of year two. The purpose of the evaluation meeting is to assess progress the awardees have made towards building a convergent team and advancing project goals. Each awardee team will prepare briefing material (10 pages or less) describing its accomplishments and make a short presentation which will be followed by Q&A. The reviewers will evaluate the team's progress towards its stated goals, and, in particular, progress towards developing a convergence culture. Taking into account reviewers input NSF will make decision if the team will receive funding for the remaining three years. As noted in "Budget Preparation Instructions," budgets for all projects must include funding for all senior personnel to attend the first GCR annual meeting and the evaluation meeting near the end of the second year.

Grantees will be required to include appropriate acknowledgment of NSF support under the Growing Convergence Research Program in any publication (including World Wide Web pages) of any material based on or developed under the project, in the following terms:

"This material is based upon work supported by the National Science Foundation Growing Convergence Research Big Idea under Grant No. (Grantee enters

NSF grant number.)"

Grantees also will be required to orally acknowledge NSF support using the language specified above during all news media interviews, including popular media such as radio, television and news magazines.

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:

- Dragana Brzakovic, telephone: (703) 292-5033, email: dbrzakov@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) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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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