Growing Convergence Research (GCR)

PROGRAM SOLICITATION
NSF 24-527

REPLACES DOCUMENT(S):
NSF 19-551

National Science Foundation
Directorate for Mathematical and Physical Sciences
Directorate for Social, Behavioral and Economic Sciences
Directorate for Computer and Information Science and Engineering
Directorate for Geosciences
Directorate for Engineering
Directorate for Biological Sciences
Directorate for STEM Education
Office of Integrative Activities

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

April 12, 2024

February 10, 2025

Second Monday in February, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Growing Convergence Research (GCR) is an NSF-wide program. Revisions clarify restrictions on the number of proposals per PI or co-PI, provide additional guidelines for proposal preparation, and clarify solicitation specific review criteria.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) that is in effect for the relevant due date to which the proposal is being submitted. The NSF PAPPG is regularly revised and it is the responsibility of the proposer to ensure that the proposal meets the requirements specified in this solicitation and the applicable version of the PAPPG. Submitting a proposal prior to a specified deadline does not negate this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Growing Convergence Research (GCR)

Synopsis of Program:

Convergence research is a means for solving vexing research problems, in particular, complex problems focusing on societal needs or deep scientific challenges. It entails integrating knowledge, methods, and expertise from different disciplines and developing novel paradigms that 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, adopt common frameworks for addressing them, and create and implement innovative scientific approaches for their solution. This includes, when appropriate, developing new integrated theories, methods, research tools, and ways of communicating across disciplines and sectors. Research teams practicing convergence aim to develop sustainable collaborations that may not only create solutions to the specific problem studied, but also develop novel ways of investigating related research questions and open new research vistas.

This GCR solicitation targets multidisciplinary teams who are embracing convergence research as a means of developing highly innovative solutions to complex research problems. GCR proposals are expected to be bold and address scientific or technical challenges and bottlenecks which if resolved have the potential to transform scientific understanding and solve vexing problems. Successful GCR projects are anticipated to lead to paradigm shifting approaches within disciplines, establishment of new scientific communities, or development of transformative technologies that have the potential for broad scientific or societal impact.

The aim of GCR is to cultivate and grow the earliest foundations of convergent approaches for addressing a specific and compelling problem. As such, proposals submitted to this solicitation are expected to explore novel avenues not previously investigated that are at the forefront of advancing science through deep integration. Proposers must make a convincing case that the research to be conducted is within NSF's purview, integrates across NSF directorate or division boundaries, and is currently not supported by other NSF programs or solicitations.

The proposers must outline a five-year research plan delineated in two phases, Phase I: years 1-2, and Phase II: years 3-5. The total budget for Phase I may not exceed $1,200,000, and the total for Phase II may not exceed $2,400,000. Successful proposals will be funded initially for two years. Each team's progress will be evaluated at a reverse site visit near the end of year 2; this will involve preparing a progress report and making a team presentation to a panel of reviewers/site visitors. Only teams that show exceptional progress according to the merit review and solicitation specific criteria during the first two years and that articulate plans for furthering advancements at the forefront of convergence research will be eligible for additional funding for up to three years pending availability of funds.

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 --- STEM Education
- 47.083 --- Office of Integrative Activities (OIA)

Award Information

Anticipated Type of Award: Continuing Grant

Estimated Number of Awards: 6 to 10

Anticipated Funding Amount: $16,000,000

$16,000,000 pending availability of funds, to support Phase I of new awards and to support Phase II of projects started two years earlier which have shown exceptional progress.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch

Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.

- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Who May Serve as PI:

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 GCR project at a time. This includes currently funded projects and those currently under review. No PI or co-PI may participate in any role, such as researcher, consultant, co-PI or PI in any other GCR proposal currently under review. This eligibility constraint will be strictly enforced. If an individual is involved in more than one pending GCR project, the most recently submitted proposal will be returned without review. If an individual is already involved in an active GCR award, the newly submitted proposal will be returned without review. No exceptions will be made.

Past PIs and co-PIs who are no longer supported by the program may participate in this open competition only if the proposed research topics or themes are substantially different from those they pursued with prior NSF GCR support. New proposals that simply extend the methods and intent of a past GCR award to a slightly larger scope or a new geographic area will be returned without review. In determining the relationship between submitted proposals and past awards, NSF will employ text analysis software and technical expertise of program directors across the foundation.

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):

  April 12, 2024

February 10, 2025

Second 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.

TABLE OF CONTENTS

I. INTRODUCTION

Convergence research is a critical mechanism for solving many vexing research problems, in particular, those stemming from complex scientific challenges. The two primary characteristics of Convergence Research as defined by the GCR program 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, and create and implement innovative convergence approaches for their solution.

Convergence research is supported in many ways by the Programs of NSF. Cross-cutting initiatives in particular often place priority on convergence. Examples include NSF Science and Technology Centers, NSF Engineering Research Centers, Smart Health and Biomedical Research in the Era of Artificial Intelligence and Advanced Data Science, Future of Work at the Human-Technology Frontier, Strengthening American Infrastructure, and many others. These programs depend on a research community with existing capacity for engaging in a convergent approach. Yet, for many specific and compelling problems in science and engineering, the capacity for doing convergence research is still developing. The

focus of GCR is to facilitate the growth and development of the earliest foundations of new convergence research approaches to addressing specific and compelling problems. It is expected that this work will, over time beyond the duration of GCR award, feed into additional research at the forefront of science and engineering. This may occur, for example, through NSF's Convergence Accelerators, projects funded by other programs or solicitations, or establishment of centers or institutes supported by NSF or other funding agencies.

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 disciplines, but in areas for which research communities and integrated approaches have not yet developed. Consistent with the two primary characteristics of convergence research, the problem motivating the research should be rooted in a specific societal and/or scientific challenge and the research strategy should embrace deep integration across multiple disciplines. Of particular interest are those problems and research strategies that have potential to grow new scientific areas and catalyze sustained interactions across research communities beyond the period of the award.

This GCR solicitation targets integrated team research that crosses NSF Directorate or Division boundaries and disciplines and is currently not supported by other NSF programs or solicitations. Proposers must clearly identify which elements of different disciplines will be contributing to the convergence project and how the team plans to deeply integrate those elements. They must also make a convincing case that the research to be conducted cannot be supported by other NSF programs and solicitations, innovates at interdisciplinary intersections beyond existing approaches, and has potential to transform foundational scientific understanding. 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.

The proposing team should be comprised of researchers from different disciplines that do not typically work together in the proposed research areas and are crucial to catalyze the proposed scientific discovery and innovation. Involvement as leads or partners is especially encouraged from investigators and institutions that would benefit from greater participation in the national research enterprise, such as primarily undergraduate institutions (PUIs), non-R1 IHEs, two-year colleges, minority-serving institutions (MSIs), and institutions within EPSCoR jurisdictions. Engagement of other stakeholders important for addressing the problem being studied is also 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 convergent science by committing time, effort, and intellectual expertise throughout the project.

In shaping projects responsive to this call, proposers should articulate how they will intentionally bring together their research team and develop a convergent culture of discovery and communication. Proposals should specifically address the strategies that will be implemented to organize collaboration among project participants, promote team effectiveness, and advance convergent science processes and outcomes. In addition to discussing the input activities that will enable integration, proposals should also articulate the intended convergent outputs related to both intellectual merit and broader impacts.

All project participants should recognize that readiness to engage in extensive interactions and conceptual and methodological integration 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 convergent culture.

Important Program Characteristics

Project funds should be used to grow new forms of deep integration across disciplines and conduct transformative research with high-impact potential. The proposed activities should be designed to fit the five-year timeframe. The proposal should explain how the project team will advance progress in developing the fundamental scientific or engineering understanding needed to address the specific societal and/or scientific problem that inspired the proposal. It should articulate what scientific and convergent outcomes are anticipated on two- and five-year time scales. It should also explain how the project may catalyze novel interactions beyond the project duration and new forms of scientific discovery within and across disciplines.

Proposals must include the following:

- A description of a long-term scientific vision motivated by a specific societal and/or scientific problem;
- A rationale explaining proposal suitability for this solicitation and why the stated problem requires growing a new convergence research approach;
- Clear description of scientific or technical challenges and bottlenecks which if resolved have the potential to transform our foundational scientific understanding;
- A five-year research plan, divided into two phases (years 1-2 and years 3-5), that employs a novel convergence paradigm comprising deep integration across disciplines;
- A convergence management plan that outlines strategies and procedures for growing convergent science during the project and beyond and that articulates how progress will be assessed.

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

III. AWARD INFORMATION

Anticipated Funding Amount: $16,000,000 pending availability of funds, to support Phase I of new awards and to support Phase II of projects started two years earlier which have shown exceptional progress.

Successful proposals will be funded initially for Phase I. Each team's progress will be evaluated at a reverse site visit near the end of year 2 and will then be considered for Phase II funding for up to three years pending availability of funds.

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 laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Who May Serve as PI:

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 GCR project at a time. This includes currently funded projects and those currently under review. No PI or co-PI may participate in any role, such as researcher, consultant, co-PI or PI in any other GCR proposal currently under review. This eligibility constraint will be strictly enforced. If an individual is involved in more than one pending GCR project, the most recently submitted proposal will be returned without review. If an individual is already involved in an active GCR award, the newly submitted proposal will be returned without review. No exceptions will be made.

Past PIs and co-PIs who are no longer supported by the program may participate in this open competition only if the proposed research topics or themes are substantially different from those they pursued with prior NSF GCR support. New proposals that simply extend the methods and intent of a past GCR award to a slightly larger scope or a new geographic area will be returned without review. In determining the relationship between submitted proposals and past awards, NSF will employ text analysis software and technical expertise of program directors across the foundation.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via*

Grants.gov. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

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

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

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

The following instructions supplement guidance in the PAPPG:

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, including a separate section labeled "Broader Impacts", the Project Description must include the following three clearly labeled sections:

- *Long-term vision:* Describe the specific societal and/or scientific problem being addressed, including its significance and a brief description of what is already known. Discuss why a new convergent approach is needed to address the problem and the potential for the proposed work to grow convergence research that continues beyond the project duration. Specify the new knowledge and changes in research paradigms that are anticipated and types of outcomes that these will enable.
- *Appropriateness for this solicitation:* Provide a rationale explaining proposal suitability for this solicitation and articulating why the stated problem requires growing new convergence research. This includes identifying how the proposed science does not fit other available NSF funding mechanisms, which NSF areas the project integrates across, and how the proposed integration expands beyond the investigators' and relevant research communities' current work.
- *Research Plan:* The research plan must be written for a full five year scope of work. Frame the plan in the context of the existing scientific body of knowledge and approaches within and across the involved disciplines. Include the following elements:

  - Approach: Describe the research questions or hypotheses and gaps in science, engineering and/or education knowledge that the proposed research will address.
  - Challenges and bottlenecks: Describe scientific and/or technical challenges and bottlenecks that the proposed work addresses and how resolving them has potential to change the frontiers of science. Discuss the risks and rewards involved in the proposed research, including issues that may arise and approaches for addressing them.
  - Project activities: Describe the proposed activities, including how the work will integrate conceptual models, tools, methodologies, and/or infrastructures from multiple disciplines in new ways. Articulate how these activities are anticipated to transform our foundational scientific understanding and realize broader impacts.
  - Description of two phases: Delineate the activities into two phases (Phase I covering years 1-2 and Phase II covering years 3-5). Specify both convergence and research goals, in the form of identifiable milestones, at the end of each of the two phases. Support for Phase II of GCR projects is not guaranteed, and will depend on the progress assessment at the reverse site visit near the end of year 2 of the project and availability of funds.
  - Resources 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 Supplementary Documents as instructed in the PAPPG. The following items are to be provided as Other Supplementary Documents.

List of Project Personnel: Each proposal must include a table that lists the PI, co-PIs, and all senior/key 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 Convergence Management Plan that describes how the project will be managed across disciplines, organizations, and partners over time. This aspect of the proposal should articulate what convergence is planned and how it will be operationalized and assessed.

This first page of this plan should be titled "Project Management" and address the specific roles and responsibilities of all participants and organizations involved (including PIs, Co-PIs, other Senior/Key Personnel, paid consultants, stakeholder participants and their organizations). It should articulate how tasks and forms of expertise will be integrated over the course of the project. This page should also provide a project timeline during Phase I and Phase II, including anticipated activities and milestones.

The second page of this plan should be titled "Convergence Management" and describe the new forms of conceptual and/or methodological integration that the project intends to grow. It should discuss how the research plan is designed to enable that integration, and how progress in research and convergence will be assessed throughout the duration of the project.

Letters of Collaboration: If the project involves collaborative arrangements of significance, these arrangements should be described in the project description and confirmed by letters of collaboration included as supplementary documents. Such letters must adhere to the recommended format contained in the PAPPG and are limited to stating the intent to collaborate and describing the nature of collaboration. The letters may not contain endorsements or evaluation of the proposed project, ***nor recommendations of the PI(s) or other statements of support.***

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.

C. Due Dates

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

    April 12, 2024

    February 10, 2025

    Second 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 1-800-381-1532 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

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

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

The NSF Grants.gov Proposal Processing in Research.gov informational page provides submission guidance to applicants and links

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.

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

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

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

2. Merit Review Criteria

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

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.D.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.D.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and other underrepresented groups in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management 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 growing new convergence research? Is

there potential for this project to transform foundational scientific understanding and open new research vistas?

- Is the proposed research appropriate for this solicitation? Do the proposed ideas integrate deeply across disciplines and differ markedly from research supported by other NSF programs, solicitations, or funding mechanisms?
- Are the goals outlined for the two phases of the research plan sufficiently novel to develop new paradigms and approaches and move the science toward addressing the problem that engendered the proposal?
- Are the proposed research activities innovative, promising, and appropriate for growing convergence research? Are these activities well-suited to building convergence and addressing scientific and/or technical challenges that are currently limiting progress?
- Is the proposed management plan appropriate to foster an effective convergent team and advance the intended convergence and research outcomes?
- Is the assembled team of project participants and partners 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 proposers whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new recipients 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:

Within the first 90 days of the award, senior/key personnel from each funded project will be required to participate in a virtual workshop focusing on building convergence across disciplines. In addition, senior/key personnel will be required to attend a virtual reverse site visit near the end of year two. The purpose of this reverse site visit is to assess progress the recipients have made towards building a convergent team, advancing the forefront of science, and making progress towards the project's goals. Each recipient 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/site visitors will evaluate the team's progress towards its stated convergence and research goals and its plans for further advancements. Taking into account reviewers' input and based on available funding, NSF will decide if the team will receive funding for the remaining three years.

Recipients 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 program under Grant No. (Recipient enters NSF grant number.)"

Recipients 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 NSF systems contact:

- NSF Help Desk: 1-800-381-1532
- Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail:support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at https://www.grants.gov.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at https://www.nsf.gov

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314

- **For General Information** (703) 292-5111
  (NSF Information Center)**:**

- **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 proposers 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 proposers 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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National Science Foundation, 2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (703) 292-5090 or (800) 281-8749

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