

Pathways to Enable Open-Source Ecosystems (POSE)

PROGRAM SOLICITATION

NSF 22-572



National Science Foundation

- Directorate for Biological Sciences
- Directorate for Computer and Information Science and Engineering
- Directorate for Education and Human Resources
- Directorate for Engineering
- Directorate for Geosciences
- Directorate for Mathematical and Physical Sciences
- Directorate for Social, Behavioral and Economic Sciences
- Directorate for Technology, Innovation and Partnerships

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

May 12, 2022

Phase I

October 21, 2022

Phase II

IMPORTANT INFORMATION AND REVISION NOTES

The Pathways to Enable Open-Source Ecosystems (POSE) program is an NSF-wide endeavor supported by all [directorates](#) within the Foundation. As such, POSE welcomes and encourages proposals from all scientific, technical, and engineering fields.

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in [Important Notice No. 147](#). In support of these efforts, research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov, and may not be prepared or submitted via FastLane.

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Pathways to Enable Open-Source Ecosystems (POSE)

Synopsis of Program:

NSF is introducing a new program called "Pathways to Enable Open-Source Ecosystems" (POSE). The purpose of the program is to harness the power of open-source development for the creation of new technology solutions to problems of national and societal importance. Many NSF-funded research projects result in publicly accessible, modifiable, and distributable open-sourced software, hardware or data platforms that catalyze further innovation. In some cases, an open-source product is widely adopted and forms the basis for a self-sustaining open-source ecosystem (OSE) comprises a distributed community of developers and a broad base of users across academia, industry and government. The goal of the POSE program is to fund new OSE managing organizations, each responsible for the creation and maintenance of infrastructure needed for efficient and secure operation of an OSE based around a specific open-source product or class of products. The early and intentional formation of such managing organizations is expected to ensure more secure open-source products, increased coordination of developer contributions, and a more focused route to impactful technologies.

The POSE program aims to support managing organizations that will facilitate the creation and growth of sustainable high-impact OSEs

around already-developed open-source research products. In particular, POSE constitutes a new pathway to translate research results, akin to the Lab-to-Market Platform that NSF has pioneered over many decades. Whereas programs like the [NSF Innovation Corps \(I-Corps™\)](#), [Partnerships for Innovation](#), and [Small Business Innovation Research and Small Business Technology Transfer \(SBIR and STTR\)](#) represent an integrated set of programs to provide researchers with the capacity to transform their fundamental research into deep technology ventures, POSE is specifically focused on another translational lineage – supporting translation from research results to OSEs.

Importantly, the POSE program is **not** intended to fund the development of open-source research products, including tools and artifacts. The POSE program is also **not** intended to fund existing well-resourced open-source communities and ecosystems. Instead, the program aims to fund new managing organizations that catalyze community-driven development and growth of the subject OSEs. The expected outcomes of the POSE program are (1) to grow the community of researchers who develop and contribute to OSE efforts, and (2) to enable pathways for the development of collaborative OSEs that could lead to new technology products or services that have broad societal impacts. OSEs can stem from any areas of research supported by NSF.

This solicitation seeks two types of proposals, allowing teams to (1) propose specific activities to scope the development of an OSE (Phase I), and (2) develop a sustainable OSE based on a mature open-source product that shows promise both in the ability to meet an emergent societal or national need and to build a community to help develop it (Phase II).

Phase I: OSE Scoping Proposals

The objectives of Phase I projects are (1) to enable scoping activities that could result in the preparation of Phase II proposals to grow promising research products that are already available in an open-sourced format into a sustainable and robust OSE that will have broad societal impacts, and (2) to provide training to teams interested in building such an OSE.

Each Phase I proposal should describe the current context and, to the extent known at the time of the Phase I proposal, the long-term vision and impact of the proposed OSE. The proposals should also include specific scoping activities that will lead to a well-developed and sustainable plan for ecosystem discovery, organizational and governance structure, and community building.

Phase I proposals are limited to a total budget of \$300,000 with durations of up to one year. The Project Description can be up to 7 pages for Phase I proposals.

Phase II: OSE Development Proposals

The objective of Phase II projects is to support the transition of a promising open-source research product into a sustainable and robust OSE. Each Phase II proposal is expected to include a detailed project plan to support the community-driven and collaborative development and deployment of later-stage successful research tools into operational environments. The proposals must include a community outreach plan that (a) outlines activities to engage the intended contributor community that will help to further develop and maintain the technology, and (b) identifies an intended user community or organizations that will serve as early adopters of the technology.

Each Phase II proposal should describe the current context and the long-term vision and impact of the proposed OSE. The proposal should also include a well-developed plan for building an OSE including ecosystem establishment/growth, organizational and governance structure, community building, and sustainability and evaluation plans.

Phase II proposals are limited to a total budget of \$1,500,000 with durations of up to two years. The Project Description can be up to 15 pages for Phase II proposals.

Phase I awardees are not obligated to submit Phase II proposals in the future. An NSF POSE Phase I award is not required for the submission of a Phase II proposal.

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.

- Nina Amla, Program Director, CISE/CCF, telephone: (703) 292-7991, email: pose@nsf.gov
- Peter S. Atherton, Program Director, TIP/TI, telephone: (703) 292-8772, email: pose@nsf.gov
- Christopher Balakrishnan, Program Director, BIO/DEB, telephone: (703) 292-2331, email: pose@nsf.gov
- Robert Beverly, Program Director, CISE/OAC, telephone: (703) 292-7068, email: pose@nsf.gov
- Sarit B. Bhaduri, Program Director, ENG/EEC, telephone: (703) 292-2975, email: pose@nsf.gov
- Richard Dawes, Program Director, MPS/CHE, telephone: (703) 292-7486, email: pose@nsf.gov
- Jean X. Gao, Program Director, BIO/DBI, telephone: (703) 292-7253, email: pose@nsf.gov
- Michael E. Jackson, Program Director, GEO/OPP, telephone: (703) 292-8033, email: pose@nsf.gov
- Deepankar Medhi, Program Director, CISE/CNS, telephone: (703) 292-2935, email: pose@nsf.gov
- Rebecca Shearman, Program Director, CISE/CNS, telephone: (703) 292-7403, email: pose@nsf.gov
- Chia Shen, Program Director, EHR/DRL, telephone: (703) 292-8447, email: pose@nsf.gov
- Sylvia J. Spengler, Program Director, CISE/IIS, telephone: (703) 292-7347, email: pose@nsf.gov
- Patricia Van Zandt, Program Director, SBE/BCS, telephone: (703) 292-7437, email: pose@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: Standard Grant or Continuing Grant

Estimated Number of Awards: 30

Approximately 20 Phase I awards of up to \$300,000 per award with durations up to 1 year and 10 Phase II awards of up to \$1,500,000 per award with durations up to 2 years are anticipated, subject to the availability of funds and quality of proposals received.

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

Anticipated Funding Amount: \$21,000,000

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.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- State and Local Governments: State educational offices or organizations and local school districts.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** 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 12, 2022

Phase I

October 21, 2022

Phase II

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

The term “*open source*” has often referred to software systems for which the original source code is widely distributed to anyone and for any purpose, including for further development and refinement in a collaborative public manner. However, increasingly, “open source” refers to a much broader range of products including data, models, and design files as well as processes such as innovative biotechnologies that benefit from open collaboration and innovation.

Academic and industry researchers worldwide are extensively using the open-source model to make research artifacts such as software, tools, and prototypes freely available with the goal of enabling collaboration and catalyzing further innovation. An open-source product can simply be shared via a webpage on the Internet, but a more common approach uses a version control system. Multiple NSF research-infrastructure programs support further development of open-

source projects with the goal of serving the research community and enabling advances in science and engineering research and education, including the [Computer and Information Science and Engineering Community Research Infrastructure \(CCRI\)](#), [Cyberinfrastructure for Sustained Scientific Innovation \(CSSI\)](#), and [Infrastructure Capacity for Biological Research \(Capacity\)](#).

Some open-source projects go well beyond their original research teams, catalyzing broad adoption across academia, industry, government, and other sectors, and resulting in civic-minded communities of users and developers who coalesce around them into “ecosystems”. Examples of NSF-funded open-source research projects and products that have transitioned into OSEs with broad measurable impact include: [Apache Spark](#), a unified analytics engine for large-scale data processing that has transformed big-data analytics and is in use in many industrial cloud facilities; [Galaxy](#), a scientific workflow, data integration and analysis, and publishing platform that makes computational biology accessible to researchers who do not have computer programming or systems administration experience; and [RISC-V](#), an open standard instruction set architecture (ISA) that enables researchers, developers and manufacturers to design and experiment building hardware with a proven and freely available ISA. A wide range of research products, including but not limited to those related to image data processing, climate modeling, educational data mining or learning analytics, and genome and microbiome data analyses may be ripe for this transition from an open-source product to an open-source ecosystem.

An Open-Source Ecosystem (OSE) is a self-sustaining organization that enables the ongoing collaborative asynchronous development of an open-source product that is designed to be publicly accessible, modifiable, and distributable by anyone under an open-source licensing model. This model is governed by socio-technical processes and sustained by a decentralized and open network of civic-minded contributors who believe in the OSE and lend their time and expertise to develop and maintain it. A recent [Association for Computing Machinery \(ACM\) case study](#) notes that building a successful open-source community depends on many different elements including skills to recruit, to inspire, to mentor, to manage, and to mediate disputes, and all without the use of various forms of compensation to reward and provide incentives to contributors. There are many existing models of OSEs, ranging from non-profit institutions based on academic research projects that have grown into well-coordinated community efforts (e.g., the [Linux Foundation](#) and [Mozilla Foundation](#)), to for-profit companies that open-source products and then coordinate an open-source community around them (e.g., [IBM's Qiskit](#) for quantum computing and [Google's TensorFlow](#)).

OSEs are an important counterpoint to (but not a replacement of) more common for-profit companies and offer several key strengths: they are well suited to large, multidisciplinary efforts aimed at solving large-scale problems; they engender a sense of ownership among all participants and encourage contributions from new technical disciplines as the OSE evolves; and they avoid costs, delays, and disputes that frequently arise in circumstances where proprietary solutions are developed. OSEs encourage rapid prototyping in moving value from the conception to execution phases, serving as important catalysts for innovation.

A key aspect of successful OSEs is their value in demonstrating the potential of a technology at scale in diverse application scenarios. While not always easy to quantify, the significant technological, societal, and economic impacts of OSEs over the past decades are undeniable. For example, a recent [European Commission study](#) estimated that companies located in the European Union invested around 1 billion Euros in open-source software alone in 2018, which brought about a positive impact on the European economy of between 65 and 95 billion Euros.

II. PROGRAM DESCRIPTION

The purpose of the POSE program is to support a new pathway for translating research results – specifically by supporting managing organizations that facilitate the creation and growth of sustainable, high-impact OSEs around already-developed open-source products, including tools and artifacts. The POSE program aims to (1) grow the community of researchers who develop and contribute to OSE efforts, and (2) enable pathways to intentionally transition promising mature open-source research projects into self-sustaining OSEs that could lead to new technology products or services with broad societal impacts.

Importantly, the POSE program, unlike other NSF programs like CCRI, CSSI, and Capacity, does not itself support further development of open-source research products or infrastructure. Instead, the POSE program provides support for later-stage activities where developing large OSEs would expand the community of users and developers and engender long-term project sustainability. Likewise, the POSE program is not intended for open-source development, robustness efforts, or focused communities with limited impact. Instead, POSE proposals are expected to have an existing mature and robust open-source product with some active users outside of the participating institutions. For example, open-source software specific to the advanced cyberinfrastructure or a particular scientific community may be better served as submissions to the “Transition to Sustainability” track in CSSI. Finally, POSE is also not intended to support the development of products that are intended for profit; such efforts may be better suited for NSF’s SBIR or STTR programs.

The transition from an open-source research project to an OSE requires an organized and intentional approach that depends on many factors. These include (1) the guiding principles and vision of the team founding the organization, (2) the specific open-source product being developed, (3) the market demand for this product within the current technological landscape, (4) the need for adaptability and flexibility in deployment scenarios, (5) a distributed community of contributors who will drive the collaborative development of the technology, and (6) a community of users who will serve as early adopters of the technology. OSEs are generally supported by an international community of users and developers from different entities including academia, non-profit, and industry. POSE strongly encourages proposers to consider mechanisms to intentionally involve all these groups, including international collaborators.

This solicitation seeks two types of proposals: first to scope (Phase I), and second to develop (Phase II) a sustainable OSE based on a mature open-source product that shows promise both in the ability to meet an emergent societal or national need and to build a community to help develop it. Importantly, the open-source product should already (i) be publicly accessible preferably via an open-source license (proposers are encouraged to consider [licenses](#) approved by the Open Source Initiative) and (ii) have some external third party users and/or content contributors. In this way, the open-source product has already achieved an initial state of “maturity”. Further, in Phase II proposals, the existing open-source products should have basic mechanisms already in place to enable continuous development, integration, and deployment processes towards updating the product to evolve with state-of-the-art.

A maximum of three members of each awarded team are expected to attend mandatory OSE training to be held virtually in 2022 and 2023. Training will enable each awarded team to determine whether there is the potential for a relevant and sustainable OSE for their open-source product, learn best-practices for building a secure, private, and sustainable OSE, and identify broad societal impacts for their OSE. The program will include experiential learning activities in ecosystem discovery and workshop sessions focused on community building, governance, and sustainability of OSEs. For planning purposes, NSF anticipates this training will require a time commitment on the order of 8 hours a week for four weeks. NSF will provide further details (e.g., logistics) about this training to all awardees.

All Phase I and Phase II proposals are **required** to have the following components:

- The last line of the Project Summary section **must** consist of a prioritized list of 1-5 keywords that best characterize the broad technical area and applications that the OSE will target. The first keyword must denote the directorate [Biological Sciences (specified as “BIO”), Computer and Information Science and Engineering (CISE), Education and Human Resources (EHR), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), or Social, Behavioral and Economic Sciences (SBE)] that most closely matches the technical topic advanced in the OSE.

- The Project Description section **must** have a separate section titled "Context of OSE" describing the context and vision of the proposed OSE. This required section **must** include a description of the guiding principles and long-term vision for the proposed OSE, the specific societal or national need(s) that the OSE will address, and the anticipated broader impacts of the OSE (note that, per the PAPPG, the Project Description must also have a separately-titled section on "Broader Impacts"). In addition, the section **must** have (1) a pointer to the existing publicly-available open-source product that is being transitioned; (2) details on the current status of the research product, development model, methods of dissemination, and user base; and (3) a description of the problem being addressed, and the novelty of the intended product being transitioned, including substantiating evidence of the technology's potential to significantly impact/address the problem.
- A minimum of three and up to five letters of collaboration from third-party users or contributors of the open-source product **must** be uploaded as Supplementary Documents. These letters of collaboration must be from current users or contributors (who are not directly related to the proposing team) of the open-source product that is the subject of the proposed OSE. Each letter writer should clearly describe how they have contributed and will continue to contribute to the development of an OSE including the technical advancements enabled by these contributions and the value proposition associated with the product.
- All proposals **must** include a security plan that addresses all project-relevant security aspects, particularly those related to the open-source products, such as data and source code including data privacy and code quality. Proposers are encouraged to consider the Open Source Security Foundation's [best practices](#). This security plan should be part of the "Data Management Plan" (see Proposal Preparation Instructions for additional details).

See Section V. for further details and other additional requirements. Proposals that do not meet these requirements will be returned without review.

Phase I: OSE Scoping Awards

Phase I awards are not intended to support further development efforts since the research products are expected to be mature and robust tools with active user bases. Rather, Phase I awards will support scoping and planning activities for an eventual OSE that will inform the development of full proposals in Phase II. Phase I proposals are limited to \$300,000 in total budget, with durations of up to one year. The Project Description can be up to 7 pages.

Phase I proposals should address the following:

- Ecosystem Discovery: Include a plan for developing a strategy that (1) describes methods to evaluate and justify the need for the innovation within the current technological landscape; (2) explains why an OSE is the right approach to further develop the technology; and (3) outlines methods to identify potential users who will utilize this technology;
- Organization and Governance: Describe a plan for establishing a sustainable organizational structure that includes (1) specific activities and rationale to discover the appropriate organizational, coordination, and governance models including the licensing approach to be employed; (2) continuous development, integration and deployment processes and infrastructure that will enable further open, asynchronous, and distributed development of the open-source product and support sustainability goals for the OSE; (3) methods to sustain the organizational structure at an appropriate level, along with metrics to assess and evaluate success, in the longer term, of the development methodology, processes for ensuring quality control, security and privacy of new content, support for users, and onboarding mechanisms for new contributors; and (4) qualifications of the team to conduct this work; and
- Community Building: Describe the specific activities that will aid in developing a strategy to engage potential content contributors who will help develop and maintain the open-source product, including (1) identification of the specific research and development capabilities required of the potential contributor communities; (2) mechanisms to engage these communities (e.g., workshops, hackathons, competitions, research coordination networks, Ideas Labs); and (3) specific plans for supporting for users and onboarding mechanisms for new contributors.

Phase II: OSE Development Awards

The objective of Phase II awards is to support the development of a sustainable and robust OSE. Phase II proposals are limited to \$1,500,000 in total budget, with durations of up to two years. The Project Description can be up to 15 pages.

Phase II proposals should have the following components:

- Ecosystem Establishment/Growth: Include a well-developed ecosystem establishment/growth and ongoing discovery strategy that ensures that the proposed OSE will further develop the open-source product within the current technological landscape, along with specific plans to identify, engage and support potential users and partners who will serve as early adopters for the product; specific plans to engage industrial and international collaborators are encouraged;
- Organization and Governance: Describe a well-developed and sustainable organizational, coordination, and governance model including the licensing approach to be employed, the specific continuous development, integration and deployment processes and infrastructure that will enable the open, asynchronous, and distributed development of the open-source product and support sustainability goals for the OSE, along with metrics to assess and evaluate success, in the longer term, of the development methodology and processes for ensuring quality control, security and privacy of new content;
- Community Building: Describe a long-term strategy for community building to engage, incentivize, and onboard potential content contributors who will help in further developing and maintaining the open-source product; and
- Sustainability: Articulate clear sustainability goals of the OSE, and an actionable evaluation plan, along with metrics to assess and evaluate success, in the longer term, of the development methodology, processes for ensuring quality control, security and privacy of new content, support for users, and onboarding mechanisms for new contributors.

Budget

The budget for either Phase I or Phase II proposals can include support for:

- Salary: Any staff who will assist in the scoping and/or development or governance of the OSE, including the principal investigator (PI) and co-PIs, students, developers, and marketing, administrative, and/or legal professionals;
- Setup costs: Costs incurred for the organizational, coordination, and governance approach, any necessary infrastructure, market analysis, and customer-discovery activities; and
- Mandatory training: The budget may include funds (up to \$10,000 per team) to cover the costs of attending the mandatory NSF-provided training to be held virtually in 2022 and 2023.

General Considerations

The POSE program seeks broad and diverse representation of PIs and organizations in its award portfolio, reflective of the Nation's demography and geography. For example, POSE seeks to support individuals who are from underrepresented or underserved groups in Science, Technology, Engineering and Mathematics (STEM) including women or persons with disabilities.

Ethical use of data, including the privacy and protection of human subjects, is of paramount importance. If the proposed project will involve the use of human

This document has been archived and replaced by NSF 23-556.

data or data related to human activities, PIs should consult with their local Institutional Review Board (IRB) to obtain either IRB approval or official letters of exemption. Proposals will not be recommended for award until and unless appropriate IRB approval or exemption documents have been submitted to NSF. See PAPPG Chapter II.D.5 for NSF policies on proposals involving human subjects.

For proposals involving the use of vertebrate animals, sufficient information must be provided in the project description to enable reviewers to evaluate the choice of species, number of animals to be used, and any necessary exposure of animals to discomfort, pain, or injury. NSF requires that proposed projects involving use of any vertebrate animal for research or education be approved by the submitting organization's Institutional Animal Care and Use Committee (IACUC) before an award can be made. See PAPPG Chapter II.D.4 for NSF policies on proposals involving vertebrate animals.

III. AWARD INFORMATION

Anticipated Type of Award: Continuing Grant or Standard Grant

Estimated Number of Awards: 30

Approximately 20 Phase I awards of up to \$300,000 per award with durations up to 1 year and 10 Phase II awards of up to \$1,500,000 per award with durations up to 2 years are anticipated, subject to the availability of funds and quality of proposals received.

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

Anticipated Funding Amount: \$21,000,000

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.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.
- State and Local Governments: State educational offices or organizations and local school districts.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Additional Eligibility Info:

Organization Limit: Although POSE proposals are expected to be multi-organizational, a single organization must serve as the lead and all other organizations as subawardees. Collaborative proposals arranged as separate submissions from multiple organizations will not be accepted in response to this solicitation. Organizations ineligible to submit to this program solicitation may not receive subawards; if they are part of the team, their participation is expected to be supported by non-NSF sources.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

Collaborative Proposals: If multiple organizations are involved in a proposal, the submission must take the form of a single proposal with subawards. Collaborative proposals arranged as separate submissions from multiple organizations will **not** be accepted in response to this solicitation. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

Titles:

Proposal titles **must** begin with "POSE:" and the Phase followed by a colon (":"), and then the title of the project. For example, a proposal to Phase I would have a title of the form **POSE: Phase I: Title**.

Project Summary:

The last line of the Project Summary **must** have a prioritized list of 1-5 keywords that best characterizes the technical area and applications that the OSE is intended to pursue. The first keyword **must** denote the directorate [Biological Sciences (specified as "BIO"), Computer and Information Science and Engineering (CISE), Education and Human Resources (EHR), Engineering (ENG), Geosciences (GEO), Mathematical and Physical Sciences (MPS), or Social, Behavioral and Economic Sciences (SBE)] that most closely matches the technical topic advanced in the OSE. The list should start with "Keywords:" followed by a list of keywords separated by semi-colons (";").

Project Description:

Describe the activities to be undertaken in up to 7 pages for Phase I proposals and up to 15 pages for Phase II proposals. See Section II. Program Description, in this solicitation for guidance.

Supplementary Documents:

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

1. Letters of Collaboration (required)

A minimum of three and up to five letters of collaboration from third-party users or contributors of the open-source product are required. The letters of collaboration must be from current users or contributors (who are not directly related to the proposing team) of the open-source product that is the subject of the proposed OSE. Each letter writer should clearly describe how they have contributed and will continue to contribute to the development of OSE including the technical advancements enabled by these contributions and the value proposition associated with the product.

In addition to the above information, each letter of collaboration (not to exceed two pages) must contain the name of the letter writer, current affiliations, and relationship to the members of the proposing team.

2. A list of Project Personnel, Collaborators, and Partner Institutions (required)

Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list must include all PIs, co-PIs, Senior Personnel, paid/unpaid consultants or collaborators (including everyone who has provided a letter of collaboration), subawardees, postdocs, and project-level advisory committee members. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. John Jones; University of PQR Non-Profit; Senior Personnel
3. Jane Brown; XYZ University; Letter of Collaboration
4. Bob Adams; ABC Community College; Paid Consultant
5. Susan White; DEF Corporation; Unpaid Collaborator
6. Tim Green; ZZZ University; Subawardee

3. Data Management Plan (required):

In accordance with the guidance in the PAPPG, proposals must include a Data Management Plan of no more than two pages (in the Data Management Plan section in Research.gov or as a Supplementary Document in Grants.gov). The Data Management Plan must be substantive and specific to the project and should address all project-relevant aspects of security and data privacy. In addition to addressing how the project will conform to NSF's policy on the dissemination and sharing of research results, the Data Management Plan should address the following topics if they are relevant to the project:

- Security: The project must describe a security plan if the OSE will collaboratively develop and/or release any artifacts, including (without limitation) (a) source code in any form; (b) languages or formats; (c) hardware instruction sets; (d) hardware designs or specifications; (e) scientific methodologies, models, or processes; (f) manufacturing processes or process specifications; (g) material formulations; and/or (h) data. The plan should discuss the

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access control mechanisms that are planned for both users and content contributors, and the specific mechanisms that will be in place to ensure (i) quality; (ii) secure modification, integration, and release of content (e.g., secure software development methodologies, policies for patching known security vulnerabilities); and (iii) chain of custody.

- Handling of sensitive data: If the project involves sensitive data, the plan must discuss the method of data collection and identification of harms that could arise from its collection or inadvertent dissemination, techniques that will be used to protect the privacy of individuals and organizations associated with the data, and plans to request IRB and/or IACUC approval for data collection, aggregation, and analysis if applicable. Methods for providing other users with controlled access to datasets and the time period during which data will be available, and policies for authorizing access to the data and techniques (including security protections) that will be used to prevent the unauthorized dissemination of the data should also be discussed.

For additional information on the Dissemination and Sharing of Research Results, see: <https://www.nsf.gov/bfa/dias/policy/dmp.jsp>.

Submission Checklist:

To assist proposal preparation, the following checklist is provided as a reminder of some important items that should be checked before submitting a proposal to this solicitation. For the items marked with "(RWR)," the proposal will be returned without review if the required item is non-compliant at the submission deadline. Note that these are requirements unique to this solicitation; for other return-without-review requirements, see the PAPPG.

- (RWR) The last line of the Project Summary **must** consist of the word "Keywords" followed by a colon and between 1-5 keywords separated by semi-colons. The first keyword must denote the acronym of the directorate that most closely matches the technical topic advanced in the OSE.
- (RWR) The Project Description **must** have a section labeled "Context of the Open-Source Ecosystem" (or "Context of OSE") that discusses the context and vision of the proposed OSE.
- (RWR) The maximum budget shown on the Cover Sheet and on the budget sheets **must** not exceed \$300,000 for Phase I proposals and \$1,500,000 for Phase II proposals.
- (RWR) A minimum of three and up to five letters of collaboration from third-party contributors or users of the open-source product **must** be included as Supplementary Documents.
- (RWR) A Project Personnel and Partner Institutions list as a Supplementary Document **must** be included.

Proposals that do not comply with the requirements marked as RWR will be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

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

May 12, 2022

Phase I

October 21, 2022

Phase II

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

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

For Proposals Submitted Via Grants.gov:

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

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

Proposers that submitted via Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on

Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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- **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

Phase I proposals will be evaluated on the basis of the following solicitation-specific review criteria:

1. Does the proposal present a convincing case that the OSE will address an issue of significant societal or national importance that is not currently being adequately addressed?
2. Does the proposal clearly describe the long-term vision for the OSE, including potential partnerships and sustainability?
3. Does the proposal provide convincing evidence that a substantial user base exists, or could be built, for the open-source product that will be the subject of the OSE?
4. Does the proposal justify the OSE within the current technological landscape and present a strong case that an OSE is the best approach for generating impact?
5. Does the proposal present clear plans for discovering the ecosystem within which the OSE will be operating?
6. Does the proposal present a credible plan for exploring the establishment of a sustainable organizational structure?
7. Does the proposal present a credible plan to develop a strategy for building a community of contributors?
8. Does the proposing team have the required expertise and experience to undertake the Phase I activities described in the solicitation?
9. Will NSF support serve as a critical catalyst for the establishment of the OSE?
10. Does the proposal include third-party letters of collaboration from current users of the open-source product that is the subject of the OSE?

Phase II proposals will be evaluated on the basis of the following solicitation-specific review criteria:

1. Does the proposal present a convincing case that the OSE will address an issue of significant societal or national importance that is not currently being adequately addressed?
2. Does the proposal clearly describe the long-term vision for the OSE, including potential partnerships and sustainability?
3. Does the proposal provide convincing evidence that a substantial user base exists for the open-source product that will be the subject of the OSE?
4. Does the proposal justify the OSE within the current technological landscape and present a strong case that an OSE is the best approach for generating impact?
5. Does the proposal present a clear and comprehensive description of the ecosystem within which the OSE will be operating along with plans for ongoing ecosystem establishment/growth and discovery?
6. Does the proposal present a specific, actionable plan for establishing a sustainable organizational structure?
7. Does the proposal present a credible strategy and actionable plan for building a community of contributors and retaining contributors?
8. Does the proposal include a clear, detailed licensing approach for the open-source product that is the subject of the OSE?
9. Does the proposal clearly describe a build and test infrastructure, and procedures to address quality control and security of new content?
10. Does the proposal present a clear, actionable evaluation plan to measure the success of the OSE with respect to its sustainability goals?
11. Does the proposing team have the required expertise and experience to undertake the Phase II activities described in the solicitation?
12. Will NSF support serve as a critical catalyst for the establishment and growth of the OSE towards achieving sustainability?
13. Does the proposal include third-party letters of collaboration from current users of the open-source technology that is the subject of the OSE?

B. Review and Selection Process

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

The review process will include ad-hocs, panels and/or reverse site visits, and will be based on the merit review criteria with special consideration to the additional solicitation specific review criteria.

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

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review

and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

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

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.

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:

- Nina Amla, Program Director, CISE/CCF, telephone: (703) 292-7991, email: pose@nsf.gov
- Peter S. Atherton, Program Director, TIP/TI, telephone: (703) 292-8772, email: pose@nsf.gov
- Christopher Balakrishnan, Program Director, BIO/DEB, telephone: (703) 292-2331, email: pose@nsf.gov
- Robert Beverly, Program Director, CISE/OAC, telephone: (703) 292-7068, email: pose@nsf.gov
- Sarit B. Bhaduri, Program Director, ENG/EEC, telephone: (703) 292-2975, email: pose@nsf.gov
- Richard Dawes, Program Director, MPS/CHE, telephone: (703) 292-7486, email: pose@nsf.gov
- Jean X. Gao, Program Director, BIO/DBI, telephone: (703) 292-7253, email: pose@nsf.gov
- Michael E. Jackson, Program Director, GEO/OPP, telephone: (703) 292-8033, email: pose@nsf.gov
- Deepankar Medhi, Program Director, CISE/CNS, telephone: (703) 292-2935, email: pose@nsf.gov
- Rebecca Shearman, Program Director, CISE/CNS, telephone: (703) 292-7403, email: pose@nsf.gov
- Chia Shen, Program Director, EHR/DRL, telephone: (703) 292-8447, email: pose@nsf.gov
- Sylvia J. Spengler, Program Director, CISE/IIS, telephone: (703) 292-7347, email: pose@nsf.gov
- Patricia Van Zandt, Program Director, SBE/BCS, telephone: (703) 292-7437, email: pose@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

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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: nspfubs@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.

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