Community Facility Support: Synchrotron-based analytical capabilities advancing Earth and Environmental Sciences research and training

PROGRAM SOLICITATION
NSF 21-592

National Science Foundation

Directorate for Geosciences
Division of Earth Sciences

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

March 04, 2022

IMPORTANT INFORMATION AND REVISION NOTES

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Community Facility Support: Synchrotron-based analytical capabilities advancing Earth and Environmental Sciences research and training

Synopsis of Program:

The NSF Division of Earth Sciences (EAR) hereby solicits proposals to develop, manage, operate, and support user access to U.S. synchrotron-based analytical capabilities necessary to advance Earth and environmental sciences research and training. EAR seeks proposals that prioritize support for the U.S. Earth and environmental science community supported by EAR core or special programs (see https://www.nsf.gov/funding/programs.jsp?org=EAR for a current list of funding programs in EAR).

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.

- Russell C. Kelz, telephone: (703) 292-4747, email: rkelz@nsf.gov
- David D. Lambert, telephone: (703) 292-8558, email: dlambert@nsf.gov

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

- 47.050 --- Geosciences

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

NSF anticipates that a successful proposal for facility management and operations would be awarded as a Cooperative Agreement commencing on or about 1 December 2022 with a duration of five (5) years contingent on the availability of funds.

First year funding will be determined based on merit review of the proposal, NSF evaluation and approval. Subsequent annual funding increments will be determined based on NSF review and approval of:

- An Annual Program Plan and Budget submitted by the Awardee to NSF

- Annually reported Project Metrics
- Findings of a comprehensive external review of Awardee performance and facility success in the third year of award

Please see Section VII.B, "Special Award Conditions".

Annual and cumulative funding is subject to the availability of funds.

Anticipated Funding Amount: $35,000,000

This is the total amount of anticipated NSF funding for a 5-year award, starting on or about 15 December 2022. Funding is contingent on the availability of funds and successful performance as periodically evaluated by NSF, including a comprehensive external management review in the 3rd year of the award.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

1. Institutions of higher education (Ph.D.-granting and non-Ph.D.-granting), acting on behalf of their faculty members, that are accredited in and have their main campus in the United States, its territories, or possessions. Distinct academic campuses (e.g., that award their own degrees, have independent administrative structures, admissions policies, alumni associations, etc.) within multi-campus systems qualify as separate submission-eligible institutions.
2. Not-for-profit, non-degree-granting domestic U.S. organizations, acting on behalf of their employees, for example (but not limited to) independent museums and science centers, observatories, research laboratories and similar organizations that are directly associated with the Nation's research activities. These organizations must have an independent, permanent administrative organization (e.g., a sponsored projects office) located in the United States, its territories, or possessions, and have 501(c)(3) tax status.
3. Consortia as follows:
    a. A legally incorporated, not-for-profit consortium that includes two or more submission-eligible organizations as described in items (1) and (2) above. Such a consortium is one with an independent administrative structure (e.g., a sponsored projects office) located in the United States, its territories, or possessions and has 501(c)(3) status.
    b. Submission-eligible organizations as described in items (1) and (2) above, on behalf of an informal consortium. These consortium proposals may also include as partners, via subawards, other U.S. and non-U.S. organizations that are not otherwise eligible to submit directly to this solicitation.

In either case, the proposal title should indicate that a consortium is proposing.

For-profit commercial organizations, especially U.S. small businesses with strong capabilities in scientific or engineering research or education, are eligible for participatory support through subawards/subcontracts as private sector partners with submitting organizations; they may not submit proposals. Such partnerships must be substantive and meaningful. In addition, the value added by the for-profit commercial organization should be justified as a unique contribution that is otherwise unavailable within organizations described in (1) and (2).

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 1

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 FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
    - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

Not Applicable

- **Other Budgetary Limitations:**

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

C. Due Dates

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

  March 04, 2022

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:

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

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I. INTRODUCTION

The National Science Foundation (NSF) is authorized and directed to initiate and support basic and applied scientific research and to initiate and support programs to strengthen scientific research potential. To achieve these goals, NSF supports facilities that provide research capabilities in various scientific disciplines.

The Division of Earth Sciences (EAR) supports NSF's mission and strategic goals and objectives articulated in 'Building the Future: Investing in Discovery and Innovation' (NSF Strategic Plan for Fiscal Years (FY) 2018-2022). EAR supports community accessible research infrastructure that Earth scientists require to expand knowledge of the composition, evolution and dynamics of the solid Earth and its surface environment, freshwater resources and biologic history. Support for state-of-the-art, instrument-based and associated human research infrastructure is a strategic investment for the Nation with multiple goals including promoting and maintaining U.S. global leadership in science and technology, advancing our capability to meet current and future societal challenges, and fostering the growth of a more capable, diverse, and inclusive scientific workforce. EAR supported research infrastructure capitalizes on partnerships with other government agencies, academia, private and international entities.

EAR supports a broad spectrum of research and research infrastructure. A recent National Academies committee report, hereafter the "Earth in Time" Report, documents priority science questions to guide EAR research over the coming decade (National Academies of Sciences, Engineering, and Medicine 2020. A Vision for NSF Earth Sciences 2020-2030: Earth in Time. Washington, DC: The National Academies Press. https://doi.org/10.17226/25761). The report

discusses the infrastructure and facilities necessary to advance identified science priority questions and reviews existing infrastructure and facilities available to the EAR research community.

The Earth in Time report notes that Department of Energy (DOE) synchrotron facilities are needed for the chemical, physical, and mechanical characterization of Earth materials under the wide range of conditions found on Earth. The report documents that NSF/EAR and DOE partnerships allow for advanced Earth materials characterization at synchrotron light sources and are needed to address stated science priorities including:

1. Study of the evolution and dynamics of the geodynamo
2. Plate tectonic history and evolution
3. Critical element distributions and cycling in Earth materials
4. Earthquake physics
5. Volcanic processes
6. Critical zone processes and climate feedbacks
7. Paleoclimatology
8. Water cycle dynamics
9. Biogeochemical processes and biodiversity evolution
10. Geohazards mitigation

As previously announced and anticipated (Dear Colleague Letter NSF 20-124), EAR is soliciting proposals to develop, manage, operate, and support user access to U.S. synchrotron-based and supporting laboratory capabilities necessary to advance Earth sciences research and training. EAR seeks proposals that prioritize support for the research and training needs of the U.S. Earth science community supported by EAR core or special programs (see https://www.nsf.gov/funding/programs.jsp?org=EAR for a current list of programs funded by EAR).

Goals of this solicitation include: 1) centralizing management of synchrotron light source beamlines focused on Earth and environmental science applications; 2) allowing for broad science community access to new capabilities that will be realized as part of Department of Energy plans for next-generation synchrotron light sources in the U.S.; 3) providing an opportunity to develop and support new beamlines, instrumentation and techniques at U.S. synchrotron light sources in support of Earth and environmental research and training including new capabilities, enhanced user support, and mechanisms to engage both the low-temperature geochemistry and Earth materials research communities; 4) addressing priority science questions and related infrastructure recommendations identified in a 2020 National Academies of Sciences, Engineering, and Medicine Report (A Vision for NSF Earth Sciences 2020-2030: Earth in Time. Washington, DC: The National Academies Press. https://doi.org/10.17226/25761); 5) encouraging innovative efforts to include and foster engagement with individuals and communities historically underrepresented in the Earth and environmental sciences to be integrated with Facility activities including staffing, education, outreach and community activities, and considerate of needs to support belonging, accessibility, justice, equity, diversity, and inclusion (BAJEDI); 6) preserving high-priority components of EAR's facility portfolio; 7) encouraging oversight, management, and operational efficiencies for EAR supported synchrotron-based analytical capabilities within a defined budget projection; and 8) complying with National Science Board (NSB) policy on periodic competition of NSF facilities.

II. PROGRAM DESCRIPTION

A. Background

The EAR Instrumentation and Facilities Program (EAR/IF) supports community facilities to make complex and expensive instruments, systems of instruments or services broadly available to the Earth science research and student communities.

For over twenty years, EAR/IF has provided operational support for facility infrastructure that relies and leverages on National Laboratory-based, synchrotron light sources through independent awards. These are briefly described and referenced below:

GeoSoilEnviro Consortium for Advanced Radiation Sources (GSECARS)

GSECARS community facility infrastructure is supported through a Cooperative Agreement between NSF and the University of Chicago (EAR-1634415) that is scheduled to expire on 31 January 2022. Total EAR/IF funding for GSECARS over the five-year period of the current award is anticipated to total $14.8 million.

GSECARS provides Earth and environmental scientists with access to high-brilliance hard X-rays produced at Sector 13 of the Advanced Photon Source (APS), Argonne National Laboratory. Currently, synchrotron-based analytical techniques available to the Earth science community at GSECARS include: high-pressure/high-temperature X-ray diffraction, scattering, and spectroscopy using the laser heated diamond anvil cell or large volume presses; X-ray powder, single crystal and interface diffraction; inelastic X-ray scattering; X-ray absorption fine structure spectroscopy; X-ray fluorescence microprobe analysis; and X-ray computed microtomography.

Beamtime is open and freely available to the scientific community for non-proprietary research that will be published in open literature given acceptance of an application submitted to the APS general user program.

Research enabled by GSECARS supports advanced knowledge of Earth processes and the composition, structure, and properties of crystalline and non-crystalline Earth materials under the entire range of Earth's environmental conditions from surface to core.

Enabled research addresses virtually all priority science questions articulated in the Earth in Time Report including societally relevant research with implications for subsurface carbon sequestration, remediation of toxic and radioactive substances in the environment, synthesis, transport and fate of nanomaterials, and understanding deep focus earthquake mechanisms.

The facility addresses the human infrastructure needs of the Earth science community through provision of jobs for beamline scientists and technical support staff and through student and postdoctoral research training.

Consortium for Materials Properties Research in Earth Sciences (COMPRES)

COMPRES community facility infrastructure is supported through a Cooperative Agreement between NSF and University of New Mexico (EAR-1661511) that is scheduled to expire 31 May 2022. Total EAR/IF funding for COMPRES over the five-year period of the current award is anticipated to total $12 million.

COMPRES is: 1) an organization to promote and facilitate high-pressure research in the science of Earth materials that is governed by established Bylaws; 2) managed by elected member representatives of an informal consortium of educational and governmental institutions that are chartered in the United States with research and educational programs in high-pressure research in the science of Earth materials; 3) maintains organization officers including a President that is appointed by the Electorate member institution representatives and who serves as the chief executive officer tasked with executing all contracts and agreements on behalf of the organization; and 4) manages both analytical facilities and a program of educational and community activities.

EAR/IF support of COMPRES facilitates access to high-brilliance, hard X-ray and infrared radiation beamlines at multiple sectors across three National Laboratory-based synchrotron light sources and laboratory facilities at one academic institution. COMPRES facilities are located at the Advanced Photon Source (APS) at Argonne National Laboratory, the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory, the National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory, and Arizona State University.

Beamtime is open and freely available to the scientific community for non-proprietary research that will be published in open literature given acceptance of an application submitted to the relevant synchrotron light source user program.

COMPRES beamline, laboratory facilities and related personnel are supported through multiple institutional subawards managed through the NSF-University of New Mexico Cooperative Agreement.

APS located COMPRES facilities are supported through subawards to:

- **Stony Brook University** for the management and operation of multi-anvil equipment that permits high pressure and high temperature deformation/rheological in situ ultrasonic interferometry experiments at extreme conditions at APS beamline 6-BM-B
- **University of Hawaii** for the management and operation of single crystal and power X-ray diffraction and Raman spectroscopy equipment, in a partnership with GSECARS, at APS beamline 13-BM-C
- **University of Illinois** for the management and operation of inelastic X-ray scattering equipment for the study of thermodynamic and elastic properties of minerals at APS beamline 3-ID and an off-line Mossbauer spectroscopy laboratory
- **University of Chicago** for the management and operation of a diamond anvil cell gas loading facility, in a partnership with GSECARS, at APS Sector 13
- **ALS located COMPRES facilities** are supported through a subaward to:
- **University of California Santa Cruz** for management and operation of equipment that permits high pressure, laser heated, single crystal X-ray diffraction experiments in the diamond anvil cell at ALS beamline 12.2.2

NSLS-II located COMPRES facilities are supported through subawards to:

- **Stony Brook University** for the development, management and operation of a multi-anvil X-ray facility that supports high pressure and high temperature powder X-ray diffraction, X-radiographic imaging, deformation experiments and ultrasonic interferometry at NSLS-II beamline 28-ID-2-D. This development will ultimately replace and lead to decommissioning of the multi-anvil facility at APS beamline 6-BM-B
- **University of Illinois at Chicago** for the management and operation of synchrotron and conventional infrared and micro-Raman spectroscopic instrumentation and supporting laboratory facilities that permit high pressure studies of volatiles in Earth and planetary materials over a range of temperatures

ASU located COMPRES facilities are supported through a subaward to:

- **Arizona State University** for the management and operation of computerized machining and supporting laboratory equipment and personnel for the development, testing, production and use of cell assemblies for multi-anvil high pressure research

Research enabled by COMPRES managed facilities supports advanced knowledge of the composition, structure and properties of deep Earth rocks, minerals and melts providing insight into: the dynamics of Earth's upper mantle and tectonic plates and assisting in the interpretation of seismic signals and models; sequestration and circulation of water and carbon in the deep Earth; partitioning of trace elements between minerals and melts and the redox conditions in the Earth's interior; the nature and dynamics of the lower mantle, core-mantle boundary and core with implications for understanding the genesis and behavior of the Earth's magnetic field and thermal gradients in the deep Earth; and processes related to early Earth formation and evolution.

Enabled research addresses several of the priority science questions articulated in the Earth in Time report.

The facility addresses the human infrastructure needs of the Earth science community through provision of jobs for beamline scientists and technical support staff and through student and postdoctoral research training.

B. Community Facility Requirements

Proposers are expected to describe and budget for personnel and activities necessary to provide for the development, management, and operation of a community user facility that provides access to U.S. synchrotron-based analytical and supporting laboratory capabilities that will advance Earth and environmental science research and training priorities over the coming decade. Proposals should prioritize support for research and training needs of the U.S. Earth and environmental science community for basic research supported by EAR core or special programs (see https://www.nsf.gov/div/index.jsp?div=EAR for a current list of programs funded by EAR).

Proposals should describe how the submitting organization would facilitate, manage and support: 1) end-user access to U.S. synchrotron-based and supporting sample analytical capabilities; 2) on-site technical support; 3) development of new instrumentation and techniques made possible by evolving capabilities at synchrotron light sources; 4) the needs of NSF/EAR-funded research and education projects, including data services; 5) an integrated program of education, workforce development, and outreach promoting equity, diversity and inclusiveness at all levels; 6) partnerships with government agencies, universities, industry, private organizations, and the international community; and 7) scientific community advisory input.

Proposals may include geographically distributed capabilities located at U.S. Department of Energy (DOE) supported, National Laboratory-based, synchrotron light sources, or other solicitation eligible institutions that provide similar resources.

Submissions must be a single proposal, from one organization that accepts overall management responsibility. Proposals may be collaborative through inclusion of subawards (see PAPPG, Chapter II.D.3.a).

C. Awardee Responsibilities and Expectations

Responsibilities

The Awardee will be responsible for the development, management and operation of Facility infrastructure as described in the proposal submitted in response to this solicitation as may be amended beyond the first year of award via submission and NSF acceptance of Annual Program Plans and associated budget.

The Awardee shall ensure that the Facility infrastructure enables:

1. State-of-the-art, synchrotron light source enabled analytical techniques necessary to expand collective knowledge of Earth and environmental materials, processes and dynamics, under the entire range of Earth's environmental conditions from surface to core.
2. NSF-funded, Earth and environmental science research that addresses science priority questions articulated in the Earth in Time report.
3. Advances in the Nation's capability to meet current and future societal challenges.
4. Growth of a more capable, diverse, and inclusive national scientific workforce.
5. Partnerships with other government agencies, academia, private and international entities.

The Awardee will work closely with cognizant EAR Program management and the Earth and environmental science research community to ensure the Facility enables efficient and effective user access to a range of synchrotron light source-based analytical and supporting capabilities necessary to advance understanding of Earth and environmental materials and processes under the entire range of Earth's environmental conditions from surface to core. The awardee will have primary responsibility for coordination with DOE and any other partners but will be assisted by EAR management when appropriate.

Expectations

The Awardee shall:

1. Promote a culture of excellence that meets the highest standards for service and delivery to the Earth and environmental scientific community.
2. Demonstrate a proactive and effective approach to facility management.
3. Be advised by appropriate representatives of the Earth and environmental science community.
4. Promote engagement with people and communities historically underrepresented in Earth Science, such as women, persons with disabilities, minority groups in science, technology, engineering, and mathematics (STEM), those from geographically underrepresented areas in STEM, and veterans of the U.S. Armed Forces through targeted staffing, educational and outreach activities.
5. Maintain records of all Facility activities including but not limited to project support, financial, advisory reports, any workshop or meeting findings, educational activities and any related assessments.

D. General Information

For additional information on this competition, and NSF practices and policies, proposing organizations should contact the Cognizant Program Officers, David Lambert (dlambert@nsf.gov) and/or Russ Kelz (rkelz@nsf.gov).

III. AWARD INFORMATION

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:

1. Institutions of higher education (Ph.D.-granting and non-Ph.D.-granting), acting on behalf of their faculty members, that are accredited in and have their main campus in the United States, its territories, or possessions. Distinct academic campuses (e.g., that award their own degrees, have independent administrative structures, admissions policies, alumni associations, etc.) within multi-campus systems qualify as separate submission-eligible institutions.
2. Not-for-profit, non-degree-granting domestic U.S. organizations, acting on behalf of their employees, for example (but not limited to) independent museums and science centers, observatories, research laboratories and similar organizations that are directly associated with the Nation's research activities. These organizations must have an independent, permanent administrative organization (e.g., a sponsored projects office) located in the United States, its territories, or possessions, and have 501(c)(3) tax status.
3. Consortia as follows:
    a. A legally incorporated, not-for-profit consortium that includes two or more submission-eligible organizations as described in items (1) and (2) above. Such a consortium is one with an independent administrative structure (e.g., a sponsored projects office) located in the United States, its territories, or possessions and has 501(c)(3) status.
    b. Submission-eligible organizations as described in items (1) and (2) above, on behalf of an informal consortium. These consortium proposals may also include as partners, via subawards, other U.S. and non-U.S. organizations that are not otherwise eligible to submit directly to this solicitation.

In either case, the proposal title should indicate that a consortium is proposing.

For-profit commercial organizations, especially U.S. small businesses with strong capabilities in scientific or engineering research or education, are eligible for participatory support through subawards/subcontracts as private sector partners with submitting organizations; they may not submit proposals. Such partnerships must be substantive and meaningful. In addition, the value added by the for-profit commercial organization should be justified as a unique contribution that is otherwise unavailable within organizations described in (1) and (2).

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 1

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

There are no restrictions or limits.

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 FastLane or Grants.gov.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

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

Solicitation specific proposal preparation instructions follow:

Submissions must be single proposal, from one organization that accepts overall management responsibility. Proposals may be collaborative through inclusion of subawards (see PAPPG, Chapter II.D.3.a).

Cover Sheet:

- **Budget and Duration Information:** Proposers should request a start date that allows one year for NSF review, processing and decision.

Project Description (*up to 30 pages including Results from Prior Support, which is limited to five pages*):

- Should clearly describe proposed Facility activities and objectives for the period of proposed work; provide examples of the scientific motivation for proposed Facility capabilities; discuss the relationship of this work to the present state of knowledge in the field and to work in progress by the PI(s) under other support.

Special Information and Supplementary Documentation:

- **Documentation of collaborative arrangements of significance to the proposal through letters of collaboration:** Letters of collaboration should be limited to stating the intent to collaborate and should not contain endorsements or evaluation of the proposed project.

Letters confirming substantive collaboration efforts should use organization letterhead, and must follow the format indicated below:

To: Cognizant NSF Program Officer

From: [Organization]

Lead Investigator: [Investigator Name]

Date:

Subject: Statement of Collaboration

[Organization] hereby acknowledges a proposed collaboration on this proposal, entitled "[Proposal Title]," with [PI name] as the Principal Investigator. If awarded, [Organization] agrees to undertake the tasks assigned, as described in the proposal, with commitment to providing or making available the resources therein designated. The collaboration with be under the direction of [Investigator Name].

Signed: [Authorized Organization Representative]

The proposal body itself should describe the nature and need for a collaboration.

Statements of collaboration by individuals beyond that specified above, including letters of support/endorsement, are not allowed.

- **Work Breakdown Structure (WBS) Dictionary:** (text-searchable PDF up to 10 pages in length): Should provide detailed information about each

element in the WBS, such as a brief definition of the scope of work, deliverables, basis for budget and schedule estimates, assessment measures, and anticipated milestones.

Suggested top-level WBS elements include:

- Project Administration and Management
- Facility Operations
- Equipment Acquisition and Technique Development
- Cyberinfrastructure
- Education, Outreach and Community Activities

- **Vendor Quotations:** for any equipment requested that exceeds $50,000/unit.

- **Summary Table of Personnel, Educational Credentials, and Duties:** Should list alphabetically by last name, all proposed facility personnel, including any staff that would be supported under planned institutional subawards, their highest educational credentials, and a brief description of their planned duties. Positions proposed for which no individuals are identified should be noted as TBD but with anticipated educational requirements and planned duties.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

The maximum annual request is $7,000,000 and the maximum total five-year request is $35,000,000.

It is expected that the majority of requested support will fall under the WBS element of Facility Operations.

C. Due Dates

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

  March 04, 2022

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

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals

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

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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

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

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and

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

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and 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 the National Science Board approved merit review criteria (Intellectual Merit/Broader Impacts), criteria that will be considered in the evaluation of proposals submitted to this solicitation will include:

1. What is the potential for the Facility to advance the Nation’s capability to conduct cutting-edge Earth and environmental science research and does the proposal present plans for novel technological developments and capabilities that are likely to foster growth in NSF Division of Earth Science (EAR) use of the Facility while balancing the scientific, technical, and training needs across EAR programs?
2. Does the proposal present a detailed management plan that includes plans for appropriately balanced community participation and oversight, self-evaluation and plans for maintaining a flexible and innovative facility that is likely to be effective?
3. Are proposed activities to include and foster engagement with people and communities historically underrepresented in the Earth and environmental sciences innovative, well integrated with Facility activities including staffing, education, outreach and community activities, and considerate of needs to support belonging, accessibility, justice, equity, diversity, and inclusion (BAJEDI)?
4. Does the proposal present plans for supporting user community needs for cyberinfrastructure and data services that support NSF and EAR Data Management policies?
5. Is the proposed budget adequately justified with tractable scope, schedule and allocation of activities across a clearly defined Work Breakdown Structure that is logical and appropriately detailed?

B. Review and Selection Process

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

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

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

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements 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.

Special Award Conditions:

The award associated with this solicitation will be a Cooperative Agreement. Any special requirements not stated herein will be negotiated at time of award.

TBD - Programmatic Terms and Conditions:

The Cooperative Agreement awarded as a result of this competition will be administered by the NSF Division of Earth Sciences. The following are some of the measures NSF envisions using to conduct oversight for the Cooperative Agreement:

- Review of annual reports, program plans and performance metrics.
- Site visits, either reverse or at a Facility venue TBD and either virtual or in person as permissible given any pandemic restrictions or considerations, periodically as deemed necessary.
- Review of Facility activities and management performance in the third year of award
- The mid-term review will be used to inform an NSF decision to either invite the Awardee to submit a renewal proposal for an additional five-year period of support, issue a new solicitation, or transition the facility activities in some other fashion.

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.

The Principal Investigator will also be required to provide periodic reports to the cognizant NSF Program Officer beyond the standard reports described above. The content, format and submission times of such reports will be established as part of Programmatic Terms and Condition of a Cooperative Agreement but in general terms will include:

1. Annual Program Plans and Budgets beyond the first year of award
2. Annual Financial Reports showing a comparison between budgeted amounts approved in the Annual Program Plan and Budget and actual expenditures in the NSF Form 1030 budget categories and by WBS elements
3. Annual Report of Facility Supported Research Projects

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:

- Russell C. Kelz, telephone: (703) 292-4747, email: rkelz@nsf.gov
- David D. Lambert, telephone: (703) 292-8558, email: dlambert@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov
- Research.gov Help Desk e-mail: rgov@nsf.gov.

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

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

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

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

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

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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