Science and Technology Centers: Integrative Partnerships

PROGRAM SOLICITATION
NSF 19-567

REPLACES DOCUMENT(S):
NSF 14-600

National Science Foundation

Office of Integrative Activities

Directorate for Biological Sciences

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

Directorate for Engineering

Directorate for Geosciences

Directorate for Mathematical & Physical Sciences

Directorate for Social, Behavioral & Economic Sciences

Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. submitter's local time):

June 25, 2019

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

January 27, 2020

IMPORTANT INFORMATION AND REVISION NOTES

Descriptions of the program have been updated to better reflect characteristics of successful STCs.

The preliminary proposals are now structured and their length is increased to 12 pages. The preliminary proposal solicitation-specific review criteria are accordingly updated to match the proposal structure.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 19-1).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Science and Technology Centers: Integrative Partnerships

Synopsis of Program:

The Science and Technology Centers (STC): Integrative Partnerships program supports exceptionally innovative, complex research and education projects that require large-scale, long-term awards. STCs focus on creating new scientific paradigms, establishing entirely new scientific disciplines and developing transformative technologies which have the potential for broad scientific or societal impact. STCs conduct world-class research through partnerships among institutions of higher education, national laboratories, industrial organizations, other public or private entities, and via international collaborations, as appropriate. They provide a means to undertake potentially groundbreaking investigations at the interfaces of disciplines and/or highly innovative approaches within disciplines. STCs may involve any area of science and engineering that NSF supports. STC investments support the NSF vision of creating and exploiting new concepts in science and engineering and providing global leadership in research and education.

Centers provide a rich environment for encouraging future scientists, engineers, and educators to take risks in pursuing discoveries and

new knowledge. STCs foster excellence in education by integrating education and research, and by creating bonds between learning and inquiry so that discovery and creativity fully support the learning process.

NSF expects STCs to demonstrate leadership in the involvement of groups traditionally underrepresented in science and engineering at all levels (faculty, students, and postdoctoral researchers) within the Center. Centers use either proven or innovative mechanisms to address issues such as recruitment, retention and mentorship of participants from underrepresented groups.

Centers must undertake activities that facilitate knowledge transfer, i.e., the exchange of scientific and technical information with the objective of disseminating and utilizing knowledge broadly in multiple sectors. Examples of knowledge transfer include technology transfer, providing key information to public policy-makers, or dissemination of knowledge from one field of science to another.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

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

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

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

Award Information

Anticipated Type of Award:

Cooperative Agreement - initial commitment of 5 years with the possibility of a 5-year continuation.

Estimated Number of Awards: up to 5

Centers. Number of awards is approximate and subject to availability of funds in FY2021.

Anticipated Funding Amount: $25,000,000

Up to $25,000,000 annually, pending the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Preliminary proposals and invited full proposals may only be submitted by domestic (United States) institutions of higher education that are located in the United States, its territories or possessions, and have doctoral degree-granting research and education programs in any area of research supported by NSF. The lead institution is expected to develop partnerships or arrangements with other universities, colleges, or other institutions, such as national laboratories, research museums, private sector research laboratories, state and local government laboratories, and international organizations as appropriate to enable the Center to attain its strategic goals.

Who May Serve as PI:

The PI must be a full-time faculty member at an institution of higher education and have an established record of leading research teams.

Limit on Number of Proposals per Organization: 3

A single organization may submit a maximum of three preliminary proposals as the lead institution. Full proposals are to be submitted only when invited by NSF. There is no limit on the number of proposals in which an organization participates as a partner institution. The STC program will not support more than one Center from any one lead institution in this competition.

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

A PI or co-PI on one proposal in this competition may not be a participant in another STC proposal under review in the same competition. If a proposal is declined at any stage of the review process, a PI or co-PI on the declined proposal may then participate in another STC proposal. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on the earliest date and time of proposal submission (i.e., the first compliant proposal received will be accepted and the others will be returned without review). No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

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

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

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

  Not applicable.

- **Other Budgetary Limitations:**

  Not Applicable

C. Due Dates

- **Preliminary Proposal Due Date(s) *(required)*** (due by 5 p.m. submitter's local time):

  June 25, 2019

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

  January 27, 2020

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

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 Science and Technology Centers: Integrative Partnerships — Concept

The Science and Technology Centers (STC): Integrative Partnerships program supports exceptionally innovative, complex research and education projects that require large-scale, long-term awards. STCs focus on creating new scientific paradigms, establishing entirely new scientific disciplines, and developing transformative technologies that have the potential for broad scientific or societal impact. STCs conduct world-class research through partnerships among institutions of higher education, national laboratories, industrial organizations, other public and private entities**,** and via international collaborations, as appropriate.

The STC program supports potentially groundbreaking investigations at the interfaces of disciplines or highly innovative approaches within disciplines. STCs may involve any area of science and engineering that NSF supports. STCs exploit opportunities in science, engineering and technology where the complexity of the research agenda requires the duration, scope, scale, flexibility, and facilities that center support can provide. They help enable U.S. leadership in research in a world in which discovery, learning, and innovation enterprises are increasingly interconnected and increasingly global**.** Centers offer the science and engineering community a venue for developing effective mechanisms to integrate scientific and technological research and education activities; to explore better and more effective ways to educate students; to broaden participation of underrepresented groups; and to ensure the timely transfer of research and education advances made in service to society. STC partner organizations work together with the lead institution as an integrated whole to achieve the shared research, education, broadening participation, and knowledge-transfer goals of the Center.

II. PROGRAM DESCRIPTION

A. Objectives of the STC Program are to:

- Support research and education of the highest quality, in a center-based environment, where the whole is greater than the sum of its parts;
- Exploit opportunities in science, education, engineering and/or technology where the complexity of the research agenda requires the advantages of scope, scale, flexibility, duration, equipment, and facilities that a Center can provide;
- Support potentially groundbreaking investigations at the interfaces of disciplines or highly innovative approaches within disciplines;
- Support the creation of new scientific paradigms, establishment of new scientific disciplines, and development of transformative technologies;
- Foster science and engineering in service to society;
- Engage and develop the Nation's intellectual talent, including groups underrepresented in the sciences, mathematics and engineering, in the conduct of research and education activities;
- Promote organizational connections and linkages within and between campuses, schools and the world beyond (e.g., state, local, Federal agencies, national labs, industry, international collaborations), capitalizing upon cyberinfrastructure to facilitate these linkages; and,
- Focus on integrative learning and discovery and the preparation of U.S. students for a broad set of career paths.

B. Characteristics of Science and Technology Centers

The lead institution accepts overall management and budgetary responsibility for the proposed Center and is responsible for oversight of subawards to partner institutions. The partners comprising an STC share a common research vision and work on developing sustainable collaborations while jointly pursuing highly innovative research pathways to address deep scientific questions or pressing societal needs. They capitalize on the latest scientific and technological developments to seek ways to develop groundbreaking, sometimes risky approaches, to enable rapid progress and address what seem to be intractable problems. They work towards developing and maintaining a flexible and agile research plan to accommodate change as the research proceeds, new challenges and opportunities arise, and the global landscape of science evolves.

STCs may vary in size and exhibit diverse forms of organization, collaboration, and operation suited to their individual needs. Not every partner must support every aspect of the Center's activity, but all of the expected features of a Center must be accomplished via the integrated portfolio of the partners' activities. Partnerships may include multi-organizational collaborations or arrangements with other universities/colleges, national laboratories, research museums, private sector research laboratories, industrial organizations, state and local government laboratories, and international collaborations. NSF encourages, but does not require, STCs to include international dimensions (e.g., collaboration with foreign research partners and international research experiences for students) to enhance research and promote a diverse, internationally competitive science and engineering workforce.

The STC program seeks to support education activities directed toward the development of a diverse, globally engaged workforce of scientists, engineers, and citizens, well-prepared for a broad set of career paths. The education goals of an STC may address the needs of students participating in the Center's research activities or students in broader fields of research represented by the STC activities. STCs are encouraged to focus their education efforts on specific programs that are appropriately integrated into the research activities of the Center rather than attempting to be comprehensive. Education programs and activities should be developed in the context of current education research and be monitored through a formal evaluation effort.

NSF expects STCs to demonstrate leadership in the involvement of groups traditionally underrepresented in science and engineering, at all levels (faculty, students, and postdoctoral researchers) within the Center. STCs are encouraged (but not required) to form substantive and long-term partnerships and collaborations with institutions that serve populations of underrepresented students interested in science, technology, engineering, and mathematics (STEM) (such as minority serving institutions, women's colleges, or institutions that serve students with disabilities). Increasing the participation of a diverse U.S. citizenry, including women, persons with disabilities, and underrepresented minorities, by creating opportunities and enabling them to contribute, is essential to the health and vitality of science and engineering.

STCs foster knowledge transfer that involves the exchange of scientific and technical information between the Center and external stakeholders who can then apply and utilize the knowledge to create further advances. Examples of knowledge transfer include, but are not limited to, providing key information to support policy-making decisions and establishing spinoff companies, license agreements or other technology transfer arrangements to support innovation. Knowledge transfer can be facilitated in a variety of ways, including but not limited to formal partnerships established through membership agreements, visiting research/teaching positions for industrial scientists at the STC, external use of industrial or university facilities, student internships in industry or public policy arenas, student mentoring by industrial or other partners, innovative use of cyberinfrastructure, informal science education, and/or other mechanisms.

C. Leadership, Management, and Oversight of STCs

One of the partner institutions acts as the lead institution and accepts overall management and budgetary responsibility for the proposed Center. The Center Director must provide the leadership to develop and lead a diverse team to fulfill the vision of the Center. It is expected that the Center Director will have experience in leading research teams and excellent verbal and written communication skills. S/he is responsible for the management, staffing, and resource allocation of the Center, and for serving as the liaison between the Center and the national network of STC Directors. The Center Director must ensure that the STC develops the ability to communicate effectively with NSF and the other STCs electronically, including web-based distribution of information and videoconferencing capability. Key members of the Center management team must possess appropriate management experience and qualifications to administer their components of the Center. The Center team must develop a management plan to share responsibilities appropriately.

STC Directors participate in the National Network of STC Directors. This group is charged with addressing common goals, problems and opportunities, and facilitating personnel and resource exchanges as well as ensuring linkages and cooperation among STCs. Typical functions of this Network include: facilitating interactions to address research, education, and management issues and opportunities that transcend individual Center capabilities; planning joint implementation strategies, workshops, and other forums; developing and sharing of best practices; and arranging for documents or web-sites to enhance public understanding of the importance of science, engineering, technology and education advances in service to society.

Each Center will establish, maintain, and convene annually an External Advisory Committee (EAC). The function of the EAC is to provide guidance, advice, and direction for all of a Center's activities, consistent with its vision, goals, and objectives. The EAC must include members who are able to assess each aspect of the project including management, research, education, broadening participation, and knowledge transfer. EAC membership is subject to NSF approval and must include representatives from those sectors served by the Center (e.g., institutions of higher education, industry, state and local agencies, national laboratories). The EAC must include members from groups that are underrepresented in science and engineering (for example, women, persons with disabilities, and minorities). Individuals with a financial, institutional, or collaborative connection to the Center may not serve as members of the EAC.

D. Summary of STC Features

Each STC must:

- Be focused on exceptionally innovative, complex research and education projects that require large-scale, long-term awards;
- Be based at an institution of higher education which assumes responsibility for oversight of subawards to partner institution;
- Be directed by a faculty member with experience in leading research teams;
- Demonstrate institutional commitment to achieving strategic goals that are shared by the lead and partnering institutions;
- Establish multi-institutional collaborations or linkages with other universities/colleges, national laboratories, research museums, private sector research laboratories, state and local government organizations, and international collaborations, as appropriate;
- Develop a management plan that integrates the research, education, broadening participation, and knowledge transfer activities across all partners and affiliates;
- Include diverse teams at all organizational levels of the Center, inclusive of women and men, underrepresented minorities, and persons with disabilities;
- Provide research and education opportunities for U.S. students, postdoctoral researchers and faculty that will result in outcomes consonant with the Center's goals;
- Facilitate knowledge transfer through significant intellectual exchange among various types of institutions and organizations (e.g., nonprofit organizations; national laboratories; industry; Federal, state, and local governments); and,
- Establish and convene annually an External Advisory Committee to provide guidance, advice, and oversight.

E. Timeline for this FY 2019 to FY 2021 STC competition:

- Preliminary proposals due June 25, 2019
- Invited list informed, late October, 2019
- Invited full proposals due January 27, 2020
- Notification of invitation for site visit, late June, 2020
- Site visits, September 1-October 30, 2020
- Declined proposers informed, and recommended awards announced, early February, 2021
- Anticipated start date of awards, June 1, 2021

III. AWARD INFORMATION

Up to a total of $25 million may be available, pending the availability of funds, for first-year support of newly funded Centers beginning in FY 2021. NSF expects to make up to 5 awards, contingent on availability of funds and receipt of competitive proposals. Each award will be made as a cooperative agreement to the lead institution, with an initial commitment for five years of support and a possibility of continuation for five additional years. The amount of NSF's investment in each Center will depend upon the needs, plans, and opportunities offered by the Center, as well as the availability of NSF funds. Oversight of each individual STC is the responsibility of the appropriate NSF directorate in coordination with the Office of Integrative Activities (OIA).

Support for each year of the cooperative agreement of a funded STC will be contingent upon a satisfactory annual review and site visit by NSF of the Center's progress and future plans, with an emphasis on the quality of the research, education, broadening participation and knowledge transfer activities. In the fourth year of operation, the STC may submit a continuation proposal for five additional years of NSF support. During the subsequent annual review, the STC's achievements and future plans will be evaluated comprehensively to determine if the STC is meeting its goals and objectives as well as the goals and objectives of the STC Program. This in-depth review will consist of an *ad hoc* review of the continuation proposal and a formal on-site

review, involving external reviewers who will produce a written report to NSF. Centers successful in passing the fourth-year review will be continued for another five years, commencing at the beginning of the sixth year. The cooperative agreement will include a two-year phase-out period for years nine and ten. Centers that pass the fourth-year review will continue to be reviewed by NSF every 12 months. Centers that do not pass the fourth year review will be phased-out over a one-year period at a reduced level of support. The NSF may support an STC for a maximum of ten years.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Preliminary proposals and invited full proposals may only be submitted by domestic (United States) institutions of higher education that are located in the United States, its territories or possessions, and have doctoral degree-granting research and education programs in any area of research supported by NSF. The lead institution is expected to develop partnerships or arrangements with other universities, colleges, or other institutions, such as national laboratories, research museums, private sector research laboratories, state and local government laboratories, and international organizations as appropriate to enable the Center to attain its strategic goals.

Who May Serve as PI:

The PI must be a full-time faculty member at an institution of higher education and have an established record of leading research teams.

Limit on Number of Proposals per Organization: 3

A single organization may submit a maximum of three preliminary proposals as the lead institution. Full proposals are to be submitted only when invited by NSF. There is no limit on the number of proposals in which an organization participates as a partner institution. The STC program will not support more than one Center from any one lead institution in this competition.

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

A PI or co-PI on one proposal in this competition may not be a participant in another STC proposal under review in the same competition. If a proposal is declined at any stage of the review process, a PI or co-PI on the declined proposal may then participate in another STC proposal. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on the earliest date and time of proposal submission (i.e., the first compliant proposal received will be accepted and the others will be returned without review). No exceptions will be made.

Additional Eligibility Info:

Proposed STC annual budgets may range up to $5.0M per year of NSF support. Full proposals outside this range will be returned without review. Each preliminary and invited full proposal must demonstrate institutional commitment in the area proposed. Inclusion of voluntary committed cost sharing is prohibited.

Past members of STCs may participate in this open competition only if the proposed research and education topics or themes are substantially different from those they pursued with prior NSF Center support. The proposal must focus on a different research topic. New proposals that simply extend the methods and intent of a past STC to a slightly larger scope or a new geographic area will be returned without review.

The STC Program complements the Engineering Research Centers (ERCs), the Materials Research Science and Engineering Centers (MRSECs), Centers of Chemical Innovation (CCIs) and other NSF programs that support group research and education activities. Participation in a Center does not preclude individuals from receiving NSF support for their individual research in complementary areas.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required)*: Preliminary proposals are required and must be submitted via the NSF FastLane system, even if full proposals will be submitted via Grants.gov.

When preparing a preliminary proposal for this competition, proposers are advised to consult the Program Description for general information pertinent to the STC program and the Proposal Review Information found in section VI of this solicitation for information on specific questions that reviewers of preliminary proposals will be asked to address. Required components of the preliminary proposal are given below. Strict adherence to page limitations given in this document is required. Proposers should review the most current *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) for specific information on format for the required sections. 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. Proposers are also encouraged to access the STC web site for updated information and answers to frequently asked questions (FAQ's) relevant to this competition: https://www.nsf.gov/od/oia/programs/stc/index.jsp.

Preliminary Proposal Contents

The preliminary proposal must consist of the following elements:

1. Cover Sheet. For planning purposes, June 1, 2021 should be shown as the start date. The proposed Center Director must be shown as the Principal Investigator.
2. Project Summary. (1 page maximum) Provide an overview of the proposed STC, addressing separately the intellectual merit and broader impacts of the Center. The summary should be informative to those working in the same or related field(s), and understandable to a broad audience within the scientific domain.

   At the end of the Overview section of the Project Summary, indicate up to three NSF divisions that are the most relevant for your center research activities. They should be listed in order of priority, i.e., the first listed should be the most relevant. Also include up to three keywords that pertain to your research topics, again listed in order of priority.

3. Table of Contents. A Table of Contents is automatically generated for the proposal by the FastLane system. The proposer cannot edit this form.
4. Project Description (12 pages maximum). Results from Prior NSF Support should not be included. Links to URLs may not be used. Include the following sections:

   4a. *Center Rationale* - Articulate your vision for the proposed Center that clearly outlines the grand challenge(s) being addressed, the breakthroughs being sought, the potential impacts, and intended legacies of the center. Explain the unique opportunities that an integrated STC will provide and describe what will be achieved in the center mode that could not be achieved with other NSF funding mechanisms including other NSF centers programs. Address the timeliness of the proposed center (why is this the right time for the center and why is this an important area for a research investment at this time).

   4b. *Center Plan* - Provide an overview of your research plan, in the context of national and global landscapes of relevant scientific fields, with sufficient detail to allow the assessment of the scientific merit and to justify the necessity for the center mode of operation. Delineate what you anticipate will be the major accomplishments over the first five years of the Center's existence. Include a description of what you perceive will be the major challenges and bottlenecks in achieving these accomplishments and explain why.

   4c. *Team Description* - Describe the role and assets each participating organization brings to the center. Briefly describe the role that each team member will have in addressing the center's goals. Highlight the unique assets and strengths of the proposing team compared to other groups working in related areas.

   4d. *Integration strategies* - Describe how the proposed research areas/themes integrate with each other to realize the Center's research vision. Describe the focus of the education, broadening participation, and knowledge transfer activities. Outline how the integration of research, education, and knowledge transfer, in a center-level activity, will advance the proposed research. Identify specific activities and mechanisms that will enable cross-organizational and cross-sector integration of the team. Address the specific roles and responsibilities of the PI, co-PIs, and other Senior Personnel in leading the center and developing a center culture.

5. References Cited (2-page limit). See NSF PAPPG instructions for format.
6. Biographical Sketches (2-page limit per person). Biographical Sketches are required for the Center Director and all faculty and staff members whose research, education, knowledge transfer, or broadening participation activities will be supported by the Center. See PAPPG for details.
7. Supplementary Documents (to be entered in the Supplementary Documents section of FastLane). A list of Partner organizations and Project Personnel as described below is required. This information provides NSF and reviewers with a comprehensive list of personnel and organizations involved in the STC.
   a. List all project personnel who have a role in the management, research, education, broadening participation, and knowledge transfer components of the Center. Use the following format: last name, first name, institution/organization.
   b. List of all institutions and organizations with which project personnel are affiliated. Designate for each an appropriate category: Institution of Higher Education, National Laboratory, Federal Government, Industry, Non-Governmental Organization, State/Local Government, or International organization.

Information to be submitted to NSF via the FastLane Single Copy Documents Section.

Optional

- List of suggested reviewers or reviewers not to include (with a brief explanation or justification for why the reviewer should be excluded);
- Proprietary or privileged information (if applicable).

Required

Collaborators & Other Affiliations Information: Information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified in list 7(a). The COA information must be uploaded using the NSF COA template into the Single Copy Documents section as described in the PAPPG and the Collaborators and Other Affiliations Information website (https://nsf.gov/bfa/dias/policy/coa.jsp). The accuracy of this section is very important to the integrity of the STC review process. Please be accurate and complete with the entries.

No other items or appendices are to be included. Information pertaining to "Current and Pending Support" and "Facilities, Equipment and Other Resources" is not required for preliminary proposals and should not be included. Indicate "N/A" in FastLane, as needed. Preliminary proposals containing items other than those required above will be returned without review.

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

- 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) 292-7827 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) 292-7827 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.

Important Instructions: Full proposals will be accepted only if invited by NSF. Due to the complexity of the proposals being submitted, use of FastLane to prepare and submit invited full proposals is strongly encouraged. When preparing a full proposal for this competition, proposers are advised to review the Program Description and the Proposal Review Information found in this solicitation for general information pertinent to this program.

As a multi-institution STC, the proposal must be submitted as a single, integrated proposal by the lead institution, with proposed subawards to the other partner institutions. **Separate proposals from each partner will not be accepted.**

The full proposal should provide much more detail than the preliminary proposal and include information on implementation plans and assessment. Descriptions should be clear and concise. Every effort should be made to update information that was provided in the preliminary proposal and to fully address issues raised in the preliminary proposal review. Full proposals should be comparable in scope and effort to that which was presented in the preliminary proposal. Required proposal components and additions to or differences from the NSF PAPPG are given below.

Full Proposal Contents

Required Sections of the Full Proposal

The full proposal must include only the main documents and supplementary documents described in Sections 1-14, below.

1. Cover Sheet. For planning purposes, June 1, 2021 should be shown as the start date. The full proposal must show the proposed Center Director as the Principal Investigator. Include the preliminary proposal number and follow instructions provided in NSF's electronic systems and the PAPPG.
2. Project Summary (2 page limit). Upload in the Project Summary section a single page with the statement "See Supplementary Documents section for the Project Summary" and then upload the two-page Project Summary in the Supplementary Documents section of the proposal. Both NSF merit review criteria (intellectual merit and broader impacts) must be addressed in separate statements (see the PAPPG for additional instructions). The summary should be informative to persons working in the same or related fields, and understandable to a broad audience within the scientific domain. Provide a clear and concise description of the Center including rationale, mission, and vision. Describe the multidisciplinary or disciplinary research focus, goals for education and broadening participation, the integrative nature of the Center, and the knowledge transfer strategy of the Center. Articulate the potential legacy and national and global impact of the Center if funded. Identify all partner organizations and describe the major contribution of each to the integrated Center activities.
3. Table of Contents. A Table of Contents is automatically generated for the proposal by the system. The proposer cannot edit this form.
4. Project Description. The Project Description must contain only Sections (4.a) through (4.f) described below and cannot exceed 25 pages including tables and illustrations. The broader impacts resulting from the proposed project must be addressed and described as an integral part of the narrative.

   (4.a) Problem Description and Rationale for Center Approach: Provide description of the grand challenge that engendered the proposal and the importance of specific aspects of this grand challenge that you aspire to solve. Include timeliness of addressing this problem.

   Explain the unique opportunities that an integrated center will provide and describe what will be achieved in the center mode that could not be achieved with group or individual support. Discuss why the STC program is particularly suited to support this effort. Discuss the long-term strategic goals of an integrated center. Describe the potential legacy and national and global impact of the proposed Center.

   (4.b) Description of the Research Objectives of the Center: State the overall vision and long-range research goals of the integrated center. Describe the proposed research areas/themes and how they integrate with each other to realize the Center's research vision. Provide 5-year timelines for the activities. Indicate the specific role of each partner organization or participant in each research topic/goal area. Provide a research plan with sufficient detail to allow assessment of the scientific merit and to justify the necessity for the center mode of operation.

   Indicate the potential impact or expected significance the Center's research will have on the Nation's scientific and/or technological base. Include a description of current research activities and, if the proposed Center research is closely related to ongoing research at an existing Center (e.g., an STC, ERC, MRSEC, CCI or national laboratory), explain how the research activities of the proposed Center complement as well as differ from those of the existing Center(s). Explain how the proposed research relates to other state and national research capabilities as well as international programs in the proposed fields of research.

   (4.c) Description of the Education and Human Resource Development Objectives of the Center: Present an education plan that describes how the Center will integrate research and education. Education programs and activities should be evidence-based practices developed in the context of current education research and be monitored through a formal evaluation effort led by competent evaluators.

   Describe plans for the mentoring and professional development of students involved in Center activities. Describe plans for attracting and retaining high quality students. Describe the process by which the education and human resource development goals will be established, used to guide the formal evaluation approaches, and modified during the award period, if needed. Name the lead organizations and key individuals involved with individual projects, and explain the potential contributions and role of each in the education activity. Describe all proposed activities in sufficient detail to allow assessment of their intrinsic merit, potential effectiveness, and their anticipated contribution toward a highly competent and globally engaged technical and instructional workforce and educated citizenry.

   (4.d) Description of the Broadening Participation Objectives of the Center: Describe the broadening participation objectives and outline strategies for achieving them. Describe plans for increasing diversity through the participation of women, underrepresented minorities, and persons with disabilities who are U.S. citizens, nationals, or permanent residents in all organizational levels of Center activities, and cite the relevant literature on effective practices. Describe the contribution/role of partner institutions in the broadening participation plans. Describe plans, if appropriate, for partnerships with minority-serving institutions, women's colleges, and institutions that primarily serve persons with disabilities, and indicate the role of students and faculty from such institutions and how they will be fully integrated into Center activities. Explain how progress will be measured and how strategies will be adapted, if necessary. Describe the proposed activities in sufficient detail to allow assessment of their intrinsic merit and potential effectiveness.

(4.e) Description of the Knowledge Transfer Objectives of the Center: Knowledge transfer involves the exchange of scientific and technical information between the Center and external non-academic stakeholders (such as industrial partners or public policy-makers) with the objective of applying that knowledge. State the specific goals for knowledge transfer and the expected impact of the activities. Linkages should involve significant intellectual exchange and could involve, for example, mechanisms such as internships or novel use of cyberinfrastructure to enhance connections.

(4.f) Description of the Management Plan for the Research, Education, Broadening Participation, and Knowledge Transfer Activities of the Center: Present a management plan for the integrated Center including a diagram to explain the organizational relationships and reporting structure among the key areas of responsibility. Identify key members of the Center Management Team and explain their specific roles and areas of responsibility. The Center Director must have the appropriate experience to lead a diverse team to fulfill the vision of the Center. Key members of the Center Management Team must have experience and qualifications to administer their component of the Center. Identify responsibilities of the lead and partner organizations. Explain the role of each key participant/component and explain the approach for integrating and managing all partners. Describe the processes to be used to prioritize Center activities; to select and integrate research projects with one another and with other Center activities; to allocate funds and equipment across Center activities and among partners; and to select a replacement for the Center Director if needed. Although an External Advisory Committee is required for all Centers, potential members should not be approached or identified unless the Center is funded.

5. Facilities, Equipment and Other Resources (1 page limit). Provide a synopsis of institutional resources that will be available to the Center (dedicated space, access to facilities and instrumentation, faculty and staff positions, access to programs that assist with curriculum development or broadening participation, or other institutional programs that could provide support to the STC). In order for NSF, and its reviewers, to assess the scope of a proposed project, all resources (including those from partner organizations) available to the project, must be described in this section. Note that inclusion of voluntary committed cost sharing is prohibited. The description should be narrative in nature and must not include any quantifiable financial information.
6. Budget and Budget Justification. Provide a budget for each of the five years. FastLane or Grants.gov will automatically provide a cumulative budget. The proposed budget should be consistent with the needs and complexity of the proposed activity. The budget and budget justification should reflect start-up activities at the commencement of the Center activities. Funds allocated for research, education, broadening participation, and knowledge transfer areas must be discernible. Funds also should be included for attendance at yearly cross-Center meetings.

   Submit a separate budget and budget justification (2 page limit) for each participating organization in cases where a subaward exceeds $100,000 per year. Identify items of equipment costing more than $10,000. Full justification for the latter is required. Individual graduate students may not be supported for a period in excess of five years.

   NSF will not provide salary support for scientists, engineers, or educators employed by Federal agencies or Federally Funded Research and Development Centers. For participants at foreign organizations, NSF will consider support only for the U.S. portion of the collaborative projects involving U.S. and foreign organizations.

7. References Cited. Section not to exceed five pages.
8. Biographical Sketches (2 page limit per person). Biographical sketches are required for all key participants (Center Director, Managing Director, Education Coordinator, Diversity Coordinator, Knowledge Transfer Coordinator, Research Coordinator, Research Group Leaders, and any faculty and staff members whose research, education, knowledge transfer, or broadening participation efforts will be supported by the Center).
9. Current and Pending Support. Provide current and pending support information for the PI and co-PIs only, i.e., only those persons listed on the Cover Sheet of the proposal.

Special Information and Required Supplementary Documents (Sections 10-14):

Required information to be entered in the Supplementary Documents section in FastLane. For Grants.gov users, supplementary documents should be attached in Field 11 of the R&R Other Project Information Form.

10. (10 a.) Partner Organizations and (10 b.) Project Personnel. The list of Partner Organizations and Project Personnel that were required in the preliminary proposal must be updated to reflect any changes occurring since the time of preliminary proposal submission.
11. Ethics Plan (1 page limit). Provide a clear statement of the proposed Center's policies on ethics training, responsible conduct of research, and intellectual property rights. Discussion should address the nature of the research, methodologies used, ownership of research and ideas, and roles and responsibilities regarding intellectual property. A program of training in ethics and responsible conduct of research within the cross-disciplinary and multi-organizational context of the Center, for all Center and subawardee staff, including faculty, visiting faculty, industrial fellows, postdoctoral researchers, and graduate and undergraduate students is required. Training topics should include the nature of the research, methodologies used, ownership of research and ideas, and roles and responsibilities regarding intellectual property. If a proposal is selected for a site visit, a more detailed description of the lead institution's official policy will be required.
12. Shared Experimental Facilities (2 page limit). Where appropriate, describe the shared facilities to be established, including specific major research instrumentation, and plans for the development of new instrumentation. Distinguish between existing facilities/instrumentation (and their location) and any that will be developed by the Center.

    The following elements should be addressed in this section:

    - maintenance and operation of STC-related facilities, including assurance of organizational commitments/support;
    - mechanisms to deal with potential risk;
    - availability of sufficient infrastructure and technical expertise to ensure effective usage of any major instruments;
    - availability of appropriate technical expertise to design and construct new instruments if proposed; and provisions for user fees and plans for ensuring shared access by all partners and outside users.

13. Data Management Plan (2 page limit). This document should describe how the proposal conforms to NSF policy on the dissemination and sharing of research results, which provides that investigators are expected to share with other researchers, at no more than incremental cost and within a reasonable amount of time, the primary data, samples, physical collections, software, curriculum materials, and other supporting materials created or gathered in the course of work under NSF grants. The following items should be included in this subsection:
    - the types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the course of the project;
    - the standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies);
    - policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements;

    - policies and provisions for re-use, re-distribution, and the production of derivatives; and
    - plans for archiving data, samples, and other research products, and for preservation of access.
14. Postdoctoral Researcher Mentoring Plan (1 page limit). Each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. The mentoring plan must describe the mentoring that will be provided to all postdoctoral researchers supported by the project, irrespective of whether they reside at the submitting organization or any subawardee organization. Proposers are advised that the mentoring plan may not be used to circumvent the Project Description page limitation.

Information to be submitted to NSF via the FastLane Single Copy Documents Section. If submitting via Grants.gov, complete the information and attach as a PDF file (see Field 6, Additional Single Copy Documents, on the NSF Grant Application Cover Page).

Optional

- List of suggested reviewers or reviewers not to include (with a brief explanation or justification for why the reviewer should be excluded);
- Identification of proprietary or privileged information (if applicable).

Required

Collaborators & Other Affiliations Information: Information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified in list (10 b). The COA information must be uploaded using the NSF COA template into the Single Copy Documents as described in the PAPPG and the Collaborators and Other Affiliations Information website (https://nsf.gov/bfa/dias/policy/coa.jsp). The accuracy of this section is very important to the integrity of the STC review process. Please be accurate and complete with the entries.

Full proposals containing items other than those described above will be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations:

Not applicable.

Budget Preparation Instructions:

Proposed STC annual budgets may range up to $5.0M per year of NSF support. Full proposals outside this range will be ineligible and will not be reviewed or considered for support. The core budget for the Center is expected to include support for all research, education, broadening participation, and knowledge transfer activities including, if proposed, those for undergraduate students and for teachers. Inclusion of voluntary committed cost sharing is prohibited.

The following information applies only for those STC proposals that are relevant to the Office of Polar Programs in the Geosciences Directorate:

The Office of Polar Programs (OPP) strongly encourages STC proposals related to all aspects of polar research supported by the Foundation. For proposals requiring access to the polar regions or polar logistical support, investigators must contact appropriate OPP program managers for guidance regarding information needed to assess logistical support requirements for their submission. This should be done during proposal development.

For proposals requiring access to the Arctic, contact Pat Haggerty (phagert@nsf.gov). For proposals requiring access to the Antarctic continent, contact Jessie Crain (jlcrain@nsf.gov). For proposals requesting U.S. Antarctic Program vessel access to the Antarctic Peninsula and/or Southern Ocean contact Tim McGovern (tmcgover@nsf.gov). Additional information on field work requirements can be found in the OPP Arctic Research Opportunities (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5521) and Antarctic Research (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5519) solicitations.

C. Due Dates

- **Preliminary Proposal Due Date(s) *(required)*** (due by 5 p.m. submitter's local time):

  June 25, 2019

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

  January 27, 2020

Preliminary proposals are due June 25th, 2019

Full proposals (by invitation only) due January 27, 2020

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

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. To prepare and submit a proposal via Research.gov, see detailed technical instructions

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

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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

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

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

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

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

Additional Solicitation Specific Review Criteria

Preliminary proposals, full proposals, and site visits will be reviewed using the above criteria. When considering the intellectual merit and broader impacts criteria, reviewers will also be asked to address the following STC-specific questions during the various stages of the competition:

1. Preliminary Proposals. Reviewers will be asked to consider the vision and potential impact of the research proposed, along with the need for the center funding mechanism. Reviewers will be asked to evaluate and comment on the following:
    - *Rationale for an STC*, including questions: Is the vision for the project compelling enough to justify the large-scale focus of resources? If so, is an STC the appropriate vehicle? Why is an STC investment warranted at this time? Are the anticipated scientific and societal legacies substantive and transformative?
    - *Research plan*, including questions: Are the plans for research and holistic integration appropriately ambitious, leading to significant strategic outcomes? Does the proposal address potential bottlenecks and technical challenges? Does the proposal make a case for the feasibility of significant progress over the next five years?
    - *Partnerships and Participants*, including questions: Is the team of partner organizations and personnel assembled for the proposed Center appropriate and essential? Is the role of each participant clear? Does the team have unique strengths relative to the other groups working in related fields?
    - *Integration Strategies*, including questions: Are the leadership and management strategies promoting a center culture and are the foci of education, knowledge transfer and broadening participation strategically supporting the goals of the center?
2. Full Proposals. In addition to the review criteria that will be addressed in reviewing preliminary proposals, reviewers will be asked to consider the integrative nature of the proposed Center. Questions to be considered include:
    - Are the research, education, knowledge transfer, and broadening participation efforts strategically embedded and integrated in the

proposed Center?
    - Are the partner organizations and participants meaningfully integrated into a diverse Center that is more than just the sum of the parts?
    - Does the proposal include a vision and plan for leadership in broadening the participation of underrepresented groups and does it articulate a credible commitment to broadening participation as a means of achieving its overall goals?
    - Are the educational activities innovative and do they contribute to the unifying mission of the proposed Center?
    - Does the proposal include a promising plan to promote the transfer of knowledge through the meaningful exchange of scientific and technical information with external stakeholders such as industrial partners, public policy-makers, or international organizations?
    - Does the proposed Center management have the vision, experience, and capacity to manage a complex, multifaceted, and innovative enterprise that integrates research, education, broadening participation, and knowledge transfer?
    - Are the institutional and other commitments appropriate to carry out the proposed research?
3. Site Visits. The full scope of questions applicable for prior stages in the competition will be within the purview of the site visit team. The site visit team will give special consideration to the management and budget of the proposed STC and any outstanding issues that were raised during the review process.
    - Is the budget appropriate for the scale, scope and complexity of the proposed Center's activities?
    - Does the proposed Center management demonstrate the vision, experience, and capacity to manage a complex, multifaceted, and innovative enterprise that integrates research, education, broadening participation, and knowledge transfer?
    - Is the proposed management plan likely to be effective? Are there appropriate mechanisms to identify and support emerging opportunities and terminate mature or ineffective programs across all of the proposed Center's areas or themes? Are there appropriate mechanisms to enable and manage high-risk, high-reward and/or potentially transformative efforts across all activities in the proposed Center?
    - Is the role of the External Advisory Committee clearly and appropriately defined?
    - Is there an adequate succession plan for the leadership of the Center?
    - Are intellectual property issues adequately addressed?

B. Review and Selection Process

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

Preliminary proposals will be reviewed by multidisciplinary panels

Full proposals will undergo ad hoc review followed by panel review

Proposals recommended by the panel will be site visited and then the full documentation for site visited proposals will be reviewed by a summary panel.

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 letter, 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 letter; (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 letter. 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) 292-7827 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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

STC awards are made in the form of cooperative agreements. The STC cooperative agreements will have an extensive section of Special Conditions relating to the period of performance, statement of work, awardee responsibilities, NSF responsibilities, joint NSF-awardee responsibilities, funding and funding schedule, reporting requirements, key personnel, and other conditions. NSF has responsibility for providing general oversight and monitoring of STCs to help assure effective performance and administration, as well as facilitating any coordination among the STCs as necessary to further the objectives of the STC program. Within the first 90 days of the Award, a retreat of the Center's key personnel to address strategic planning of the STC will be required.

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.

Centers awarded a cooperative agreement will be required to submit annual reports on progress and plans, which will be used as a basis for performance review and determining the level of continued funding. To support this review and the management of a Center, STCs will also be required to develop a set of management and performance indicators for submission annually to NSF via an NSF evaluation technical assistance contractor. Part of this reporting may take the form of a database that will be owned by the institution and eventually made available to an evaluation contractor. This database will capture specific information to demonstrate progress towards achieving the goals of the program. Such reporting requirements may be included in the cooperative agreement which is binding between the institution of higher education and the NSF.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

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

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

- FastLane and Research.gov Help Desk: 1-800-673-6188

  FastLane Help Desk e-mail: fastlane@nsf.gov.

  Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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

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

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

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

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees

as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See System of Record Notices, NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

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