Big Data Regional Innovation Hubs (BD Hubs)

Accelerating the Big Data Innovation Ecosystem

PROGRAM SOLICITATION
NSF 18-598

REPLACES DOCUMENT(S):
NSF 15-562

National Science Foundation

Directorate for Computer & Information Science & Engineering

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

December 18, 2018

IMPORTANT INFORMATION AND REVISION NOTES

This solicitation is a follow-on to NSF 15-562. Some key changes include:

- Increasing the duration of a given award period from three to four years;
- Increasing the level of funding per award;
- Requiring that a portion of a proposal budget be allocated to a “Seed Fund”; and
- Awards under this solicitation will be Cooperative Agreements.

The solicitation asserts the role of the BD Hubs in the big data ecosystem, and in the NSF Harnessing the Data Revolution (HDR) Big Idea. It further reaffirms attention to sustainability, and strengthens the role of the regional community in the operation of the BD Hub.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 18-1), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Big Data Regional Innovation Hubs (BD Hubs)
Accelerating the Big Data Innovation Ecosystem

Synopsis of Program:

NSF's Directorate for Computer and Information Science and Engineering (CISE) initiated the National Network of Big Data Regional Innovation Hubs (BD Hubs) program in FY 2015 (NSF 15-562). Four Big Data Hubs (BD Hubs) —*Midwest*, *Northeast*, *South,* and *West*—were established, one in each of the four Census Regions of the United States [1]. The BD Hubs provide the ability to engage local or regional stakeholders, e.g., city, county, and state governments, local industry and non-profits, and regional academic institutions, in big data research, and permit a focus on regional issues. These collaborative activities and partnerships play a critical role in building and sustaining a successful national big data innovation ecosystem.

This solicitation continues the operation of a national network of BD Hubs. It builds on demonstrated strengths of the program, which has grown to include a set of BD Spokes affiliated with the BD Hubs, and is responsive to the recent developments in data science. For instance, the recently released report on Data Science for Undergraduates: Opportunities and Options from the National Academies of Sciences, Engineering, and Medicine exemplifies the urgency of multi-faceted education and training in data science. The BD Hubs will continue to nucleate regional collaborations and multi-sector projects, while fostering innovation in data science.

The NSF BD Hubs program is aligned with NSF’s Harnessing the Data Revolution (HDR) Big Idea, one of NSF’s 10

Big Ideas for Future Investment. HDR is a visionary, national-scale activity to enable new modes of data-driven discovery, allowing fundamentally new questions to be asked and answered in science and engineering frontiers, generating new knowledge and understanding, and accelerating discovery and innovation. The HDR vision is realized via a coordinated set of program solicitations resulting in an ecosystem of interrelated activities enabling (i) research in the foundations of data science; frameworks, algorithms, and systems for data science; and data-driven research in science and engineering; (ii) advanced cyberinfrastructure; and (iii) education and workforce development—all of which are designed to amplify the intrinsically multidisciplinary nature of the data science challenge. The HDR Big Idea will establish theoretical, technical, and ethical data science frameworks, and apply them to practical problems in science and engineering, and in society more generally.

Please note that this particular solicitation is not meant to be a source of funding for new research. Other funding opportunities relevant to the NSF HDR Big Idea include, but are not limited to, Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA);

Cyberinfrastructure for Sustained Scientific Innovation (CSSI) - Data and Software: Elements and Frameworks;

Resource Implementations for Data Intensive Research in the Social, Behavioral and Economic Sciences (RIDIR); and

Partnerships between Science and Engineering Fields and the NSF TRIPODS Institutes (TRIPODS + X).

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[1] Census Regions map: https://www.census.gov/geo/reference/webatlas/regions.html.

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.

- Beth A. Plale, Science Advisor, CISE/OAC, National Science Foundation, E10475, telephone: (703) 292-7004, email: BDHubQueries@nsf.gov
- Alejandro M. Suarez, Assistant Program Director, CISE/OAC, National Science Foundation, E10457, telephone: (703) 292-7092, email: BDHubQueries@nsf.gov

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

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4

Up to four awards are anticipated.

Anticipated Funding Amount: $16,000,000

Up to four projects will be funded, each up to a maximum of $4,000,000 for up to 4 years, subject to the availability of funds and quality of proposals received.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

At least one PI or co-PI of a proposal submitted in response to this solicitation must be a PI, co-PI, or Senior Personnel on one of the four currently-funded BD Hubs projects.

Limit on Number of Proposals per Organization: 1

An organization may only submit one proposal.

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

The PI may be affiliated with only one proposal in this competition, and may not serve as PI, co-PI, or senior personnel on any other proposal in this competition. These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first proposal submitted will be accepted and the remainder will be returned without review). No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via 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

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

  December 18, 2018

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

TABLE OF CONTENTS

Summary of Program Requirements

I. Introduction

II. **Program Description**

III. **Award Information**

IV. **Eligibility Information**

V. **Proposal Preparation and Submission Instructions**
- A. Proposal Preparation Instructions
- B. Budgetary Information
- C. Due Dates
- D. FastLane/Grants.gov Requirements

VI. **NSF Proposal Processing and Review Procedures**
- A. Merit Review Principles and Criteria
- B. Review and Selection Process

VII. **Award Administration Information**
- A. Notification of the Award
- B. Award Conditions
- C. Reporting Requirements

VIII. **Agency Contacts**

IX. **Other Information**

I. INTRODUCTION

In 2015, NSF launched the Big Data Regional Innovation Hubs program (BD Hubs) as one component of a national big data innovation ecosystem, to help nucleate regional collaborations and multi-sector projects, and foster innovation in data science. Four BD Hubs were funded in each of the Census Regions of the country—*Midwest*, *Northeast*, *South*, and *West*. The BD Hubs serve as a venue for building and fostering local and regional data-related activity in city, county, and state governments, in local industry and non-profits, and in regional academic institutions. Collaborative activities and partnerships emerging from a regional focus contribute to building and sustaining a successful national big data innovation ecosystem.

During the first stage, begun in 2015, the BD Hubs established themselves as regional resources and, in certain cases, a national resource for facilitating activity around big data and data science. In doing so, they convened a variety of stakeholders, both regionally and nationally, working on issues of shared interest; accelerated ideation leading to new projects; served as collectives for shared technical and organizational resources; and fostered training in data science. Over this period of time, they also undertook cross-BD Hub and cross-regional activities, working across BD Hub "boundaries," for instance, creating the *National Transportation Data Challenge*. More recently, the BD Hubs have enabled a set of BD Spokes that have accelerated progress on regional and national grand challenges.

Since the establishment of the BD Hubs in 2015, the field of big data and data science has continued to expand and evolve. In 2016, NSF unveiled a set of "Big Ideas"—10 bold, long-term research and process ideas that identify areas for future investment at the frontiers of science and engineering—and one of those Big Ideas is Harnessing the Data Revolution (HDR). HDR is a visionary, national-scale activity to enable new modes of data-driven discovery, allowing fundamentally new questions to be asked and answered in science and engineering frontiers, generating new knowledge and understanding, and accelerating discovery and innovation. The HDR vision is realized via a coordinated set of program solicitations resulting in an ecosystem of interrelated activities enabling (i) research in the foundations of data science; frameworks, algorithms, and systems for data science; and data-driven research in science and engineering; (ii) advanced cyberinfrastructure; and (iii) education and workforce development—all of which are designed to amplify the intrinsically multidisciplinary nature of the data science challenge. The HDR Big Idea will establish theoretical, technical, and ethical data science frameworks, and apply them to practical problems in science and engineering, and in society more generally. The BD Hubs program is aligned with the HDR Big Idea.

II. PROGRAM DESCRIPTION

The BD Hubs develop and maintain a community of stakeholders in a region through *communication and outreach* and through *accelerating academic, industry, and community stakeholder engagement in big data and data science.* This solicitation increases the duration of BD Hubs awards from three to four years so as to better support stakeholder commitment and promote sustainability of the BD Hubs. It strengthens the role of regional community members in governance of a BD Hub. Awards are expected to be Cooperative Agreements between NSF and the awardee(s), which may in turn be in the form of Collaborative Awards. Funds for years three and four of a given project will be released subject to agreed-upon milestones, a mid-term project review (24 months after the project begins), approval by NSF, and the availability of funds.

BD Hubs activities. The BD Hubs connect within and across regions to foster activity around big data and data science. Their specific activity in accelerating engagement falls into three general categories: programmatic activities, socio-technical services, and education and workforce training. Some of these activities serve the community, either in service of community-led activity or by working hand-in-hand with members of the community. Types of anticipated accomplishments for a given BD Hub include, but are not limited to, the

following:

Programmatic activities that accelerate academic, industry, and community stakeholder engagement in big data and data science such as:

- Fostering ideation among academic, industry, and community stakeholders;
- Developing transformative initiatives and programming in response to regional or national needs;
- Regionally engaging thought leaders; and
- Providing staff resources in aid of community-led activity.

Socio-technical shared resources/services such as:

- Acting as a coordination entity to help BD Hubs, BD Spokes, and HDR projects make their data more findable, accessible, interoperable, and reusable;
- Serving as a central repository of resources and expertise for best practices, such as data use agreements or data curation services within the region;
- Serving as a clearinghouse for regional partners with data, researchers with expertise, and educators with curricular materials;
- Identifying and fostering responses to incomplete data infrastructure, such as persistent ID services; and
- Brokering partnerships among stakeholders through seed funding to stimulate big data and data science innovation.

Data science education and workforce development activities such as:

- Responding to regional needs for data science education and workforce training, including serving as a clearinghouse of effective practices;
- Facilitating opportunities for student internships with industry;
- Providing a platform or forum for broadening participation in data science; and
- Conducting data science educational activities.

BD Hubs sustainability. For this solicitation, the BD Hubs award duration has been increased to four years. Along with this change is the *requirement for a sustainability plan* that captures the multiple facets of sustainability: the sustainability plan tracks and reports income to the BD Hub from sources outside of the BD Hubs program; it conveys a clear picture of how the organizational structure can be responsive to increased funding activity; and it has a well-defined strategy for developing outside sources. The BD Hubs have demonstrated success in obtaining funding from other agencies and stakeholders; this kind of funding is an important form of sustainability in the long term.

Some of the opportunities that present themselves to the BD Hubs may be national in nature; large industries or federal agencies, for instance, are not regionally focused. In order for the BD Hubs to be responsive to national opportunities, the eventual funded BD Hubs should plan to work collaboratively with one another to *form a lightweight national BD Hubs entity* that has shared and equitable leadership (such as through a rotating chairperson role among each BD Hub on an yearly basis). The formation of such an organizational entity can be specified as a task to undertake following award. Having a lightweight coordination body in place to respond to national opportunities better positions the BD Hubs collectively to respond to future opportunities such as those related to the HDR Big Idea.

BD Hubs governance and community representation. A successful BD Hub will represent the priorities, voices, and opportunities of the active members of its community through empowerment and shared outcomes. Flourishing and active community engagement can be accomplished through an empowered Steering Committee, an active Executive Director (ED) office, and defined roles and responsibilities for each that can offer checks and balances. While existing BD Hubs have Steering Committees comprising community members, a proposal that is responsive to this solicitation will ensure more responsibility and influence by the Steering Committee on a given BD Hub's priorities.

A BD Hub will be operated by the ED office, which will comprise key staff. Examples of key staff include PIs, the ED, Deputy ED, and Project Managers. Each BD Hub must support the equivalent of a full-time, paid ED position (who may also serve as a project PI/co-PI) along with associated staff positions that will oversee day-to-day operations of the BD Hub. Strategic decisions of the ED office should be accountable to a Steering Committee.

The Steering Committee should be small enough to be effective as a decision-making body. It will be representative of the community, consist of volunteers, and may need to utilize short rotations of membership to achieve full representation. The composition of the Steering Committee is encouraged to be representative of the diversity of interests in the proposed BD Hub while also considering representation from underrepresented groups. The Steering Committee should have substantial input in prioritization and allocation of the BD Hub's resources subject to relevant legal statutes. This includes a requirement for each BD Hub to administer a Seed Fund:

Each BD Hub must allocate $250,000 annually of its budget for seed funding for new opportunities, that is, for a ***Seed Fund****.* The Seed Fund will be allocated on a competitive basis for small conferences, planning grants, travel, etc. The *Steering Committee should be responsible for defining policy and processes for allocating the Seed Fund*.

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4 Up to four awards are anticipated

Anticipated Funding Amount: $16,000,000

Up to four projects will be funded, each up to a maximum of $4,000,000 for up to 4 years, subject to the availability of funds and quality

of proposals received.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

At least one PI or co-PI of a proposal submitted in response to this solicitation must be a PI, co-PI, or Senior Personnel on one of the four currently-funded BD Hubs projects.

Limit on Number of Proposals per Organization: 1

An organization may only submit one proposal.

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

The PI may be affiliated with only one proposal in this competition, and may not serve as PI, co-PI, or senior personnel on any other proposal in this competition. These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first proposal submitted will be accepted and the remainder will be returned without review). No exceptions will be made.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

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

The following instructions supplement guidance in the PAPPG:

Proposal Titles: Proposal titles must take the form **BD Hubs: Region: Title**. If a proposal is Collaborative, the title is **BD Hubs: Collaborative Proposal: Region: Title**.

Project Summary (1-page limit): At the top of the Overview text box, enter the title of the BD Hubs project. Provide a summary description. All project summaries must include a list of three to six keywords at the end of the broader impacts text box.

Project Description. The Project Description is limited to 15 pages, and in addition to guidance in the PAPPG, must address the following topics:

- *Anticipated Priorities, Activities, and Socio-technical Services*: The BD Hubs activities and resources fall into three general categories: programmatic activities, socio-technical services, and education and workforce training. However, the specific activity of the ED office is both in leading and in supporting the community. That is, the ED office might develop innovative programming that responds to a community need, but might also work in service of community-led activity that is deemed to be a priority of the BD Hub. The Seed Fund, for instance, will generate new community activity for which the ED office will need to be responsive. In this section, describe anticipated priorities, activities, and socio-technical services of the BD Hubs. While not all activities can be anticipated, the set of activities should demonstrate both the strong innovation capabilities of the ED office and its responsiveness to the community. *It should additionally describe proposed activities by members of the community that have the potential to strengthen the BD Hub role as a hub for big data innovation in the region*.
- *Evaluation Plan:* Proposals must include an evaluation plan. The evaluation plan specifies criteria or metrics relevant to the goals of the project, and gives a description of how the evaluation will be conducted. *The BD Hub must undergo an external evaluation at the mid-point of the project.* This may require a Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis to be performed at the beginning of the project, for use in assessing progress at the end of year 2.
- *BD Hub Sustainability Plan:* Proposals must include a sustainability plan. The sustainability plan should include i) how funding and/or Program Income from sources outside the BD Hubs program is tracked and reported, ii) how the organizational structure can scale to handle the workload created by a growing and sustainable organization, and iii) a well-defined strategy for developing outside funding sources and/or program income sources. Program Income is defined at https://www.nsf.gov/pubs/policydocs/pappg18_1/pappg_8.jsp#VIIID4.
- *Results from Prior NSF Support:* The previous BD Hubs award that funded the PI should be included in the list of awards in this section and should address (in addition to PAPPG criteria) accomplishments specific to the evaluation criteria of the original award.

Supplementary Documents: Supplementary documents are limited to the specific types of documentation listed in the PAPPG, with a few exceptions, as specified below. Any special information or supplementary documentation that has not been explicitly allowed in the PAPPG or this solicitation, such as article reprints or preprints, or appendices, will not be considered during the review process.

Collaboration and Management Plan. In 1-3 pages, describe the BD Hub governance and community representation. The plan should address the following:

Organizational Structure. The primary organizational entities of a BD Hub should be its BD Hub ED office and Steering Committee. The ED office should be structured to both support the BD Hub's mix of programmatic activities and socio-technical/educational services, and be responsive to the needs of the community. As such, the structure should reflect the organization's ability to be both innovative and responsive. It should additionally be clear from the organizational structure how the organization will grow in response to outside funding.

A BD Hub is operated by the ED office and is made up of key staff. Examples of key staff include PIs, the ED, Deputy ED, and Project Managers. Each BD Hub must support the equivalent of a full-time, paid ED position (who may also serve as a project PI/co-PI) along with associated staff positions that will oversee day-to-day operations of the regional BD Hub. Strategic decisions of the ED office should be accountable to a Steering Committee. The decisions of the PI and the Steering Committee are accountable to NSF in the context of the Cooperative Agreement.

The Steering Committee will be small enough to be effective as a decision-making body. It will be representative of the community, consist of volunteers, and may need to utilize short rotations of membership to achieve full representation. Steering Committee membership is voluntary and not remunerate. The composition of the Steering Committee is encouraged to be representative of the diversity of interests in the proposed BD Hub and also consider representation from underrepresented groups.

The PI of a BD Hub should be a permanent voting member of the Steering Committee. Co-PIs can be members of the Steering Committee but not in permanent roles.

National Coordination Entity. The regional BD Hub will contribute to a national coordination entity, a lightweight entity that is equitably supported and led by all the BD Hubs. The plan should identify the BD Hub's role in creating and sustaining a national coordination entity. The national entity should be staffed through modest contributions of time by each BD Hub and have oversight by the respective BD Hubs' Steering Committees. A timeline for formation of the national organization should be included in the plan.

Roles and Responsibilities. The plan should include a high-level breakdown of key staff roles and responsibilities associated with the proposed programmatic activities, socio-technical services, and educational activities to be undertaken by the BD Hub. Examples of key personnel and support staff might include PIs, the ED, Deputy ED, Project Managers, etc. The breakdown of roles and responsibilities should include human resources provided through collaborative awards, subawards, subcontracts, unfunded collaborations, etc. Include a description of prior experience of the project personnel related to BD Hubs.

Roles and responsibilities should be provided for the Steering Committee as well. The Steering Committee should have substantive authority over the seed investments of the BD Hub (the Seed Fund) and other major decisions involving allocation of BD Hub resources subject to relevant legal statutes. The role of the ED office in the management and support of the Seed Fund should be clearly evidenced. The Seed Fund can fund resources either within or outside the host institution(s) for the BD Hub, and can be used to fund resources within the ED staff as well.

Timeline. The plan should provide a timeline for the proposed effort, and address risk mitigation factors such as loss of key personnel.

Data Management Plan. Proposals must include as a supplementary document a Data Management Plan (DMP) of no more than two pages prepared in accordance with the guidance located at https://www.nsf.gov/bfa/dias/policy/dmp.jsp and CISE-specific guidance at https://www.nsf.gov/cise/cise_dmp.jsp. The DMP will be evaluated as an integral part of each proposal during the merit review process.

The DMP should additionally identify the data and software assets that are to be created by the BD Hub or entrusted to its care. It should identify the individual who has the role of data steward for managing these data and software assets. The DMP should further discuss commitments, data use agreements, and sharing arrangements for the data and software created by the BD Hub or entrusted to its care.

Postdoctoral Mentoring Plan. This one-page supplementary document, describing how postdoctoral researchers will be mentored, is required of all proposals that will provide funding to postdoctoral researchers. The lead institution provides this mentoring plan for the entire project. Reviewers will be asked to review the mentoring plan, as appropriate.

Letters of Collaboration. Documentation of collaborative arrangements of significance to the proposal through letters of collaboration must be included [see PAPPG Chapter II.C.2.d.(iv) for details]. All letters of collaboration must provide specific information regarding the collaboration, including whether it involves sharing resources (data, access to computational resources, or use of other equipment), time and effort, etc. No other type of letter can be provided; other types of letters will be ignored. The lead institution submits the letters of collaboration.

List of Project Personnel and Partner Organizations (note: in collaborative proposals, only the lead institution should provide this information)**.** Provide current, accurate information for all personnel and organizations involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list must include all PIs, co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdoctoral researchers, project-level advisory committee members, and writers of letters of collaboration. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. Jose Garcia; University of PQR; Senior Personnel
3. Jane Brown; XYZ University; Postdoctoral researcher
4. Bob Adams; ABC Inc.; Paid Consultant
5. Miao Cho; Welldone Institution; Unpaid Collaborator
6. Tim Green; ZZZ University; Subawardee

Proposals that do not comply with the preparation instructions above may be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

It is expected that at least one PI, co-PI, or Senior Personnel from each funded project will attend an annual national meeting of all funded BD Hubs. Proposals must budget for these individuals to attend this annual meeting, including funds for travel and subsistence for this event in the Washington, DC region.

Each BD Hub must allocate $250,000 annually of its budget for a Seed Fund. Awards are expected to be in the form of staff resources or subawards made throughout the life of the BD Hubs funding. The Seed Fund can fund resources either within or outside the host institution(s) for the BD Hub, and can be used to fund resources within the ED office staff as well.

C. Due Dates

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

  December 18, 2018

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once

registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://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 are strongly encouraged to use FastLane 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

NSF reviewers will additionally address the degree to which the proposal:

1. Defines concrete programmatic activities, socio-technical services, and educational activities;
2. Has an organizational model that is sufficiently agile to support proposed activities, including the Seed Fund, and anticipated future growth;
3. Has mechanisms for reaching a broad community within a region, and for hearing back from the community and responding to its needs;
4. Participates in and substantively contributes to a national BD Hubs ecosystem;
5. Has an evaluation plan that allows external stakeholders to assess success of the organization and allows the internal organizational entities to actively improve over the course of the award period; and
6. Address prior experience and success of the leadership team in prior BD Hub activities.

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) 292-7827 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 *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.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov

constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

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

VIII. AGENCY CONTACTS

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

General inquiries regarding this program should be made to:

- Beth A. Plale, Science Advisor, CISE/OAC, National Science Foundation, E10475, telephone: (703) 292-7004, email: BDHubQueries@nsf.gov
- Alejandro M. Suarez, Assistant Program Director, CISE/OAC, National Science Foundation, E10457, telephone: (703) 292-7092, email: BDHubQueries@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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 http://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 Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314