Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)

PROGRAM SOLICITATION
NSF 18-539

REPLACES DOCUMENT(S):
NSF 17-534

National Science Foundation

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

Directorate for Engineering

Directorate for Mathematical & Physical Sciences
    Division of Mathematical Sciences

Directorate for Social, Behavioral & Economic Sciences

Submission Window Date(s) (due by 5 p.m. submitter's local time):

   May 07, 2018 - May 14, 2018

IMPORTANT INFORMATION AND REVISION NOTES

Many participating NSF directorates/divisions have provided research themes and topics of interest, described in the *Areas of Interest* section, towards the end of Section II Program Description.

The cloud usage option continues in FY 2018. The Cloud Costing and Annual Usage Plan is now a maximum of two pages. In addition, an Excel Workbook describing cloud usage plans, if any, is now required to be submitted separately by email within five business days after the last day of the solicitation submission window (see Section V, Proposal Preparation and Submission Instructions).

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:

   Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)

Synopsis of Program:

   The *BIGDATA* program seeks novel approaches in computer science, statistics, computational science, and mathematics leading towards the further development of the interdisciplinary field of *data science.* The program also seeks innovative applications in domain science, including social and behavioral sciences, education, physical sciences, and engineering, where data science and the availability of big data are creating new opportunities for research and insights not previously possible.

   The solicitation invites two categories of proposals:

- **Foundations (BIGDATA: F):** those developing or studying fundamental theories, techniques, methodologies, and technologies of broad applicability to big data problems, motivated by specific data

challenges and requirements; and

- **Innovative Applications (BIGDATA: IA):** those engaged in *translational* activities that employ new big data techniques, methodologies, and technologies to address and solve problems in specific application domains. Projects in this category must be collaborative, involving researchers from domain disciplines and one or more methodological disciplines, e.g., computer science, statistics, mathematics, simulation and modeling, etc.

Proposals are expected to be well motivated by specific big data problems in one or more science and engineering research domains. All proposals are expected to clearly articulate the big data aspect(s) that motivate the research. *Innovative Applications* proposals must provide clear examples of the impacts of the big data techniques, technologies and methodologies on applications in one or more domains.

In FY 2018, the BIGDATA program continues the cloud option that was introduced in FY 2017, in partnership with Amazon Web Services (AWS), Google Cloud, IBM, and Microsoft Azure (see *Use of Cloud Resources,* at the end of Section II, Program Description).

Before preparing a proposal in response to this BIGDATA solicitation, applicants are strongly urged to review other related programs and solicitations and contact the respective NSF program officers to identify whether those solicitations are more appropriate. In particular:

- Proposals that focus exclusively on areas of biology supported by NSF's Directorate for Biological Sciences (BIO) should be submitted to programs such as Advances in Biological Informatics that are managed by the BIO Division of Biological Infrastructure (DBI; https://www.nsf.gov/div/index.jsp?div=DBI);

- Proposals specific to geosciences that respond to the community needs and requirements expressed by the geosciences community should consider the EarthCube program for *Developing a Community-Driven Data and Knowledge Environment for the Geosciences* (https://www.nsf.gov/geo/earthcube/);

- For the development of robust and shared data- or software-centric cyberinfrastructure capabilities, applicants should consider the *Cyberinfrastructure for Sustained Scientific Innovation - Data and Software* program (CSSI; https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505505);

- For computational and data science research not specifically addressing big data issues, applicants should consider the *Computational and Data Enabled Science and Engineering* program (CDS&E; https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504813);

- For work that is focused more on scaling performance of software rather than data-related issues, applicants should consider the *Scalable Parallelism in the Extreme* program (SPX; https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505348);

- Proposals that focus on research in mathematics or statistics that is not tied to a specific big data problem should be submitted to the appropriate program within NSF's Directorate for Mathematical & Physical Sciences (MPS) Division of Mathematical Sciences (DMS); see a list of DMS programs at https://www.nsf.gov/funding/programs.jsp?org=DMS; and

- Proposals that focus on research relevant to NSF's Directorate for Computer and Information Science and Engineering (CISE) not tied to a specific big data problem should be submitted to the appropriate CISE program, including the core programs:
  - Computer and Network Systems (CNS) Core Programs: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17570;
  - Computing and Communication Foundations (CCF) Core Programs: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17571; and
  - Information and Intelligent Systems (IIS) Core Programs: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17572.

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.

- Chaitanya Baru, Senior Advisor for Data Science, CISE/OAD, telephone: (703) 292-4541, email: cbaru@nsf.gov

- Sylvia Spengler, Lead Program Director for BIGDATA, CISE/IIS, telephone: (703) 292-8930, email: sspengle@nsf.gov

- John C. Cherniavsky, Program Director, EHR/DRL, telephone: (703) 292-5136, email: jchernia@nsf.gov

- Almadena Y. Chtchelkanova, Program Director, CISE/CCF, telephone: (703) 292-8910, email: achtchel@nsf.gov

- David Corman, Program Director, CISE/CNS, telephone: (703) 292-8754, email: dcorman@nsf.gov

- James C. French, Program Director, CISE/IIS, telephone: (703) 292-8930, email: jfrench@nsf.gov

- Nandini Kannan, Program Director, MPS/DMS, telephone: (703) 292-8104, email: nakannan@nsf.gov

- Sara Kiesler, Program Director, SBE/SES, telephone: (703) 292-8643, email: skiesler@nsf.gov

- Anthony Kuh, Program Director, ENG/ECCS, telephone: (703) 292-2210, email: akuh@nsf.gov

- Alexis Lewis, Program Director, ENG/CMMI, E 13328, telephone: (703) 292-2624, email: alewis@nsf.gov

- Bogdan Mihaila, Science Advisor, MPS/OAD, telephone: (703) 292-8235, email: bmihaila@nsf.gov

- Christina Payne, Associate Program Director, ENG/CBET, telephone: (703) 292-2895, email: cpayne@nsf.gov

- Rahul T. Shah, Program Director, CISE/CCF, telephone: (703) 292-2709, email: rshah@nsf.gov

- Ralph Wachter, Program Director, CISE/CNS, telephone: (703) 292-8950, email: rwachter@nsf.gov

- Maria Zemankova, Program Director, CISE/IIS, telephone: (703) 292-7348, email: mzemanko@nsf.gov

- Aidong Zhang, Program Director, CISE/IIS, telephone: (703) 292-5311, email: azhang@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement

Estimated Number of Awards: 25 to 33

About 25-33 projects will be funded, subject to availability of funds.

Anticipated Funding Amount: $24,000,000

Up to $24,000,000 will be invested by NSF in proposals submitted to this solicitation, subject to the availability of funds. Additional cloud credits/resources will be provided by AWS, Google, IBM, and Microsoft.

Projects will typically receive NSF funding in the range of $200,000 to a maximum of $500,000 per year, for 3 to 4 years of support. The minimum award size will be $600,000 of total NSF funding, reflecting the minimum expected level of effort for BIGDATA projects. The maximum award size will be $2,000,000 of total NSF funding. BIGDATA projects are expected to be multidisciplinary in nature and include significant student involvement. Any allocation of cloud credits/resources from AWS, Google, IBM, or Microsoft will be in addition to the NSF funding. If additional cloud providers join the program, resources/credits from those providers will be available under the same terms and conditions as described in this solicitation.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An individual may participate as Principal Investigator (PI), co-PI, Senior Personnel, consultant, or any other role in **no more than one proposal**, or related subaward, submitted in response to this solicitation.

In the event that an individual exceeds this limit, any proposal submitted to this solicitation with this individual listed as a PI, co-PI, senior personnel, consultant or any other role after the first proposal is received at NSF will be returned without review. **No exceptions will be made.**

Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals concurrently under consideration by NSF.

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

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

    May 07, 2018 - May 14, 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:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Standard NSF reporting requirements apply.

TABLE OF CONTENTS

I. INTRODUCTION

The NSF research program on *Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)* seeks to further develop *data science,* a transdisciplinary field of research, to understand phenomena through data analytics and massive computation on vast amounts of empirical data. This solicitation invites proposals that focus on the *foundations* of data science and *innovative applications* of data science. Of particular interest are proposals for which data science and the availability of big data are creating new opportunities for research not possible before, as well as proposals that explore research topics identified by participating NSF directorates listed in this solicitation. In addition, the cloud option for proposals, which was first introduced in the FY 2017 *BIGDATA* solicitation, is continued in this solicitation through the partnership of NSF with AWS, Google, IBM, and Microsoft Azure. If additional cloud providers join the program, resources/credits from those providers will be made available under the same terms and conditions as described in this solicitation. The BIGDATA program webpage (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504767) provides the current list of cloud partners participating in the program.

The BIGDATA program is a component of NSF's Harnessing the Data Revolution for 21st-Century Science and Engineering Big Idea.

II. PROGRAM DESCRIPTION

Proposers must choose one of two categories: **Foundations (F)** or **Innovative Applications (IA)**.

Foundations (BIGDATA: F): Proposals in this category are expected to address the development of highly innovative, fundamental techniques, theories, methodologies, and technologies for big data management and/or analytics—including knowledge management, semantic technologies, and foundational mathematical, statistical, and probabilistic approaches—that have wide applicability beyond specific narrow domains. Proposals must justify why the new methods are needed, and why general extensions of small data models, methods, and/or approaches are not adequate.

Proposals focusing on design and development of novel systems addressing emerging challenges in big data such as *fairness, interpretability, modeling transparency, algorithmic accountability*, *reproducibility*, and *multi-modal interfaces to data* are encouraged.

Innovative Applications (BIGDATA: IA): Proposals in this category must focus on the development of innovative big data techniques, methodologies, and technologies for specific application areas, or innovative adaptations of existing big data techniques, methodologies, and technologies to new application areas. Proposals must address a big data challenge of key importance to at least one application domain from one of the participating NSF directorates. Proposals should be clear about how research in the domain is enabled by the availability of big data and insights provided by the analysis of these big data, i.e., how new problems can be addressed that could not previously be addressed.

It is expected that projects in this category will require close interaction among researchers from technical/methodological disciplines and those from science and engineering application domains, in order to explore complex, data-driven questions in one or more domains, including the development of domain-specific and cross-domain knowledge structures. Thus, projects are expected to be collaborative in nature, involving researchers from domain disciplines and one or more technical disciplines such as computer science, mathematics, statistics, computational science, etc., stimulating further research on all sides of the collaboration.

Applicants considering submitting proposals in this category are *strongly encouraged* to discuss their planned research with one or more program officer(s) from the respective NSF directorate(s), in advance of submitting the proposal. It is anticipated that proposals awarded in this category will be jointly, or fully, funded by the participating NSF directorate(s) interested in the application area(s).

The BIGDATA solicitation encourages projects to address *reproducibility and replicability* of the proposed experimental, methodological, and computational approaches in both categories. Given the varying definitions of "replicability", "repeatability", "reproducibility", and like terms, in different contexts, and across different domains and user communities, PIs should clearly indicate which definition(s) is (are) most appropriate for their approaches. PIs are also encouraged to retain relevant digital data, software, and/or algorithms with documentation describing the study design, preprocessing pipelines, statistical methods, and computational platforms. This information may be provided as part of a project's Data Management Plan.

Areas of Interest

Some of the participating NSF directorates/divisions have provided research themes and areas of interest.

MPS/DMS is interested in foundational mathematical and statistical approaches to big data challenges generated by complex dependence structures, missing information, sparsity, and heterogeneous data. Proposals must describe the specific big data challenges being addressed and justify why the proposed research cannot be considered in one of the "core" DMS programs.

The Directorate for Education and Human Resources (EHR) is interested in fostering novel, transformative, multidisciplinary approaches that address the use of large data sets and/or learning analytics software to create actionable knowledge for improving

STEM teaching and learning environments (formal and informal) in the medium term, and to revolutionize learning in the longer term.

The Directorate for Social, Behavioral and Economic Sciences (SBE) is interested in research that advances computational social science and analytic methods using social network, sensor, text, video, administrative, and other big data. Example topics include algorithms for social policy choices; cognitive assistance; promoting American competitiveness and economic opportunity, health, and well-being in different regions and populations; new forms of work; financial markets and critical institutions of society; and the intersection of law, governance, and data science.

The Directorate for Engineering (ENG) is interested in topics specified by the programs belonging to the Divisions of Civil, Mechanical, and Manufacturing Innovation (CMMI); Chemical, Bioengineering, Environmental, and Transport Systems (CBET); and Electrical, Communications, and Cyber Systems (ECCS). Engineering-specific applications, however, must incorporate aspects of data science, data analytics, or innovation in data-driven discovery at a level significantly beyond the scope of existing ENG programs.

Use of Cloud Resources

In FY 2018, the program continues support for the cloud option, initiated in FY 2017. AWS, Google Cloud, IBM, and Microsoft Azure are participating in the program to provide cloud credits/resources to projects that require significant storage and computational resources. The objective is to encourage projects that focus on large-scale experimentation and scalability studies. If additional cloud providers join the program, resources/credits from those providers will be available under the same terms and conditions as described in this solicitation.

While the technical description and justification for use of cloud resources would be expected to be part of the Project Description, details of the cloud resource costing and annual cloud resource usage should be included in the Supplementary Documents section of a given proposal. See Section V.A.5.b, Cloud Costing and Annual Usage Plan, for details on how to provide detailed costing and annual usage information for cloud resources under Supplementary Documents.

For projects interested in utilizing cloud resources, the request for cloud credits/resources must adhere to a **maximum** 70-30 split in funding between the requested NSF funds and the requested cloud resources, respectively. In other words, if such a project requests $700,000 in NSF funds, then the **maximum** that it may request in cloud credits/resources is $300,000. The **minimum** cloud resource request for a project is $100,000, regardless of the NSF budget request—since the objective of this program is to support large-scale experimentation using the cloud resources, and not "routine" use. As an example, a proposal that requests $1,000,000 in NSF funds could request between $100,000 (the minimum allowed) and $430,000 (the maximum allowed according to the 70-30 split) in cloud credits/resources. The $1,000,000 would be requested in the NSF Budget, with the usual NSF Budget Justification; the cloud credit/resource request—in the range $100,000 to $430,000 for this example—would **not appear** in the NSF Budget pages nor in the NSF Budget Justification section, but rather under Supplementary Documents as described in Section V.A.5.b.

The technical justification for use of cloud resources that is included in the Project Description, coupled with the cost computation used to arrive at the requested amount of credits/resources as well as the detailed annual plan for usage of these credits/resources over the duration of the project included in the Supplementary Documents, will be carefully reviewed as part of the proposal review process.

III. AWARD INFORMATION

Estimated program budget, number of awards, and average award size/duration are subject to the availability of funds. An estimated 25-33 projects will be funded, subject to availability of funds. Up to $24,000,000 will be invested by NSF in proposals submitted to this solicitation, subject to the availability of funds.

Projects will typically receive NSF funding in the range of $200,000 to a maximum of $500,000 per year, for 3 to 4 years of support. The minimum award size will be $600,000 of total NSF funding, reflecting the minimum expected level of effort for BIGDATA projects, which are expected to be multidisciplinary in nature and include significant student involvement. Any allocation of cloud credits/resource from AWS, Google, IBM, or Microsoft will be in **addition** to the NSF funding.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An individual may participate as Principal Investigator (PI), co-PI, Senior Personnel, consultant, or any other role in

no more than one proposal, or related subaward, submitted in response to this solicitation.

In the event that an individual exceeds this limit, any proposal submitted to this solicitation with this individual listed as a PI, co-PI, senior personnel, consultant or any other role after the first proposal is received at NSF will be returned without review. **No exceptions will be made.**

Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals concurrently under consideration by NSF.

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.

1. **Proposal Title.** The proposal title must indicate the BIGDATA program followed by a colon, then the category ("F" for Foundations, "IA" for Innovative Applications) followed by a colon, and then the title of the project. Thus, proposal titles would be **BIGDATA: F: Title** or **BIGDATA: IA: Title**. Titles of collaborative proposals should be prepared in a similar manner, but should also include "Collaborative Research:" immediately after F or IA. Thus, the title of each proposal for a collaborative set of proposals would be **BIGDATA: F: Collaborative Research: Title** or **BIGDATA: IA: Collaborative Research: Title**.

2. **Project Summary (1-page limit).** At the top of the Overview text box enter the title of the BIGDATA project, the name of the PI, and the lead institution. Provide a summary description of the BIGDATA project, including its transformative research and education goals, and the community (communities) that will be impacted by its results. In the separate text boxes, provide succinct summaries of the intellectual merit and broader impacts of the proposed project.

   All proposals—*Foundations (BIGDATA: F)* as well as *Innovative Applications (BIGDATA: IA)*—must specify one or more relevant participating NSF directorate(s) for the project on a separate line at the bottom of the Broader Impacts text box:

      - Computer and Information Science and Engineering (CISE);
      - Education and Human Resources (EHR);
      - Engineering (ENG);
      - Mathematical and Physical Sciences, Division of Mathematical Sciences (MPS/DMS); and
      - Social, Behavioral and Economic Sciences (SBE).

   Keywords. All project summaries should include a list of three to six keywords at the bottom of the Broader Impacts text box, beginning with the phrase "Keywords:". Proposals using cloud resources should include the term "Cloud Resource" as the first keyword (i.e., **Keywords: Cloud Resource,…**).

3. **Project Description.** There is a 15-page limit for the Project Description.

   The Project Description should clearly identify:

      - The big data challenge(s), and how the proposed work plans to address these challenges;
      - The novelty of the approach.
      - The transformative potential of the proposed research.

- Where appropriate, the applicability of the proposed technique or technology to a specific domain, how it enables significant advances in that domain, and, potentially, beyond that single domain.
- An *evaluation plan* that describes how the theories, techniques, methodologies, and technologies would be evaluated, and that is appropriate for the size and scope of the proposed effort.
  - The plan may include results from the application of these theories, techniques, methodologies, and technologies to specific domains, efficacy or scalability studies, and other such activities. Where applicable, evaluation plans should specify benchmark datasets and competing methods that will be used to evaluate scalability and performance, or address the development of new benchmarks, if needed.
- If the project plans to utilize cloud resources, then it must provide the appropriate technical description(s) and technical justification(s) within the Project Description section.
  - The computation of the total amount and cost of cloud resources along with an annual usage plan over the 3- or 4-year duration of the project must be provided separately in the *Supplementary Documents* section, as described in Section V.A.5.b on Cloud Costing and Annual Usage Plan.

The Project Description must contain, as separate sections within the narrative, a section labeled "Intellectual Merit" and a section labeled "Broader Impacts", as described in Chapter II.C.2.d.i of the NSF PAPPG. ***Proposals that omit these separate sections in the Project Description will be returned without review.***

4. **Proposal Budget.** Proposal budgets should include funds to support PI travel to the annual BIGDATA PI meeting in the Washington, DC, area. It is expected that at least one PI from each funded project will attend, in order to present project research findings and broader impacts. Collaborative proposals involving investigators from multiple disciplines should have PIs from each of the major disciplines for the grants attending the annual meeting.
5. **Supplementary Documents.** Supplementary documents are limited to the specific types of documentation listed in the PAPPG, with exceptions specified below. Proposals containing 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 be returned without review**. Simultaneously submitted collaborative proposals, and proposals that include subawards, are a single unified project. Supplementary documents for such proposals should only be provided in the proposal submitted by the lead institution. See below for specific instructions for each supplementary document type.
   a. **Project Coordination Plan - Required of all proposals (page limit: 2 pages).** BIGDATA projects typically involve multidisciplinary teams of researchers and students. Thus, a Coordination Plan is an essential component of this activity. All proposals must include a supplementary document of no more than two pages labeled "Project Coordination Plan", which must include:
      - The specific roles of the collaborating PIs, Co-PIs, other Senior Personnel, and paid consultants at all organizations involved;
      - How the project will be managed across institutions and disciplines;
      - Identification of the specific coordination mechanisms that will enable cross-institution and/or cross-discipline scientific integration, e.g., workshops, graduate student exchanges, project meetings at conferences, use of videoconferencing and other communication tools, software repositories, etc.;
      - Specific references to the budget line items that support these coordination mechanisms; and
      - A detailed timeline of project activities/milestones.
   b. **Cloud Costing and Annual Usage Plan - Required of proposals requesting the cloud option (page limit: 2 pages).** Projects that intend to request AWS, Google, IBM, or Microsoft cloud resources must include a detailed costing, showing a credit usage/resource consumption plan with the amount and type of storage, compute, and network resources (and any other cloud resources needed that incur costs) to be used during each year of the project.

      The two essential items of the costing plan are:

      - The *total cost* of cloud resources—showing the distribution across storage, compute, and network, etc., resources; and
      - The *annual usage plan*, i.e., how much of these credits/resources will be used each year.

      Separately, in addition to the 2-page Cloud Costing and Annual Usage Plan that is included in the Supplementary Documents, proposers should compile and submit an Excel Workbook using the tabular format found at https://www.nsf.gov/cise/iis/cloudrequestform.xlsx, which contains a single-tab template. The completed workbook should be submitted via email to bigdatacloud@nsf.gov **within five business days** of the last day of the solicitation submission window. The completed workbook should include the FastLane proposal ID (which is assigned after the proposal is submitted to NSF).

      As described earlier in Section II, Program Description, the **minimum** cloud request is $100,000. Requests for less than $100,000 in cloud credits/resources will not be considered. The **maximum** is based on a 70-30 split. For example, a project that requests, $700,000 on the NSF Budget page may request a maximum of $300,000 of cloud credits/resources. Or a project that requests $1,000,000 from NSF can request a maximum of $430,000 of cloud credits/resources.

      Cloud credits and/or resource costs should be computed using the information provided by AWS, Google, IBM, or Microsoft, respectively (see below). Proposers are strongly encouraged to contact the point of contact for each cloud provider to obtain assistance with estimating cloud resources needed for the project. The estimate for cloud resources should account for:

      - Software development and testing;
      - Code inefficiencies and code errors that may consume more resources than anticipated;
      - Additional experiments beyond those initially anticipated; and
      - Storage of essential data and software/virtual machine images for a duration of 5 to 10 years after the end of the project.

      Proposers must use the following resources in order to develop the total cost of cloud resources, and to develop an annual usage plan over the duration of the projects:

- Amazon Web Services:
    - The website for computing AWS compute, storage and networking costs is https://calculator.s3.amazonaws.com/index.html.
    - The website for computing AWS SPOT prices is https://aws.amazon.com/ec2/spot/pricing/.
    - AWS cloud resources are provided as part of the AWS Promotional Credits program (https://aws.amazon.com/awscredits/). Use of AWS credits must adhere to this program. Please refer to the website for information about this program.
    - The AWS technical point of contact is Sanjay Padhi, sanpadhi@amazon.com.
- Google Cloud:
    - The website for computing Google credits/costs is https://cloud.google.com/products/calculator/.
    - The Google Cloud technical point of contact is Karan Bhatia, karanbhatia@google.com.
- IBM:
    - The website for calculating IBM compute, storage, and networking costs is: https://www.ibm.com/cloud/pricing; and
    - The IBM technical point of contact is: Lee B Wilson, IBM Atlanta, wilsol@us.ibm.com.
- Microsoft Azure:
    - The website for computing Microsoft Azure costs is https://azure.microsoft.com/en-us/pricing/calculator/.
    - The Microsoft Azure technical point of contact is Vani Mandava, vanim@microsoft.com.

The request for cloud resources will be reviewed along with the rest of the proposal. Credits will be allocated either for the cloud provider requested in the proposal, or for equivalent resources from an alternative cloud provider.

c. **Data Management Plan, including Software Sharing - Required of all proposals, including those requesting the cloud option (page limit: 2 pages).** Data Management Plans are an important aspect of every proposal and play a critical role in ensuring public access to results of federally-funded research. All proposals must include a supplementary document of no more than two pages labeled "Data Management Plan", which is provided in full by the lead institution.
- The Data Management Plan must include a Software Sharing Plan (described below).
- The Data Management Plan should describe how the project will manage its data and software, and share its research results, data, and software, wherever applicable.
    - If cloud resources are requested to provide longer-term storage, this should also be detailed here.
- The Data Management Plan will be fully evaluated by the reviewers, using NSF review criteria.
- Data management requirements and plans specific to the NSF directorates are available at: https://www.nsf.gov/bfa/dias/policy/dmp.jsp.

The Data Management Plan may include information on:

- The types of data, 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 to them.

A Software Sharing Plan (with appropriate timelines) is required of all proposals as part of the Data Management Plan, labeled "Software Sharing Plan". There is no prescribed single license for software produced through grants responding to this announcement. However, the BIGDATA program does have goals for software dissemination, and reviewers will be instructed to evaluate the dissemination plan relative to these goals:

- The software should be freely available to science and engineering researchers and educators in the non-profit sector, such as education institutions, research institutions, and government laboratories.
- The terms of software availability should permit the dissemination and commercialization of enhanced or customized versions of the software, or incorporation of the software or pieces of it into other software packages.
- The terms of software availability should describe the ability of researchers to modify the source code and to share modifications with other colleagues. An applicant should take responsibility for creating the original and subsequent official versions of a piece of software.
- If a particular license is selected for the software distribution, it should be specified in the proposal. If an open-source license is not selected, the proposal should explain why this decision was made.

d. **Human and Vertebrate Subjects.** Documentation regarding research involving the use of human subjects, hazardous materials, vertebrate animals, or endangered species should be included where applicable. (See PAPPG Chapter II.D.4 and II.D.5).

e. **Letters of Collaboration.** As per the NSF PAPPG (See PAPPG Chapter II.C.2.j), letters of collaboration should be limited to stating the intent to collaborate and should not contain endorsements or evaluation of the proposed project. The recommended format for letters of collaboration is as follows: "If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal."

Please ensure that appropriate details are provided in the Project Description, and/or Facilities, Equipment or Other Resources.

f. **Postdoctoral mentoring plan (page limit: 1 page).** This one-page supplementary document, describing how postdoctoral researchers will be mentored, is required of all proposals that include funding for postdoctoral researchers. The lead institution provides this mentoring plan for the entire project. Reviewers will be asked to review the mentoring plan, as appropriate.

g. **A list of Project Personnel and Partner Institutions (Note: In separately submitted collaborative proposals, only the lead institution should provide this information):**

Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list must include all PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and included (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. John Jones; University of PQR; Senior Personnel
3. Jane Brown; XYZ University; Postdoc
4. Bob Adams; ABC Inc.; Paid Consultant
5. Mary White; Welldone Institution; Unpaid Collaborator
6. Tim Green; ZZZ University; Subawardee

The listing of all project participants is collected by the project lead and entered as a supplementary document, which is then automatically included with all proposals in a project.

6. **Single Copy Documents.**

Collaborators and Other Affiliations Information:

Proposers should follow the guidance specified in Chapter II.C.1.e of the NSF PAPPG. Grants.gov Users: The COA information must be provided through use of the COA template and uploaded as a PDF attachment.

Note the distinction to the list of Project Personnel and Partner Institutions specified above under Supplementary Documents: the listing of all project participants is collected by the project lead and entered as a Supplementary Document, which is then automatically included with all proposals in a project. The Collaborators and Other Affiliations are entered for each participant within each proposal and, as Single Copy Documents, are available only to NSF staff.

Proposals that do not comply with these requirements in the Proposal Preparation instructions 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 from each funded project will attend an annual BIGDATA PI meeting in Washington, DC, to present project research findings and broader impacts. Collaborative proposals involving investigators from multiple disciplines should have PIs from each of the major disciplines for the projects attending the annual meeting. Requested budgets should include funds for travel to this event.

C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

  May 07, 2018 - May 14, 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

1. The extent to which the BIGDATA proposal pursues a big data research effort, as opposed to a traditional data research effort.
2. For BIGDATA Foundations proposals, the extent to which the research is motivated by application use cases and/or characteristics of real big data datasets and addresses the innovation with respect to computer science, mathematical, statistical, and/or computational theories proposed.
3. For BIGDATA Innovative Applications proposals, the extent to which genuine partnership between researchers in the technical community (i.e., computer scientists, statisticians, mathematicians) and researchers in science and engineering domains (e.g., science, engineering, social sciences, finance, education) is demonstrated, along with corresponding novel contributions.
4. In addition to the Broader Impacts detailed in the PAPPG, the extent to which additional broader impacts that are particularly relevant to BIGDATA activities are demonstrated (e.g., for software sharing and dissemination).
5. The extent to which the proposal includes clear plans for *evaluation and validation* that demonstrate the effectiveness and efficacy of proposed solutions, in the context of specific big data characteristics.
6. For proposals that request cloud resources, the extent to which the use of these resources and the levels of the requests is justified. As a reminder, it is expected that cloud resources will be requested and used for large-scale experimentation and scalability studies.

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 be completed and submitted by each reviewer.

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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts 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.

Special Award Conditions:

BIGDATA awardees receiving cloud credits/resources under this program are required to include appropriate acknowledgment of NSF and the corresponding cloud provider support in reports and/or publications on work performed under the awards. An example of such an acknowledgement would be: "This material is based upon work supported by the NSF under Award No. <NSF award number(s)>, using resources provided by <name of the cloud credit/resource provider> as part of the NSF BIGDATA program."

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:

- Chaitanya Baru, Senior Advisor for Data Science, CISE/OAD, telephone: (703) 292-4541, email: cbaru@nsf.gov

- Sylvia Spengler, Lead Program Director for BIGDATA, CISE/IIS, telephone: (703) 292-8930, email: sspengle@nsf.gov

- John C. Cherniavsky, Program Director, EHR/DRL, telephone: (703) 292-5136, email: jchernia@nsf.gov

- Almadena Y. Chtchelkanova, Program Director, CISE/CCF, telephone: (703) 292-8910, email: achtchel@nsf.gov

- David Corman, Program Director, CISE/CNS, telephone: (703) 292-8754, email: dcorman@nsf.gov

- James C. French, Program Director, CISE/IIS, telephone: (703) 292-8930, email: jfrench@nsf.gov

- Nandini Kannan, Program Director, MPS/DMS, telephone: (703) 292-8104, email: nakannan@nsf.gov

- Sara Kiesler, Program Director, SBE/SES, telephone: (703) 292-8643, email: skiesler@nsf.gov

- Anthony Kuh, Program Director, ENG/ECCS, telephone: (703) 292-2210, email: akuh@nsf.gov

- Alexis Lewis, Program Director, ENG/CMMI, E 13328, telephone: (703) 292-2624, email: alewis@nsf.gov

- Bogdan Mihaila, Science Advisor, MPS/OAD, telephone: (703) 292-8235, email: bmihaila@nsf.gov

- Christina Payne, Associate Program Director, ENG/CBET, telephone: (703) 292-2895, email: cpayne@nsf.gov

- Rahul T. Shah, Program Director, CISE/CCF, telephone: (703) 292-2709, email: rshah@nsf.gov

- Ralph Wachter, Program Director, CISE/CNS, telephone: (703) 292-8950, email: rwachter@nsf.gov

- Maria Zemankova, Program Director, CISE/IIS, telephone: (703) 292-7348, email: mzemanko@nsf.gov

- Aidong Zhang, Program Director, CISE/IIS, telephone: (703) 292-5311, email: azhang@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.

General Correspondence email

For general correspondence, please reply to bigdata@nsf.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.

Policies and Important Links | Privacy | FOIA | Help | Contact NSF | Contact Web Master | SiteMap

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

Text Only