Harnessing the Data Revolution (HDR): Institutes for Data-Intensive Research in Science and Engineering - Ideas Labs (I-DIRSE-IL)

PROGRAM SOLICITATION
NSF 19-543

National Science Foundation

Directorate for Computer & Information Science & Engineering

Office of Integrative Activities

Office of International Science and Engineering

Directorate for Mathematical & Physical Sciences

Directorate for Social, Behavioral & Economic Sciences

Directorate for Geosciences

Directorate for Engineering

Directorate for Biological Sciences

Directorate for Education & Human Resources

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

March 04, 2019

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

June 28, 2019

IMPORTANT INFORMATION AND REVISION NOTES

Preliminary and Full Proposals submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 19-1).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Harnessing the Data Revolution (HDR): Institutes for Data-Intensive Research in Science and Engineering - Ideas Labs (I-DIRSE-IL)

Synopsis of Program:

In 2016, the National Science Foundation (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 (see https://www.nsf.gov/news/special_reports/big_ideas/index.jsp). The Big Ideas represent unique opportunities to position our Nation at the cutting edge of global science and engineering leadership by bringing together diverse disciplinary perspectives to support convergence research. As such, when responding to this solicitation, even though proposals must be submitted to the Directorate for Computer & Information Science & Engineering/Office of Advanced Cyberinfrastructure (CISE/OAC), once received, the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

NSF’s *Harnessing the Data Revolution (HDR) Big Idea* is a national-scale activity to enable new modes of data-driven discovery that will allow fundamental questions to be asked and answered at the frontiers of science and engineering. Through this NSF-wide activity, HDR will generate new knowledge and understanding, and accelerate discovery and innovation. The HDR vision is realized through an interrelated set of efforts in:

- Foundations of data science;
- Algorithms and systems for data science;
- Data-intensive science and engineering;

- Data cyberinfrastructure; and
- Education and workforce development.

Each of these efforts is designed to amplify the intrinsically multidisciplinary nature of the emerging field of data science. The HDR Big Idea will establish theoretical, technical, and ethical frameworks that will be applied to tackle data-intensive problems in science and engineering, contributing to data-driven decision-making that impacts society.

This solicitation describes one or more Ideas Lab(s) on Data-Intensive Research in Science and Engineering (DIRSE) as part of the HDR Institutes activity. These Ideas Labs represent one path of a conceptualization phase aimed at developing Institutes as part of the NSF investment in the HDR Big Idea.

The HDR Institutes activity seeks to create an integrated fabric of interrelated institutes that can accelerate discovery and innovation in multiple areas of data-intensive science and engineering. The HDR Institutes will achieve this by harnessing diverse data sources and developing and applying new methodologies, technologies, and infrastructure for data management and analysis. The HDR Institutes will support convergence between science and engineering research communities as well as expertise in data science foundations, systems, applications, and cyberinfrastructure. In addition, the HDR Institutes will enable breakthroughs in science and engineering through collaborative, co-designed programs to formulate innovative data-intensive approaches to address critical national challenges.

HDR Institutes will be developed through a two-phase process involving conceptualization followed by convergence. The conceptualization phase will be implemented in FY 2019 via two complementary funding opportunities. The first opportunity in FY 2019, described in this solicitation, will encourage individuals with compelling data-intensive science and engineering problems and/or technical expertise to self-organize into teams with the aim of developing innovative, collaborative research proposals through an Ideas Lab process. The second opportunity in FY 2019 will encourage applications from teams of researchers proposing frameworks for integrated sets of science and engineering problems and data science solutions. The conceptualization phase will result in two-year awards aimed at building communities, defining research priorities, and developing interdisciplinary prototype solutions. NSF anticipates implementing the subsequent convergence and co-design phase in the 2021 timeframe with awards that integrate and scale successful prototypes and new ideas into larger, more comprehensive HDR Institutes that bring together multiple science and engineering communities with computer and computational scientists, mathematicians, statisticians, and information scientists around common data science approaches.

The overarching goal of the HDR Institutes DIRSE Ideas Labs is to foster convergent approaches to enable data-intensive research in science and engineering through a series of facilitated activities bringing together scientists and engineers working on important data-intensive science and engineering problems with data scientists, e.g., computer and computational scientists, mathematicians, statisticians, and information scientists with expertise in different aspects of modeling and data analysis as well as systems and cyberinfrastructure specialists with expertise in open source software development, reproducibility, and transfer learning. The Ideas Labs will focus on areas that: (1) are at a “tipping point” where a timely investment in data-intensive approaches has the maximum potential for a transformative effect; (2) have needs that can benefit from interdisciplinary investments in data analytics infrastructure; and (3) represent investment priorities for NSF science and engineering directorates during, and beyond, the lifetime of the HDR Big Idea.

US researchers may submit preliminary proposals for participating in the Ideas Labs only via Fastlane. Based on the number of preliminary proposals and the science and engineering areas and data science expertise represented by the applicant pool, one or more Ideas Labs may be scheduled in parallel. Participation in an Ideas Lab is required to be eligible to submit a full conceptualization proposal pursuant to this solicitation. Multidisciplinary ideas developed in an Ideas Lab will be submitted as full conceptualization proposals to NSF by invitation only. Interdisciplinary collaboration among researchers is required in the invited full conceptualization proposals.

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.

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

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

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 10 to 15

10 - 15 awards in FY 2019 pending availability of funds and the type, scale, and variety of project ideas developed at the Ideas Labs.

Anticipated Funding Amount: $20,000,000

Up to a total of $20 million is available for 10 - 15 two-year awards stemming from full proposals that will be developed in the Ideas Lab workshop.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

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.
- NSF-sponsored Federally Funded Research and Development Centers (FFRDCs).

Who May Serve as PI:

Individuals who accept an invitation to participate in the HDR Institutes DIRSE Ideas Labs will be ineligible to be a PI or co-PI on proposals submitted to the HDR DIRSE Frameworks solicitation. This is to ensure a diversity of ideas and expertise during the conceptualization phase of the HDR Institutes activity.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

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

B. Budgetary Information

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

  Not Applicable
- **Other Budgetary Limitations:**

  Not Applicable

C. Due Dates

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

  March 04, 2019
- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  June 28, 2019

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.

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I. INTRODUCTION

Recent technological advances and access to vast amounts of data are fueling discovery in all fields of science and engineering, creating new challenges and opportunities to transform the scientific landscape. Data-intensive challenges are now ubiquitous in all fields of science, engineering, and STEM education.

The National Science Foundation (NSF)'s *Harnessing the Data Revolution (HDR) Big Idea* is a national-scale activity to enable new modes of data-driven discovery that will allow fundamental questions to be asked and answered at the frontiers of science and engineering. Through this NSF-wide activity, HDR will generate new knowledge and understanding, and accelerate discovery and innovation. The HDR vision is realized through an interrelated set of efforts in:

- Foundations of data science;
- Algorithms and systems for data science;
- Data-intensive science and engineering;
- Data cyberinfrastructure; and
- Education and workforce development.

Each of these efforts is designed to amplify the intrinsically multidisciplinary nature of the emerging field of data science. The HDR Big Idea will establish theoretical, technical, and ethical frameworks that will be applied to tackle data-intensive problems in science and engineering, contributing to data-driven decision-making that impacts society.

The HDR Institutes activity seeks to create an integrated fabric of interrelated institutes that can accelerate discovery and innovation in multiple areas of data-intensive science and engineering. The HDR Institutes will achieve this by harnessing diverse data sources and developing and applying new methodologies, technologies, and infrastructure for data management and analysis. The HDR Institutes will support convergence between science and engineering research communities as well as expertise in data science foundations, systems, applications, and cyberinfrastructure. In addition, the HDR Institutes will enable breakthroughs in science and engineering through collaborative, co-designed programs to formulate innovative data-intensive approaches to address critical national challenges.

HDR Institutes will be developed through a two-phase process involving conceptualization followed by convergence. The conceptualization phase will be implemented in FY 2019 via two complementary funding opportunities. The first opportunity in FY 2019, described in this solicitation, will encourage individuals with compelling data-intensive science and engineering problems and/or technical expertise to self-organize into teams with the aim of developing innovative, collaborative research proposals through an Ideas Lab process. The second opportunity in FY 2019 will encourage applications from teams of researchers proposing frameworks for integrated sets of science and engineering problems and data science solutions. The conceptualization phase will result in two-year awards aimed at building communities, defining research priorities, and developing interdisciplinary prototype solutions. NSF anticipates implementing the subsequent convergence and co-design phase in the 2021 timeframe with awards that integrate and scale successful prototypes and new ideas into larger, more comprehensive HDR Institutes that bring together multiple science and engineering communities with computer and computational scientists, mathematicians, statisticians, and information scientists around common data science approaches.

Data-Intensive Research in Science and Engineering (DIRSE)

There are numerous science and engineering challenges that require, or will soon require, data science to help address research and technological questions. Some examples include: near-term ecological forecasting; understanding how the phenotype of living things is determined by their genotype and environment; real-time sensing, learning, and decision making for resilient engineering systems; development of autonomous technologies; predictive understanding of the Earth system which includes climate, weather, hydrologic, seismic, and space weather hazards; multi-messenger astrophysics; understanding the nature of dark matter; predictive design of next-generation catalysts; elucidation of design rules for emergent molecular properties from atomic-scale interactions; design of sustainable chemical manufacturing systems; real-time optimization and control of complex chemical and biological systems; discovery of new advanced materials; integration of heterogeneous data for explaining human behavior, learning, and social processes; understanding the brain, including prediction of complex systems for neuroimaging and neurological applications; and understanding student learning and success across STEM disciplines. Advancing knowledge in these areas requires solutions to many modeling and data challenges such as real-time sensing, learning, and decision making; social, political, and behavioral implications of machine learning and impacts of new data uses; issues related to ethics and fairness; and integrating heterogeneous data for explaining or predicting complex phenomena. There is also a need for approaches that combine physical models with data driven models for learning and decision making.

Data science tools, such as signal and image processing, visualization, statistical modeling and inference, machine learning, and optimization, offer a starting point for solving important scientific and engineering challenges. However, extracting new information and knowledge from data will benefit from new, convergent strategies that capitalize on existing NSF investments in data and cyberinfrastructure and that build synergy between the researchers with expertise in the generation or measurement of data and those with expertise in processing and analyzing that data.

The intent is not to pre-define the disciplines and/or data-related questions that should be represented at the Ideas Labs; the list of science and engineering drivers and data science challenges presented above is not meant to limit the scope of potential topic areas for the Ideas Labs. Rather, the topics for individual Ideas Labs will be selected after a review of the preliminary proposals to identify overarching and convergent themes that may cut across multiple scientific and engineering domains, including data science.

Recognizing the need to embrace a wide array of data science challenges across different research disciplines and communities, and to stimulate new partnerships to accelerate data-intensive discovery and innovation, this solicitation aims to support one or more HDR Ideas Labs focused on **Data-Intensive Research in Science and Engineering.** Specifically, this solicitation seeks to stimulate advances in multiple areas of science and engineering through data-intensive research that harnesses diverse data sources and the application of new methodologies, technologies, and infrastructure for data generation, collection, modeling, and analysis. As one part of the HDR ecosystem, this strategy is aimed at identifying areas of science and engineering that:

1. are at a "tipping point" where a timely investment in data-intensive approaches has the maximum potential for a transformative effect;
2. have needs that can benefit from interdisciplinary investments in data analytic infrastructure; and
3. represent investment priorities for the participating NSF directorates during, and beyond, the lifetime of the HDR Big Idea.

The overarching goal of the Ideas Labs is to foster convergent approaches to enable data-intensive research in science and engineering through a series of facilitated activities bringing together scientists and engineers working on important data-intensive science and engineering problems with data scientists, e.g., computer and computational scientists, mathematicians, statisticians, and information scientists with expertise in different aspects of modeling and data analysis as well as systems and cyberinfrastructure specialists with expertise in open source software development, reproducibility, and transfer learning. The expectation is that these activities will leverage existing NSF investments, engender fresh thinking and innovative approaches, and engage communities that might not otherwise interact.

This Ideas Labs solicitation represents one of two paths of the conceptualization phase for HDR Institutes. The goal of this path is to facilitate the formation of interdisciplinary teams with critical expertise in different areas of science and engineering and data science to address important data-intensive challenges by recruiting participants from both the research (all science and engineering disciplines) and technical (computer and computational science, mathematics, statistics, and information science) domains. The second path, Frameworks for HDR Institutes, will encourage proposals from teams that propose an integrated set of science and engineering problems and data science approaches that could form, or contribute to, the core framework of an HDR Institute.

The Ideas Labs contribute uniquely to the conceptualization phase of the HDR Institutes DIRSE activity by creating an environment for interdisciplinary teams, comprising individual participants with complementary expertise, to emerge organically through an iterative process. The process is designed to bring together diverse expertise into several Ideas Labs based on focused yet broadly applicable data-intensive research themes.

Specific outcomes are expected to include: identification of frontier science and engineering challenge problems and the associated data and data science barriers or tipping points; as well as the development of new strategies and innovative approaches, methods, and algorithms to foster scientific and engineering breakthroughs through a convergent approach involving researchers from diverse scientific and technical backgrounds. The ideas that emerge are expected to lie at the intersection of HDR and another of NSF's 10 Big Ideas, **Growing Convergent Research,** with potential impact on still other Big Ideas.

The HDR Institutes solicitations provide different paths to fulfilling the overall HDR vision of developing robust multidisciplinary capabilities through a national ecosystem of interconnected data science investments. For more information about NSF's HDR investments, see the HDR website.

II. PROGRAM DESCRIPTION

All NSF directorates and offices share complementary interests in data-intensive research in science and engineering and have provided support for different aspects of this broad area through their established programs. However, NSF recognizes the transformative potential in convergent approaches that bring together researchers with expertise in various science and engineering domains, including data science, to tackle grand challenges associated with making discoveries from analysis of complex data. The potential for identifying and solving these challenges is the impetus for this funding opportunity.

Ideas Labs

Ideas Labs are intensive workshops focused on finding innovative and bold transdisciplinary solutions to grand challenge problems. The NSF Ideas Lab process entails participation in an intensive five-day residential workshop, the development of multidisciplinary collaborative proposals through a real-time and iterative review process, and the subsequent submission of full, invited proposals. The Ideas Lab process was modeled on the "IDEAS Factory" program developed by the Engineering and Physical Sciences Research Council (EPSRC) of the United Kingdom. A typical NSF Ideas Lab includes 25-30 participants assisted by a team of professional facilitators and by a team of scientists and engineers with relevant expertise. These experts, known as mentors, are not eligible for funds from the Ideas Lab, and therefore, act as impartial referees of the process.

Participants will be expected to engage constructively in dialogue with each other, the facilitators, and the mentors to develop collaborative research proposals. Collaboration will be encouraged, especially by bringing diverse minds together to embrace the research challenge.

Each Ideas Lab will run over five days starting mid-morning on Day One and finishing mid-afternoon on Day Five. At the outset, the participants will work together to identify and define the scope of the data-intensive science and engineering challenges. As the Ideas Lab progresses, participants will dynamically develop and hone novel ideas about how the identified challenges may be addressed, and then use these ideas and approaches to develop research projects that should contain genuinely innovative and potentially risk-taking investigations. The Ideas Lab will include inputs from a variety of sources and will aim to develop collaborative research projects. Following the Ideas Labs, teams of researchers with the most potentially transformative ideas that promise to significantly advance the field will be invited to submit full proposals. It is expected that these full conceptualization proposals will be generated by multidisciplinary teams.

Participation in an Ideas Lab requires an invitation in response to a preliminary proposal. Submission of a full proposal derived from an Ideas Lab requires both participation in an Ideas Lab and an invitation to submit a full proposal.

How will Each Ideas Lab Work?

Each Ideas Lab will be an intensive, interactive, and free-thinking environment in which a diverse group of participants from a range of disciplines and backgrounds will get together for five days – away from their everyday worlds – to immerse themselves in collaborative thinking processes, to construct innovative approaches for solving significant science and engineering challenges through data-intensive research.

The nature of the Ideas Lab requires a high degree of trust among participants in order to make the required breakthroughs in scientific thinking. This trust extends to allowing the free and frank exchange of scientific ideas, some in the very early stages of development. The aim of the Ideas Lab is not to discuss ideas that are already well-developed but not yet published. Rather, the goal is to bring individuals from different disciplines together to interact and engage in free thinking from first principles, so as to learn from one another and create an integrated vision for future potentially transformative research projects. While the sharing of such ideas is encouraged within the Ideas Lab, participants will be required to maintain the confidentiality of the intellectual property of other participants.

These Ideas Labs will be led by a Director whose role is to assist in defining the topics and help facilitate discussions at the event. The Director will be joined by a small number of Mentors. The Mentors will be selected by NSF based on their scientific and engineering expertise, intellectual standing, their impartiality and objectivity, and their broad understanding of, and enthusiasm for, the subject area. The Director and Mentors will take full part in the Ideas Lab, but they will not be eligible to receive research funding under this collaborative activity. They will act as impartial peer reviewers in the process, providing a function analogous to that of an NSF review panel.

The Ideas Lab process can be broken down into several stages:

- Defining the scope of the challenges;
- Evolving common languages and terminologies among people from a diverse range of backgrounds and disciplines;
- Sharing perspectives and understanding of the scientific and engineering challenges, as well as the diverse expertise brought by the participants to the Ideas Lab;
- Taking part in breakout sessions focused on the challenges, using creative thinking techniques;

Capturing the outputs in the form of highly innovative research projects; and
- Using "real-time" peer review to develop projects at the Ideas Lab.

The Ideas Lab will be an intensive event. For the well-being of participants, the venue offers opportunities for relaxation, and the timetable will include networking and other activities as a break from the detailed technical discussions.

Outcomes of the Ideas Labs will include development of an outline of interdisciplinary data-intensive approaches to frontier science and engineering challenges.

Who Should Apply to Participate?

The success of an Ideas Lab depends on having a diverse group of participants. Applications are encouraged from individuals representing research areas across a broad range of science and engineering disciplines as well as individuals with relevant data science expertise (computer and computational science, mathematics, statistics, and information science).

The ability to develop and pursue new approaches will be crucial, and expertise is required from a very broad range of disciplines. Potential applicants should not feel limited by conventional perceptions: the Ideas Lab approach is about bringing together people who would not normally interact. We actively encourage people to apply who are experts in their own research areas and are open to new collaborations and data-driven approaches.

Participants at any stage of their research careers are welcome; however, they must be eligible to apply for funding from NSF.

Location and Date

These Ideas Labs will take place at a location near the NSF headquarters in Alexandria, VA, on May 20-24, 2019. Additional information about the venue and meeting logistics will be provided to the selected participants. It should be noted that travel to an Ideas Lab, accommodation, refreshments, and meals will be covered by NSF. However, all incidental costs incurred while at the event will be borne by the participants.

Applications for this Activity

In brief, any individual interested in participating in an Ideas Lab should respond to this solicitation by submitting a preliminary proposal application. Participation in an Ideas Lab is by invitation only from the pool of applicants who submitted a preliminary proposal.

Submission of the preliminary proposal will be considered an indication of availability to attend and participate through the full course of a five-day Ideas Lab, which will be held at a location near the NSF headquarters in Alexandria, VA, on May 20-24, 2019.

Participants will be selected on the basis of their interests, expertise, and other characteristics described in their submitted preliminary proposals.

Following the Ideas Labs, teams may be selected to submit full proposals to NSF by the June 28, 2019, deadline. These full proposals must reflect the outline developed at the Ideas Labs and include a plan that describes how the collaboration will work to achieve progress on the specific science and engineering challenges using innovative data-intensive research approaches. The Collaboration Plan should outline strategies to facilitate constructive and effective collaboration among researchers with diverse skills and disciplinary backgrounds. The Collaboration Plan should be no more than 2 pages in length and uploaded as a Supplementary Document.

III. AWARD INFORMATION

Anticipated Type of Award:

Continuing Grant or Standard Grant

Estimated Number of Awards: 10 to 15

10 - 15 awards in FY 2019 pending availability of funds and the type, scale, and variety of project ideas developed at the Ideas Labs.

Anticipated Funding Amount: $20,000,000

Up to a total of $20 million is available for 10 - 15 two-year awards stemming from full proposals that will be developed in the Ideas Lab workshop.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

organizations in the U.S. associated with educational or research activities.
- NSF-sponsored Federally Funded Research and Development Centers (FFRDCs).

Who May Serve as PI:

Individuals who accept an invitation to participate in the HDR Institutes DIRSE Ideas Labs will be ineligible to be a PI or co-PI on proposals submitted to the HDR DIRSE Frameworks solicitation. This is to ensure a diversity of ideas and expertise during the conceptualization phase of the HDR Institutes activity.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

Submission of Preliminary Proposals is required for participation in the Ideas Labs. Please note that the preliminary proposal must come from one individual and cannot include co-PIs or collaborators. Participants in the Idea Labs will be selected on the basis of information submitted in the preliminary proposal. The applications are limited to **two pages of "Project Description,"** which should be submitted as a preliminary proposal in the NSF FastLane system ONLY, **not through Grants.gov**. Standard NSF formatting guidelines apply. See the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) for guidance. Proposers are reminded to identify the program solicitation number (located on the first page of this document) in the first block on the NSF Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines.

Please note that even though proposals must be submitted to CISE, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

The Project Description section of the preliminary proposal applications should conform to the following guidelines:

Page One:

Provide a brief summary of your professional background (no more than one-half page). Please note that if you are selected as a participant, information provided in answer to this question will be made available to the other participants to facilitate networking at the Ideas Lab workshop. Please include a discussion of your data science expertise in this brief summary.

What expertise do you bring that is relevant to the Ideas Labs? In no more than one-half page, please describe either: (1) a science/engineering problem and the associated data science barriers or tipping points, including some justification for the importance of the problem; (2) computer or computational science, mathematics, statistics, or information science approaches and an example of collaborative research leveraging those approaches; or (3) expertise with the development of end-to-end framework prototypes or open source platforms for sharing different classes of models and types of data across different application domains.

Page Two:

Please spend some time considering your answers to the following prompts. Your responses (no more than 150 words each) should demonstrate that you have suitable skills and experience to participate in the Ideas Labs (going beyond your research track record).

- What is your personal experience with working across disciplines and/or as part of a collaborative team?
- Describe your ability to explain your research to non-experts.
- The Ideas Lab environment is especially suited to individuals who are willing to step outside their particular area of interest or expertise, are positively driven, enjoy creative activity, can think innovatively, and can settle in easily in the company of strangers. Please describe an experience you have had in a comparable environment.
- What would you personally and professionally gain from participating in this Ideas Lab? What would you view as a successful outcome?

Applicants must include a **Biographical Sketch** and a **Current and Pending Support** document (prepared in accordance with standard NSF formatting guidelines). All other elements of a "full proposal" are waived (Project Summary, References Cited, Budget, Budget Justification, Facilities, Equipment and Other Resources).

Selection

All preliminary proposals will be reviewed by a selection panel, a group of experts representing different science and engineering domains, including data science. The process will lead to the creation of one or more Ideas Labs based on the number of preliminary proposals, the science and engineering areas and data science expertise represented in the applicant pool, and the availability of funds.

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 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 Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 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.

Special instructions for submitting to this Big Idea solicitation

FastLane Users: Proposers are reminded to identify the program solicitation number (located on the first page of this document) in the first block on the NSF Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Please note that even though proposals must be submitted to CISE/OAC, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

Research.gov Users: The Prepare New Proposal setup will prompt you for the program solicitation number (located on the first page of this document). Compliance with this requirement is critical to determining the relevant proposal processing guidelines. As stated previously, even though proposals must be submitted to CISE/OAC, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

Grants.gov Users: The program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page, however you will need to locate the Division Code, Program Code, Division Name, and Program Name for the specific solicitation you are applying to by visiting https://www.fastlane.nsf.gov/pgmannounce.jsp. As stated previously, even though proposals must be submitted to CISE/OAC, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

One or more designated DIRSE-IL project representatives (PI/co-PI/senior researcher or NSF-approved replacement) must attend annual HDR PI meetings (to be held in the Washington, DC, area). Proposal budgets must include appropriate amounts for travel to these meetings once each year.

Full proposals based on project ideas developed through interactions at an Ideas Lab should conform to the project outline developed at the conclusion of the Ideas Lab. If substantive changes are contemplated, an NSF Program Director should be contacted for guidance.

Please note that even though proposals must be submitted to CISE, once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

B. Budgetary Information

Cost Sharing:

C. Due Dates

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

  March 04, 2019

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

  June 28, 2019

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

For Proposals Submitted Via FastLane or Research.gov:

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

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the

research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

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

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

2. Merit Review Criteria

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

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

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

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

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

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

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

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

Additional Solicitation Specific Review Criteria

The Ideas Lab approach is designed to foster the development and implementation of creative and innovative project ideas that have the potential to transform research paradigms and/or solve previously intractable problems. We anticipate that awards made through this solicitation will be high-risk/high-impact, as they represent new and unproven ideas, approaches, and/or technologies. Projects that involve the application of novel, collaborative, or interdisciplinary approaches will therefore receive priority during the consideration process. In addition, full proposals derived from the Ideas Lab will be evaluated to determine whether the scientific themes/objectives in the proposal are congruent with the goals of the DIRSE approach described above and the ideas presented at the Ideas Lab, whether the plan for collaboration among researchers with diverse skills and disciplinary backgrounds is well-justified, and whether any significant changes in project scope or resources from those presented at the Ideas Lab have been justified.

B. Review and Selection Process

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

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, Internal NSF Review, or Ideas Lab Mentors.

The competition will be consistent with the guidelines for an Ideas Lab described in PAPPG Chapter II.E.5.

Stage 1. Selection of Participants:

NSF Program Directors will convene a panel of external reviewers to advise on the selection of participants in the Ideas Lab. This group will comprise individuals

who will be barred from receiving any research funding through, or in any other way collaborating on, the Ideas Lab. These individuals will be subject matter experts from diverse disciplines pertinent to the topic of the Ideas Lab. The selection panel will review the preliminary proposals submitted by applicants and will advise NSF Program Directors on participant selection. Final selection decisions regarding participation in the Ideas Lab workshop will be made by NSF.

Overall, the panel will seek to ensure that a balance of expertise and experience is present at the Ideas Lab workshop; their assessment will be based on the specific criteria outlined below:

- The ability to develop new and highly original research ideas;
- The potential to contribute to research between disciplines; and
- The ability to work in interdisciplinary teams.

Individuals interested in participating in the Ideas Lab workshop will submit a preliminary proposal including information regarding the applicant's specific expertise and personal attributes that will enhance the success of the Ideas Lab workshop. Submission of the preliminary proposal will be considered an indication of commitment to attend and participate through the full course of the five-day residential Ideas Lab workshop on May 20-24, 2019, should the proposer be invited. The decisions of NSF about whom to invite will be final and binding.

Stage 2. Ideas Lab:

Applicants selected by NSF will participate in the Ideas Lab workshop, building collaborations and refining ideas. Organizing NSF Program Directors will select up to 6 qualified persons for each Ideas Lab to serve as Mentors during the workshop. This group will also comprise individuals who will be barred from receiving any research funding through, or in any other way collaborating on, the Ideas Lab. These individuals will be subject matter experts from diverse disciplines pertinent to the topic of the Ideas Lab. One of the Mentors will act as the Director of the workshop and will be responsible for leading the activities of the Mentors.

Anonymous real-time peer review involving the participants and the Mentors will be incorporated into a workshop format, providing iterative constructive feedback during the development of project ideas. The workshop will use a team of facilitators to guide the creation of interdisciplinary teams and the creative development of ideas, and to ensure that the workshop progresses in a productive manner. At the end of the workshop, the Mentors will provide a consensus report summarizing their evaluation of each project idea. The recommendations of the Mentors are advisory to NSF. Informed by their advice, within seven to fourteen days following the workshop, NSF Program Directors will consider which projects to invite for submission as full proposals. At their discretion, NSF Program Directors may invite some, all or none of the Ideas Lab projects for submission to NSF as full proposals. NSF Program Directors will issue written invite/not invite full proposal decisions to the Ideas Lab participants with instructions to submit invited full proposals to NSF by June 28, 2019. These invited full proposals must be prepared according to standard NSF *Proposal & Award Policies & Procedures Guide*.

It is anticipated that these full proposals developed through the Ideas Lab workshop will feature the following:

- Novel, highly multidisciplinary research projects, clearly reflecting the distinctive opportunity for creating such projects that the Ideas Lab mechanism provides;
- Clear evidence that the team has the capability to deliver its project as a high-quality multidisciplinary activity; and
- Clear relevance and potential to make a distinctive and novel contribution to addressing data-intensive challenges in one or more science and engineering domains.

Stage 3. Review and recommendation of full proposals:

NSF-invited full proposals arising from the Ideas Lab will be submitted *via* FastLane, Research.gov or Grants.gov by June 28, 2019. NSF-invited proposals will be reviewed internally by the cognizant NSF Program Officers, the Ideas Lab panelists, and other external reviewers, as appropriate.

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.

Special Award Conditions:

Grantees will be required to include appropriate acknowledgment of NSF support under the Harnessing the Data Revolution Big Idea in any publication (including World Wide Web pages) of any material based on or developed under the project, in the following terms:

“This material is based upon work supported by the National Science Foundation Harnessing the Data Revolution Big Idea under Grant No. (Grantee enters NSF grant number.)”

Grantees also will be required to orally acknowledge NSF support using the language specified above during all news media interviews, including popular media such as radio, television and news magazines.

For all awards, one or more designated DIRSE-IL project representatives (PI/co-PI/senior researcher or NSF-approved replacement) must attend annual HDR PI meetings (to be held in the Washington, DC, area). Proposal budgets must include appropriate amounts for travel to these meetings once each year.

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:

- Nandini Kannan, MPS/DMS, MPS/DMS, telephone: (703) 292-8104, email: nakannan@nsf.gov
- Amy Walton, CISE/OAC, CISE/OAC, telephone: (703) 292-4538, email: awalton@nsf.gov
- Eva Zanzerkia, GEO/EAR, GEO/EAR, telephone: (703) 292-4734, email: ezanzerk@nsf.gov
- Peter H. McCartney, BIO/DBI, BIO/DBI, telephone: (703) 292-8470, email: pmccartn@nsf.gov
- John C. Cherniavsky, EHR/DRL, EHR/DRL, telephone: (703) 292-5136, email: jchernia@nsf.gov

- Cheryl L. Eavey, SBE/SES, SBE/SES, telephone: (703) 292-7269, email: ceavey@nsf.gov
- Anthony Kuh, ENG/ECCS, ENG/ECCS, telephone: (703) 292-2210, email: akuh@nsf.gov
- Alexis Lewis, ENG/CMMI, ENG/CMMI, telephone: (703) 292-2624, email: alewis@nsf.gov
- Triantafillos J. Mountziaris, ENG/CBET, ENG/CBET, telephone: (703) 292-2894, email: tmountzi@nsf.gov
- Daryl W. Hess, MPS/DMR, MPS/DMR, telephone: (703) 292-4942, email: dhess@nsf.gov
- Larry Gottlob, SBE/BCS, SBE/BCS, telephone: 7032924383, email: lgottlob@nsf.gov
- Lin He, MPS/CHE, MPS/CHE, telephone: (703) 292-4956, email: lhe@nsf.gov
- Vyacheslav (Slava) Lukin, MPS/PHY, MPS/PHY, telephone: (703) 292-7382, email: vlukin@nsf.gov
- Nigel A. Sharp, MPS/AST, MPS/AST, telephone: (703) 292-4905, email: nsharp@nsf.gov
- James Donlon, CISE/IIS, CISE/IIS, telephone: (703) 292-8074, email: jdonlon@nsf.gov
- Tracy Kimbrel, CISE/CCF, CISE/CCF, telephone: (703) 292-8910, email: tkimbrel@nsf.gov

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

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

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

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

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