US-Japan Big Data and Disaster Research (BDD)

PROGRAM SOLICITATION
NSF 14-575

National Science Foundation

Directorate for Computer & Information Science & Engineering
  Division of Computing and Communication Foundations
  Division of Computer and Network Systems
  Division of Information & Intelligent Systems

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

September 08, 2014

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

US-Japan Big Data and Disaster Research (BDD)

Synopsis of Program:

The US National Science Foundation (NSF) and the Japan Science and Technology Agency (JST) are embarking upon a collaborative research program to address compelling research challenges that arise from leveraging Big Data approaches to transform, at both human and societal scales, disaster management.

Several recent reports have documented how transformative improvements in disaster management will require systems approaches to analyze large, noisy, and heterogeneous data and facilitate timely decision making in the face of shifting demands (*Computing for Disasters*, http://www.cra.org/ccc/files/docs/init/computingfordisasters.pdf; *Big Data and Disaster Management*, https://grait-dm.gatech.edu/wp-content/uploads/2014/03/BigDataAndDisaster-v34.pdf).

Specifically, disaster events and responses result in non-linear behaviors, and there exist large and unique interdependences among variables, multiple concurrent temporal and spatial scales, and few single optimal solutions. The resultant complexity causes algorithmic and data complexity, as well as challenges that arise in modeling chaotic systems. Other sources of complexity include the need for maintaining data security and privacy, as well as the resilience of the underlying computing and communications infrastructure during and following a disaster event.

At the same time, rapid advances in technology are enabling new opportunities for addressing disaster management. For example, new computer systems and networks – namely smartphones, tablets, and other types of edge devices; embedded and hybrid systems spanning automobiles, aircraft, chemical processing plants, and electrical power grids, etc.; sensor networks; and next-generation networking technologies spanning wireless, mobile, and cellular networks – are giving rise to potentially powerful data streams requiring novel analytics capabilities to facilitate timely and effective actions, as well as open questions about the resilience of these systems in the face of disasters.

This joint NSF/JST solicitation aims to address two specific challenges in the context of leveraging technological advances and using Big Data approaches to support effective disaster management:

1. capturing and processing the data associated with disasters to advance capabilities for disaster modeling as well as situational analysis and response modeling; and
2. Improving the resilience and responsiveness of emerging computer systems and networks to facilitate the real-time data sensing, visualization, analysis, experimentation and prediction that is critical for time-sensitive decision making.

This NSF solicitation parallels an equivalent JST solicitation (available at http://www.jst.go.jp/sicp/announce_usjoint_bdd.html). Proposals submitted under this solicitation must describe joint research with Japanese counterparts who are requesting funding separately under the JST solicitation.

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.

- Phillip Regalia, Program Director, CCF, telephone: (703) 292-8910, email: pregalia@nsf.gov

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

- Min Song, Program Director, CNS, telephone: (703) 292-8950, email: msong@nsf.gov

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

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 6 to 8

Anticipated Funding Amount: $2,000,000

dependent upon the availability of funds. Each award may be up to $300,000 over three years, and will be made to US participants.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

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: 2

In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required

- **Preliminary Proposal Submission:** Not required

- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - 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: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

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

    September 08, 2014

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

The US NSF's Directorate for Computer and Information Science and Engineering (CISE) and the Japan Science and Technology Agency (JST) have a history of collaboration that extends back several years under the umbrella of the Grants for Rapid Response Research (RAPID; http://www.nsf.gov/pubs/policydocs/pappguide/nsf14001/gpg_2.jsp#IID1) funding mechanism within NSF and the J-RAPID program in Japan. In 2011, the two agencies funded a set of projects in the area of automating emergency data management to support disaster recovery. These projects helped establish new collaborations among researchers from both countries. In early 2012, a Science Across Virtual Institutes (SAVI) for Global Research on Applying Information Technology to Support Effective Disaster Management (GRAIT-DM; https://grait-dm.gatech.edu/) was established, with a focus on leveraging Big Data to improve the preparedness for, response to, and recovery from, disasters. This SAVI specifically promotes global research on the application of information technology by engaging Big Data producers (e.g., sensor networks researchers), managers (e.g., data analytics researchers), and consumers (e.g., disaster management researchers).

In May 2013, US and Japanese principal investigators gathered in Washington, DC, to examine and prioritize collaborative research opportunities in Big Data and Disaster Research (see https://grait-dm.gatech.edu/wp-content/uploads/2014/03/BigDataAndDisaster-v34.pdf). NSF and JST are now establishing a US-Japan joint research program in Big Data and Disaster Research (BDD).

The BDD program addresses a critical subset of the issues that arise when leveraging Big Data to support effective disaster management. Consistent with other NSF solicitations, we use the term Big Data to refer to large, diverse, complex, longitudinal, and/or distributed data sets generated from instruments, sensors, Internet transactions, email, video, click streams, and/or all other digital sources available today and in the future. Unique to this particular solicitation, the focus lies on BDD research that is both transformative and challenging, at both human and societal scales.

II. PROGRAM DESCRIPTION

Disaster events and responses are complex -- indeed, chaotic -- systems. The behaviors are not linear, are not easily decomposed into separate processes, and span multiple concurrent temporal and spatial scales. This complexity results in algorithmic and data complexity, and it also makes modeling very challenging. Other sources of complexity include the need for maintaining data security and privacy, as well as the resilience of the underlying computing and communications infrastructure.

At the same time, rapid advances in technology are enabling new opportunities for addressing disaster management. For example, new computer systems and networks -- namely smartphones, tablets, and other types of edge devices; embedded and hybrid systems spanning automobiles, aircraft, chemical processing plants, and electrical power grids, etc.; sensor networks; and next-generation networking technologies spanning wireless, mobile, and cellular networks -- are giving rise to potentially powerful data streams, as well as open questions about the resilience of these systems.

In this context, proposals are solicited for joint US-Japan foundational and transformative research consistent with the theme of Big Data and Disaster (BDD) Research in the two areas specified below. Importantly, given the nature of the BDD space, a proposal responsive to this solicitation may span both areas.

1. Capturing and Processing the Data Associated with Disasters

Data associated with disasters are heterogeneous; come from myriad sources, including smartphones, tablets, and other types of edge devices, sensor networks, and embedded and hybrid systems; arrive with varying volumes and velocities; carry wide ranges of confidence due to inherent accuracy, reliability, security, and privacy issues; and exhibit different priorities for different phases of a given disaster. This data milieu and associated complexity raise the need for novel approaches to enable collection, integration, storage, and usage of many different kinds of disaster data, and at the same time, improve the trust in, and reliability of, the data.

Consider, for example, the ability to precisely assess the damage resulting from a disaster across a large geographic area. This task requires several types of domain-specific, real-time sensor maps at multiple time points, together with historical sensor maps for baseline and comparison purposes. One is confronted with a large, heterogeneous data set spanning multiple spatial and temporal scales and with varying levels of confidence that must be efficiently integrated and analyzed to refine damage predictions.

Under this theme, we seek joint US-Japan projects that explore the design of novel approaches for capturing, integrating and storing the data associated with disasters that (a) advance capabilities for disaster modeling (to learn more about how similar disasters may be understood or predicted) and/or (b) improve situational analysis and response modeling (to help facilitate the flow of information in real time to decision makers working in the midst of a disaster).

2. Improving the Resilience and Responsiveness of Emerging Computer Systems and Networks

To facilitate the real-time data sensing, visualization, analysis, and prediction that is critical for time-sensitive decision making, the resilience and responsiveness of emerging computer systems and networks in the midst of a disaster zone must be improved.

It is important to ensure that data analysis is highly dependable despite failures of various computing, communications, and information processing units immediately following a disaster. Given the distributed nature of such computational capabilities, it can be difficult to identify which units have failed and to quickly determine how best to address such failures. For example, if roadway sensors and cell towers are disrupted by a disaster, are there alternative means for detecting this disruption, and are there other data that one can use to communicate traffic flow data for decision making purposes?

Research is thus needed on disaster-proof dependable online system health monitoring tools to enable the rapid identification of faulty components and the activation of redundant standby units to ensure correct and timely completion of the analyses. In addition, to achieve effective disaster management, the underlying computing and communications infrastructure must support significantly time-constrained communication demands, distributed and heterogeneous data, and a wide variety of information sharing needs while maintaining high levels of security and privacy. The inherent difficulty of predicting disasters, along with the cost of the redundancy needed to cover all possible disaster scenarios, may lead to temporary solutions that may be easily deployed when needed. Indeed, effective disaster mitigation may require tradeoffs between short-term fixes and comprehensive long-term solutions.

Therefore, under this theme, we seek joint US-Japan projects that explore key aspects of novel networking and information technology supporting the resilient and timely data capture, communication, and integration in the face of infrastructure disruption due to both natural and man-made disasters.

Projects involving collaborations between computer scientists, including data scientists, and experts in disaster preparedness and response are encouraged.

III. AWARD INFORMATION

For each project, the US and Japanese teams will be funded by NSF and JST, respectively, through separate NSF and JST funding instruments. For each project, NSF support will be provided via a NSF standard or continuing grant. It is anticipated that approximately 6 to 8 projects, each up to $300,000 over three years, will be made to US participants, pending the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

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: 2

In the event that an individual exceeds this limit, proposals received within the limit will be accepted based on the earliest date and time of proposal submission (i.e., the first two proposals received will be accepted and the remainder will be returned without review). **No exceptions will be made.**

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG 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: (http://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. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

Important Proposal Preparation Information: FastLane will check for required sections of the full proposal, in accordance with *Grant Proposal Guide* (GPG) instructions described in Chapter II.C.2. The GPG requires submission of: Project Summary; Project Description; References Cited; Biographical Sketch(es); Budget; Budget Justification; Current and Pending Support; Facilities, Equipment & Other Resources; Data Management Plan; and Postdoctoral Mentoring Plan, if applicable. If a required section is missing, **FastLane will not accept the proposal.**

Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions. If the solicitation instructions do not require a GPG-required section to be included in the proposal, insert text or upload a document in that section of the proposal that states, "Not Applicable for this Program Solicitation." Doing so will enable FastLane to accept your proposal.

Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. Unless otherwise specified in this solicitation, you can decide where to include this section within the Project Description.

In addition to the guidelines in the GPG or NSF Grants.gov Application Guide, proposal preparation instructions specific to the preparation of proposals submitted in response to this solicitation are provided below:

It is expected that the Japanese researchers taking part in the joint research project will submit proposals separately to JST in accordance with JST's guidelines and procedures. US researchers will submit to NSF in accordance with NSF's guidelines and procedures. Proposals must be coordinated; it is expected that the Project Summary, Project Description, References Cited, Biographical Sketches, Collaboration and Management Plan, Intellectual Property Plan, and List of Personnel will be identical in both the NSF and JST submissions. Bibliographies must include not only the references relevant to the work to be undertaken by US principal investigators but also those relevant to the work to be undertaken by their Japanese counterparts. Furthermore, **Biographical Sketches for both the researchers to be funded by NSF and the researchers to be funded by JST must be included in the proposals** submitted separately to NSF and JST. US Principal Investigators (PIs) taking part in a joint research project are expected to coordinate their NSF submissions with their Japanese counterparts' JST submissions.

The following information supplements the guidelines provided in the NSF Grant Proposal Guide (GPG):

- **Proposal Titles:** Proposals for this solicitation require titles that begin with "BDD:" followed by project-specific text, i.e., **BDD: Title**.
- **Project Description:** The Project Description is limited to 15 pages. *Please note that, per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. Proposers may decide where to include this section within the Project Description.*
- **Required Supplementary Documents:** In the Supplementary Documents Section, the lead institution should upload the following information (note: this information should not be a part of the Project Description, and it needs to be submitted only by the lead institution):
  - *Collaboration and Management Plan*: In a supplemental document (up to 3 pages), describe a comprehensive collaboration and management plan: identify the project manager who will take responsibility for overall project coordination and management and who will serve as the contact PI for the project; describe management and research responsibilities for the project; define the expected contributions of each of the PIs and provide a convincing case that the collaborative contributions of the project team members will be greater than the sum of each of their individual contributions; describe mechanisms for integrating and managing all organizations and individuals involved in the project and exposing students or junior faculty to their counterparts in Japan; and provide a timeline for the proposed effort and identify the parties responsible for each major task. The length, and degree, of detail provided in the Collaboration and Management Plan should be commensurate with the complexity of the proposed project but must be sufficient to ensure that the US and Japan project elements will work together as an integrated project. *If a proposal does not include a Collaboration and Management Plan of up to 3 pages, that proposal will be returned without review.*
  - *Intellectual Property Plan*: In a supplemental document (up to 1 page), provide assurance that an agreement covering issues such as intellectual property has been or will be established within a reasonable time after the notifications of awarded projects. Such an agreement should satisfy the policies and practices of NSF and JST.
  - *A list of Project Personnel and Partner Institutions*: A list of PIs, co-PIs, senior personnel, collaborators, paid consultants, and post-doctoral researchers who will be involved in the project, including both US and Japanese personnel. The personnel information provides NSF and reviewers with a comprehensive list of personnel and institutions involved in the project, and will be used when determining conflicts of interest in the review process. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

    1. Mary Smith; XYZ University; PI
    2. 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

- *A list of Collaborators to assist with identifying Conflicts of Interest (note: in collaborative proposals, only the lead institution should provide this information):* Provide current, accurate information for all active or recent collaborators of personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage conflicts of interest. This list -- distinct from the *List of Project Personnel* above -- must include all active or recent Collaborators of all personnel involved with the proposed project. Collaborators include any individual with whom any member of the project team -- including PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members -- has collaborated on a project, book, article, report, or paper within the preceding 48 months; or co-edited a journal, compendium, or conference proceedings within the preceding 24 months. This list should be numbered and include (in this order) Full name and Organization(s), with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

  1. Mary Smith; XYZ Universit
  2. John Jones; University of PQ
  3. Jane Brown; XYZ Universit
  4. Bob Adams; ABC Inc
  5. Mary White; Welldone Institutio
  6. Tim Green; ZZZ University

- *Letters of Commitment:* These should be included only if they document collaboration or contributions of resources, data, or other assistance necessary to carry out this project.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Grantees of this program will be expected to attend, and should budget for, annual review meetings for the purpose of sharing research progress with representatives of other projects funded under this solicitation as well as other NSF/JST-designated individuals. For budgetary purposes, proposers should assume that two of these meetings will be held in Japan and one will be held in the US.

C. Due Dates

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

  September 08, 2014

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 the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://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 *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. 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. (GPG 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 GPG 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

In addition to the merit review principles and criteria described above, BDD Research proposals will also be evaluated by:

- The extent to which the proposed work supports the solicitation theme of Big Data and Disaster Research; and
- The extent to which the work and collaboration plans describe a unified project between the US and Japanese participants and the added value to be expected from the US-Japan collaboration proposed.

B. Review and Selection Process

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

NSF will manage and conduct the review process of proposals submitted in accordance with NSF standards and procedures. Reviewers will be asked to formulate a recommendation to either support or decline each proposal. Following, and based upon the results of, independent and parallel review processes by NSF and JST, program managers at the two agencies will discuss recommendations. During this discussion, NSF and JST program managers may share unattributed reviews (i.e., the reviews will not include reviewer identities) with one another. The NSF Program Officer assigned to manage the proposal's review will consider the advice of both the US and Japanese review processes and the results of the discussions with JST program managers 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 http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

NSF intends to make awards to the US collaborators named in the recommended proposals. JST intends to make awards to the Japanese collaborators named in the recommended proposals. Both NSF and JST awardees will acknowledge the collaboration in their award notices. NSF awards will be made in FY 2015 as standard grants. The awards will be made for three-year periods.

Grantees of this program will be expected to attend, and should budget for, annual grantee review meetings for the purpose of sharing research progress with representatives of other projects funded under this solicitation as well as NSF and JST representatives and other persons designated by NSF and JST. The first such meeting will be held approximately 9 months after the awards are made, and succeeding meetings will be held every 12 months thereafter.

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 at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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:

- Phillip Regalia, Program Director, CCF, telephone: (703) 292-8910, email: pregalia@nsf.gov

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

- Min Song, Program Director, CNS, telephone: (703) 292-8950, email: msong@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website at https://public.govdelivery.com/accounts/USNSF/subscriber/new?topic_id=USNSF_179.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new 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 provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 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 http://www.nsf.gov

- **Location:**   4201 Wilson Blvd. Arlington, VA 22230

- **For General Information**   (703) 292-5111
  (NSF Information Center)**:**

- **TDD (for the hearing-impaired):**   (703) 292-5090

- **To Order Publications or Forms:**

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

    or telephone: (703) 292-7827

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel

National Science Foundation
Arlington, VA 22230

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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

Last Updated:
11/07/06
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