Networking Technology and Systems (NeTS: JUNO)

Japan-US Network Opportunity: R&D for "Beyond Trillions of Objects"

PROGRAM SOLICITATION

NSF 13-574

National Science Foundation

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems

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

October 09, 2013

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the ***NSF Proposal & Award Policies & Procedures Guide*** (PAPPG)**,** NSF 13-1, was issued on October 4, 2012 and is effective for proposals submitted, or due, on or after January 14, 2013. Please be advised that the guidelines contained in NSF 13-1 apply to proposals submitted in response to this funding opportunity.

Please be aware that significant changes have been made to the PAPPG to implement revised merit review criteria based on the National Science Board (NSB) report, National Science Foundation's Merit Review Criteria: Review and Revisions. While the two merit review criteria remain unchanged (Intellectual Merit and Broader Impacts), guidance has been provided to clarify and improve the function of the criteria. Changes will affect the project summary and project description sections of proposals. Annual and final reports also will be affected.

A by-chapter summary of this and other significant changes is provided at the beginning of both the *Grant Proposal Guide* and the *Award & Administration Guide*.

Please note that this program solicitation may contain supplemental proposal preparation guidance and/or guidance that deviates from the guidelines established in the Grant Proposal Guide.

Proposers are encouraged to contact J. Bryan Lyles (jlyles@nsf.gov) two weeks prior to submission.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Networking Technology and Systems (NeTS: JUNO)
Japan-US Network Opportunity: R&D for “Beyond Trillions of Objects”

Synopsis of Program:

The Division of Computer and Network Systems (CNS) supports research and education activities that invent new computing and networking technologies and that explore new ways to make use of existing technologies. The Division seeks to develop a better understanding of the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems. The Networking Technology and Systems (NeTS) program supports transformative research on fundamental scientific and technological advances leading to the development of future-generation, high-performance networks and future Internet architectures.

Under this umbrella, the National Science Foundation (NSF) and the National Institute of Information and Communications Technology (NICT) of Japan have agreed to embark on a collaborative research program to address compelling research challenges that arise from networks supporting future demands of device proliferation and data objects. This NSF solicitation parallels an equivalent NICT solicitation. Proposals submitted under this solicitation must describe joint research with Japanese counterparts who are requesting funding separately under the NICT solicitation.

This research and development program addresses three specific challenges that arise when environments with trillions of device and information objects are connected via networks. Trillions of network-connected objects are expected to emerge in the global network around 2020. This trend will require novel approaches for network design and modeling, new technologies to manage and control object mobility, and new and more flexible networks with the speed, capacity and environmental characteristics needed to accommodate communications among objects in the emerging world.

This program seeks joint Japan-US research projects that leverage each nation's expertise and address these challenges via work in three areas:

1. *Network Design and Modeling:* Addressing the design, modeling and component interaction challenges

associated with increasingly dynamic and heterogeneous network technologies and applications at scale.

2. *Mobility:* Addressing issues such as security, control, provisioning, naming, discovery, and fast mobility in a world in which mobility is driven by factors such as social networks, the Internet of things, and cyber-physical systems.

3. *Optical Networking:* Finding novel approaches for sustainable high speed, high capacity, and energy-efficient networks that will accommodate communications required in "beyond trillions of devices and information objects" situations.

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.

- Joseph B. Lyles, Program Director, 1175, telephone: (703) 292-8950, email: jlyles@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

Estimated Number of Awards: 6 to 8

Anticipated Funding Amount: $2,000,000 dependent upon the availablity of funds. Each award may be up to $300,000 over three years, and will be made to US participants, pending availability of funds.

Eligibility Information

Organization Limit:

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.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

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 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 Applicable
- Preliminary Proposal Submission: Not Applicable
- 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):

  October 09, 2013

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 Division of Computer and Network Systems (CNS) and the National Institute of Information and Communications Technology (NICT) of Japan have a history of collaboration that extends back several years. The NICT has tracked the NSF-funded Global Environment for Networking Innovation (GENI; http://www.geni.net/) project since its inception in 2007, and in 2010 the two agencies jointly funded a set of Japan-US proposals in the area of future Internet design. These projects helped establish new collaborations among researchers from both countries.

In 2012, NSF and NICT officials reviewed prior efforts and discussed possible future joint programs organized around common interests and complementary strengths. The overarching area that emerged was the support for advanced Internet architectures, and in particular support for an Internet where trillions of objects are connected to, and accessed from, a mobile world. Under this heading, in November 2012, Japanese and US principal investigators gathered in Tokyo to discuss topics in the general areas of optical networking, mobile computing, and network design and modeling as these were felt to be important components of the future Internet. On the basis of the workshop output (http://netrel.umkc.edu/usjw2012/), NSF and NICT moved forward to establish a second Japan-US joint research and development program.

This "Beyond Trillions of Objects" Japan-US joint research and development program addresses a critical subset of the issues that arise when environments with trillions of device and information objects are network-connected, as is expected to be the case by the year 2020. This trend will require novel approaches for network design and modeling, new technologies for network management and control in support of object mobility, and flexible networks with the speed, capacity and environmental characteristics needed to accommodate communications among objects in the emerging world. This program seeks joint Japan-US research projects that address these challenges.

II. PROGRAM DESCRIPTION

Proposals are solicited for joint Japan-US foundational and transformative research consistent with the theme of "Beyond Trillions of Objects" in the following three areas:

1. Network Design and Modeling

We seek joint Japan-US projects exploring the design and modeling implications of increasingly dynamic, heterogeneous network technologies and applications at scale. The needs of network design and modeling are driven by the dramatic increase in numbers of users, applications, services, data objects, and physical devices. There are diverse access technologies, an expanding role of data centers, a dynamic edge consisting of mobile devices, sensors and "things," and an increased emphasis on energy utilization and green networking. Network utilization patterns are becoming increasingly dynamic due to the interaction with overlays, such as social networks, yet the current design and modeling methods are based on quasi-static network models. Proposals addressing problems arising out of these challenges are sought, including, but not limited to, the following:

- Models and analysis frameworks for self-organized or evolved networks;
- Models incorporating adaption in response to mobile network use patterns, such as social networks, content sharing patterns, and the responses of cyber-physical systems to changing environments; and
- Impacts on modeling and analysis of new network architectures that make explicit use of cross-layer management information.

2. Mobility

We seek joint Japan-US projects exploring the mobility protocols and architectures needed to support novel applications and services at very large scale and spanning heterogeneous and high-density networks. Challenges associated with such mobility protocols and architectures include scalability and metrics, security and privacy, service composition, naming and addressing, resource management, mobility management, federation of heterogeneous resources, testing and validation, system control, and interfaces with cloud computing and content delivery. Examples of relevant areas include, but are not limited to:

- Architectures that provide or support integration of personal communications, sensing, and computing for dense, highly mobile devices and data sources;
- Security and privacy frameworks that are relevant to mobility architectures where the number of networks, number of devices, and number and sources of data exceed the administrative capabilities of today's networking paradigms;
- Novel methods for integrating cloud computing with small mobile devices; and
- Scalable resource management for a world of trillions of mobile terminals, services, and objects.

3. Optical Network Architectures

We seek joint Japan-US optical networking projects that address challenges related to the flexible and reliable provisioning of bandwidth in support of dynamic capacity demands, simplification of network design and modeling tasks, and energy efficiency. While the network architectures will likely include a mixture of switching technologies, dynamically provisioned or switched optical networks are believed to be the most cost- and energy-efficient for higher-volume traffic. Challenges include energy-efficient mechanisms for multi-granular optical services, dynamic resource allocation mechanisms for switching, traffic classification in high-speed networks in support of routing and switching decisions, and other topics relevant to dynamic provisioning of bandwidth. These challenges arise from both the growth in bandwidth required to support the data volumes implied by trillions of objects and from the increasingly dynamic traffic matrices implied by device mobility and the interaction with social and content networks. Energy efficiency and reliability is required for both environmental reasons and because communication networks may be required to operate for extended periods of time without direct support from electrical grids (e.g., during periods of disaster recovery or for remote locations). Example projects include, but are not limited to:

- Architectures for dynamically provisioned, energy-efficient and high-reliability optical core, access and data center networks;
- Methods for assigning data transfers to the appropriate network layer, i.e., switched layer-1, switched layer-2, or layer-3, with at least one layer optical; and
- Novel optical node architectures supporting the above objectives.

III. AWARD INFORMATION

For each project the US and Japanese teams will be funded by the NSF and the NICT, respectively, through separate NSF and NICT funding instruments. For each project, NSF support will be provided via a NSF grant, and NICT support will be provided either via a contract entered between NICT and a research institute under NICT's extramural Commissioned ICT Research and Development Program or via a new opportunity under NICT's intramural R&D funding program for NICT researchers. 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

Organization Limit:

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.

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

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 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.

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 NICT in accordance with NICT'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 NICT 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 NICT must be included in the proposals submitted separately to NSF and NICT. US Principal Investigators taking part in a joint research project are expected to coordinate their NSF submissions with their Japanese counterparts' NICT 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 "NeTS: JUNO:" followed by project-specific text.
- 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. You can 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 (not part of the project description and need only be submitted 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 of, 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* (up to 1 page): In a supplemental document, 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 each Participant.
- *Personnel*: 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 Personel
  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

  Proposers are encouraged to contact J. Bryan Lyles (jlyles@nsf.gov) two weeks prior to submission.

- 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/NICT-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):

  October 09, 2013

D. FastLane / Grants.gov Requirements

- For Proposals Submitted Via FastLane:

  Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are 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.

  Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

- 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://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding 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.

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 *Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016*. 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 core strategies 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 provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the variety of learning perspectives.

Another core strategy in support of NSF's mission is broadening 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, JUNO proposals will also be evaluated by:

- The extent to which the proposed work supports the solicitation theme of "Beyond Trillions of Objects."
- The extent to which the work and collaboration plans describe a unified project between the US and Japanese participants.

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 NICT, program managers at the two agencies will discuss recommendations. During this discussion, NSF and NICT 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 U.S. and Japanese review processes and the results of the discussions with NICT 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, 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.

In all cases, 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 and 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.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at 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. NICT intends to make awards to the Japanese collaborators named in the recommended proposals. Both NSF and NICT awardees will acknowledge the collaboration in their award notices. NSF awards will be made in FY 2014 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 NICT representatives and other persons designated by NSF and NICT. 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:

- Joseph B. Lyles, Program Director, 1175, telephone: (703) 292-8950, email: jlyles@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, "My NSF" 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. "My NSF" also is available on NSF's website at http://www.nsf.gov/mynsf/.

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 (NSF Information Center): (703) 292-5111
- TDD (for the hearing-impaired): (703) 292-5090
- To Order Publications or Forms:

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Arlington, VA 22230