

# Computer Science for All (CS for All: RPP)

## Researcher Practitioner Partnerships

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### PROGRAM SOLICITATION

#### NSF 17-525

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#### National Science Foundation

Directorate for Education & Human Resources  
Research on Learning in Formal and Informal Settings

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

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

February 28, 2017

### IMPORTANT INFORMATION AND REVISION NOTES

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Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 17-1](#)), which is effective for proposals submitted, or due, on or after January 30, 2017. Please be advised that proposers who opt to submit prior to January 30, 2017, must also follow the guidelines contained in NSF 17-1.

### SUMMARY OF PROGRAM REQUIREMENTS

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#### General Information

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**Program Title:**

Computer Science for All (CS for All: RPP)  
Researcher Practitioner Partnerships

**Synopsis of Program:**

This program aims to provide *all* U.S. students the opportunity to participate in computer science (CS) and computational thinking (CT) education in their schools at the K-12 levels. With this solicitation, the National Science Foundation (NSF) focuses on researcher-practitioner partnerships (RPPs) that foster the research and development needed to bring CS/CT to all schools. Specifically, this solicitation aims to provide high school teachers with the preparation, professional development (PD) and ongoing support that they need to teach rigorous computer science courses, and K-8 teachers with the instructional materials and preparation they need to integrate CS/CT into their teaching.

**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.*

- Janice Cuny, Program Director, CISE/OAD, telephone: (703) 292-8900, email: [jcuny@nsf.gov](mailto:jcuny@nsf.gov)
- Karen King, Program Director, EHR/DRL, telephone: (703) 292-5124, email: [kking@nsf.gov](mailto:kking@nsf.gov)
- Arlene M. de Strulle, Program Director, EHR/DRL, telephone: (703) 292-8620, email: [adestrul@nsf.gov](mailto:adestrul@nsf.gov)
- David L. Haury, Program Director, EHR/DRL, telephone: (703) 292-8614, email: [dhaury@nsf.gov](mailto:dhaury@nsf.gov)

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

- 47.070 --- Computer and Information Science and Engineering
- 47.076 --- Education and Human Resources

### Award Information

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**Anticipated Type of Award:** Standard Grant

**Estimated Number of Awards:** 19

approximately 5 small, 10 medium, and 4 large awards.

**Anticipated Funding Amount:** \$20,000,000

Subject to the availability of funds

## Eligibility Information

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### Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

### Who May Serve as PI:

There are no restrictions or limits.

### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

## Proposal Preparation and Submission Instructions

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### 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](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](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. submitter's local time):

February 28, 2017

## Proposal Review Information Criteria

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### 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

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### Award Conditions:

Standard NSF award conditions apply.

### Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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## I. INTRODUCTION

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A key goal of this program is to provide *all* U.S. students the opportunity to participate in computer science (CS) and computational thinking (CT) education in their schools at the preK-12 levels. CT refers to the thought processes involved in formulating problems and their solutions in such a way that the solutions can be effectively carried out by an information-processing agent (usually a computer)[1]. CT activities do not require the presence of a computing tool, but involve the requisite reasoning needed to capitalize on the use of computational tools. CS, as used in this solicitation, includes CT but also the broad range of understandings, competencies, and skills needed to apply computation in our digital world. It includes topics of problem specification and representation; algorithm development; software design, programming, and debugging; the Internet; big data; cybersecurity; and application across a wide range of disciplines, including the associated societal impact and ethical considerations. This solicitation focuses on CS and CT instruction, as distinct from the mere use of computers or the use of common computational tools such as word processors or presentation software (the later often referred to as computational literacy).

As the lead Federal agency for building the research knowledge base for CS and CT education, NSF aims to build upon past and ongoing efforts to enable rigorous and engaging CS and CT education in schools across the Nation, including approximately \$25 million in FY 2016 in support of these efforts.

## II. PROGRAM DESCRIPTION

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This program supports researcher-practitioner partnerships (RPPs) with the goal of building knowledge from research and development to support providing opportunities for *all* students to participate in CS and CT formal STEM learning at the elementary, middle, and high school grade levels. Proposals will be funded in two "strands" that foster design, implementation at scale, and research:

- At the **high school level**, the focus is on preparing and supporting teachers to teach rigorous CS courses; and
- At the **preK-8 level**, the focus is on designing, developing, and piloting instructional materials that integrate CS and CT into preK-8 classrooms.

In order to ensure that advances in computing education are inclusive of our diverse student populations (the "for All" part of "CS for All"), proposals on either strand **must** address, in a significant manner, the longstanding underrepresentation in computing. Groups traditionally underrepresented or underserved in computing include women, persons with disabilities, African Americans/Blacks, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, Native Pacific Islanders, and persons from economically disadvantaged backgrounds.

Proposals in either strand must come from RPPs, defined in the literature as "long-term, mutualistic collaborations between practitioners and researchers that are intentionally organized to investigate problems of practice and solutions for improving district [and school] outcomes" [1]. RPPs require well-organized teams of academic researchers and preK-12 practitioners (teachers, administrators, and counselors), possibly augmented with other community, foundation, policy, and industry partners. Members of these teams work together to iteratively define and refine common goals, metrics, and implementations. There are a variety of ways in which these RPPs can be organized. Examples include Research Alliances, Design Research, and Networked Improvement Communities as described in the implementation and improvement science literature:

- [http://edr.sagepub.com/content/early/2016/01/28/0013189X16631750.full.pdf+html?utm\\_source=CPRE+Insights%2C+April%2FMay+2016&utm\\_campaign=Insights%3A+April%2FMay+2016&utm\\_medium=email](http://edr.sagepub.com/content/early/2016/01/28/0013189X16631750.full.pdf+html?utm_source=CPRE+Insights%2C+April%2FMay+2016&utm_campaign=Insights%3A+April%2FMay+2016&utm_medium=email);
- <http://edr.sagepub.com/content/45/4/243.full.pdf+html>;
- <http://www.carnegiefoundation.org/> under Improvement Resources;

- <http://rpp.wtgrantfoundation.org/>;
- <http://researchandpractice.org/>; and
- <http://learnbir.org/>.

RPPs aim to strengthen the capacity of an organization to reliably produce valued CS and CT education outcomes for diverse groups of students, educated by different teachers from varied organizational contexts. The focus is on succeeding when implemented at scale. These studies have less prescriptive research designs and methods, with research occurring in rapid, iterative, and context-expanding cycles. They require deep engagement of researchers and practitioners during the collaborative research on problems of practice that are co-defined and of value to researchers and education agencies, for example, a school district or community of schools. These types of projects seek to:

- study implementation in the local context;
- employ rapid changes in implementation with short-cycle methods;
- capitalize on variation in educational contexts to address the sources of variability in outcomes to understand what works, for whom, and under what conditions;
- address organizational structures and processes and their relation to innovation;
- employ measurement of change ideas, key drivers, and outcomes to continuously test working theories and to learn whether specific changes actually produce improvement; and
- reform the system in which the approach is being implemented as opposed to overlaying a specific approach on an existing system.

#### Proposal Strands:

**High School Strand.** Proposals submitted to this strand should address scalable preparation and support for high school CS teachers. As schools attempt to respond to the increasing demand for CS courses and including CS and CT in the curriculum, they are faced with a critical shortage of teachers. Proposals in this strand should address key issues in the preparation and professional development (PD) of teachers of high school computer science, recognizing the need for quickly scaling effective PD efforts to tens of thousands of teachers, many of whom have had little or no formal CS preparation. Additional issues include (but are not limited to):

- recruitment of teachers;
- differential PD based on prior experiences;
- creating robust PD materials for teachers and facilitators;
- establishing online and hybrid PD approaches;
- assessing the effectiveness of PD models with respect to content knowledge, pedagogy, classroom equity, and student outcomes;
- adapting and scaling PD models for greater impact, especially with respect to inclusion and equity;
- establishing certification programs and pre-service paths for teacher PD;
- undertaking studies to inform state or local policy about CS requirements; or
- designing, piloting and assessing scalable mechanisms for ongoing support of classroom teachers.

While the focus of the High School strand is RPPs to conduct implementation and improvement research on teacher preparation and PD, it is possible within a project to adapt or enhance instructional materials for high school students. However, PIs are encouraged to focus their RPPs on studying supports for teachers who are interested in using instructional materials that already have been developed and piloted and are now scaling nationally, such as Exploring Computer Science (ECS), curricula based on the Advanced Placement® (AP) Computer Science Principles (CSP) framework, Bootstrap or other widely used CS and CT curricula. Strong proposals should document the wide use of the proposed instructional materials and include any available results about effectiveness as part of the argument for focusing on the materials of choice, and address how findings from the research will inform practitioners' choices about CS and CT materials.

**K-8 Strand.** Thus far, there has been less attention paid to teaching CS and CT in preK-8 than at the high school level. RPPs proposed in this strand may address a wide range of topics on the teaching and learning of CS/CT in grades preK-8 including but not limited to:

- Development and study of prototype instructional materials for preK-8 both for stand-alone CS/CT courses or modules as well as teaching and testing of CS/CT concepts with other content;
- creation of developmentally-appropriate learning progressions that underlie the design of instructional materials;
- design of classroom-based assessments to inform teaching and learning along the way; or
- development of PD and teacher support—including face-to-face and online learning communities, coaching, and mentoring—as needed for piloting of instructional materials, along with research about their use and effectiveness.

#### High quality proposals on either strand will:

- Delineate clearly the CS/CT content to be taught;
- Address underrepresentation, demonstrating knowledge of the relevant literature on underrepresentation and best practices, and providing concrete plans of action and clear metrics for documenting outcomes [2];
- Document the extent to which the approach has already scaled and its potential for further scaling;
- Specify jointly-developed research questions and document the investment of the partners in those questions;
- Provide work plans for implementation, improvement, data collection, analysis, and use; and
- Draw from RPP literature on assessing/evaluating the quality of the partnership to articulate plans for assessing the success of the work of the RPP.

#### All projects should provide research results or findings on:

- strategies for improvement or implementation that address the shared goal of the researcher/practitioner collaborators;
- conceptual frameworks that address issues of scale, human capacity, and technical support for implementation and improvement in educational systems;
- measures of organizational learning that assess the progress of implementation and improvement;
- sustainable communities that can support implementation and improvement in the targeted educational system; and
- documented practices with an ongoing forum for continued engagement of collaborators from various levels of the educational system.

#### Proposal size classes:

Proposals may be submitted in the following **size classes**:

- **Small** proposals (maximum of \$300,000 for up to 2 years) are designed to support the initial steps in establishing a strong and well-integrated RPP team that could successfully compete for a Medium or Large proposal in the near future;
- **Medium** proposals (maximum of \$1,000,000 for up to 3 years) are designed to support the modest scaling of a promising

- approach by a well-defined RPP team; and
- **Large** proposals (maximum of \$2,000,000 for up to 4 years) are designed to support the widespread scaling of an evidence-based approach by a RPP team that builds on some prior collaborations.

[1] Coburn, C.E., Penuel, W.R., & Geil, K.E. (January 2013). Research-Practice Partnerships: A Strategy for Leveraging Research for Educational Improvement in School Districts. William T. Grant Foundation, New York, NY, pg. 2.

[2] Proposers are encouraged to leverage the resources of the Broadening Participation in Computing Alliances: [http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503593](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503593).

### III. AWARD INFORMATION

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**Anticipated Type of Award:** Standard Grant

**Estimated Number of Awards:** 19, approximately 5 small, 10 medium, and 4 large awards.

**Anticipated Funding Amount:** \$20,000,000

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

### IV. ELIGIBILITY INFORMATION

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#### Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

#### Who May Serve as PI:

There are no restrictions or limits.

#### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

### V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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#### A. Proposal Preparation Instructions <

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**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](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](mailto: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](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](mailto: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.5 of the Grant Proposal Guide provides additional information on collaborative proposals.

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

## COVER SHEET:

Mark the **Human Subjects** box as pending, approved, or exempted (with exemption subsection indicated). **This box should not be left blank.** The **Human Subjects** box should be marked as pending if an IRB is either (1) reviewing the project plan and has not yet determined a ruling of "approved" or "exempt", or (2) the project plan has not yet been submitted to an IRB for review. Additional guidance on the use of Human Subjects is available in the [PAPPG, Chapter II.D.5](#).

## PROJECT SUMMARY:

In addition to the guidance provided in the PAPPG on project summary preparation, the first line of the overview must indicate the proposal strand and size class from among the options specified in the Program Description of this solicitation.

## PROJECT DESCRIPTION:

In addition to the guidance provided in the PAPPG on project description preparation, the project description for all size classes should also include:

- The management and administrative structure and the capability for administering the program; and
- Mechanisms to assess success of the proposed project.

A proposal must describe appropriate mechanisms to assess success through project-specific external review and feedback processes. All projects must have external, critical reviews of their designs and activities (including their theoretical frameworks, as well as data collection, analysis, and reporting plans). These might include an external review panel or advisory board proposed by the project or a third-party evaluator. The external critical review should be sufficiently independent and rigorous to influence the project's activities and improve the quality of its findings. Successful proposals will (1) describe the expertise of the external reviewer(s); (2) explain how that expertise relates to the goals and objectives of the proposal; and (3) specify how the PI will report and use results of the project's external, critical review process.

All proposals must explicitly address how they are addressing broadening participation of students traditionally underrepresented in computing and Science, Technology, Engineering and Mathematics (STEM).

For Small size class proposals, the project description must describe:

- what is known about the issue to be investigated;
- the contributions of collaborators representing multiple perspectives;
- how the development of the collaboration will have the potential to result in a future RPP with education researchers, experts in CS/CT and schools or districts;
- the steps to build effective collaborations for achieving the project goals; and
- the steps and actions to further refine and develop the research question(s) and methods or design and development approaches, leveraging the expertise of the collaborators.

## SPECIAL INFORMATION AND SUPPLEMENTARY DOCUMENTS:

In addition to guidance provided in the PAPPG on required Special Information and Supplementary Documents, provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list should include all PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and 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:

- Mary Smith; XYZ University; PI
- John Jones; University of PQR; Senior Personnel
- Jane Brown; XYZ University; Postdoc
- Bob Adams; ABC Community College; Paid Consultant
- Susan White; DEF Corporation; Unpaid Collaborator
- Tim Green; ZZZ University; Subawardee

## SINGLE COPY DOCUMENTS:

### Collaborators and Other Affiliations Information:

For this solicitation, the *Collaborators & Other Affiliations* information specified in the PAPPG should be submitted using the spreadsheet template found at <https://www.nsf.gov/cise/collab/>. For each proposal, a completed spreadsheet for each PI, co-PI, or senior personnel must be uploaded directly into Fastlane in .xls or .xlsx format as a "Collaborator and Other Affiliations" Single Copy Document. NSF staff use this information in the merit review process to help manage reviewer selection; the spreadsheet will ensure the Collaborator and Other Affiliations information has a common, searchable format.

Note the distinction to above for Supplementary Documents: the listing of all project participants is collected by the project lead and entered as a Supplementary Document, which is then automatically included with all proposals in a project. The Collaborators and Other Affiliations are entered for each participant within each proposal and, as Single Copy Documents, are available only to NSF staff. Collaborators and Other Affiliations due to participants listed above that are not PIs, co-PIs, or senior personnel can be uploaded under Additional Single Copy Documents using Transfer File.

## B. Budgetary Information

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### Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

### Budget Preparation Instructions:

Projects should budget to have two members attend a meeting of principal investigators annually.

## C. Due Dates

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

February 28, 2017

## D. FastLane/Grants.gov Requirements

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### 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](mailto: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](mailto: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

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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://www.nsf.gov/bfa/dias/policy/merit\\_review/](http://www.nsf.gov/bfa/dias/policy/merit_review/).

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *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

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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

This program solicitation is particularly interested in broadening participation in CS and CT for groups traditionally underrepresented in CS. In addition to considering the two general NSF Merit Review Criteria, reviewers will also be asked to evaluate the following:

1. Does the proposal identify the characteristics and needs of the targeted underrepresented groups (public or professional) to be served?
2. Does the proposal include specific plans or strategies for addressing or accommodating the particular needs of participants of the identified underrepresented groups?

## B. Review and Selection Process

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



Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

## VII. AWARD ADMINISTRATION INFORMATION

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### A. Notification of the Award

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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

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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](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](mailto: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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag).

### C. Reporting Requirements

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

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

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

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

Projects will be required to maintain a website, attend annual PI meetings, and participate in a common evaluation where appropriate.

## VIII. AGENCY CONTACTS

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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:

- Janice Cuny, Program Director, CISE/OAD, telephone: (703) 292-8900, email: [jcuny@nsf.gov](mailto:jcuny@nsf.gov)
- Karen King, Program Director, EHR/DRL, telephone: (703) 292-5124, email: [kking@nsf.gov](mailto:kking@nsf.gov)
- Arlene M. de Strulle, Program Director, EHR/DRL, telephone: (703) 292-8620, email: [adestrul@nsf.gov](mailto:adestrul@nsf.gov)
- David L. Haury, Program Director, EHR/DRL, telephone: (703) 292-8614, email: [dhaury@nsf.gov](mailto:dhaury@nsf.gov)

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: [fastlane@nsf.gov](mailto: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](mailto:support@grants.gov).

## IX. OTHER INFORMATION

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

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

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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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](mailto: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

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