Future of Work at the Human-Technology Frontier: Core Research (FW-HTF)

PROGRAM SOLICITATION
NSF 19-541

REPLACES DOCUMENT(S):
NSF 18-548

National Science Foundation

Directorate for Engineering

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

March 06, 2019

IMPORTANT INFORMATION AND REVISION NOTES

The Future of Work at the Human-Technology Frontier (FW-HTF) program solicitation has been revised for the FY 2019 competition, and prospective Principal Investigators are encouraged to read the solicitation carefully. Among the changes are the following:

- The Project Categories have been revised.
    - FW-HTF Research Grants (FW-HTF-R) category includes two sizes: Medium and Large. Medium projects have a budget of up to $1,500,000 for up to 3 years, and Large projects have a budget of $1,500,001-$3,000,000 for up to 4 years.
    - FW-HTF Planning Grants (FW-HTF-P) category has been added. Planning Grants may be requested for a total budget not to exceed $150,000 for a period of 1 year.
- Research themes responsive to this solicitation have been updated, incorporating previous elements and adding new elements. Proposers no longer submit to a designation of Theme 1 or Theme 2.
- In addition to the sections required by the PAPPG, the Project Description must include the following separate sections, clearly labeled "Work Context," "Integrative Research," and "Methods, Measures, and Metrics."
- Solicitation Specific Review Criteria have been removed.
- The Letter of Intent requirement has been removed.
- Proposal deadline has been revised.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 19-1), which is effective for proposals submitted, or due, on or after January 28, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Future of Work at the Human-Technology Frontier: Core Research (FW-HTF)

Synopsis of Program:

In 2016, the National Science Foundation (NSF) unveiled a set of "Big Ideas," 10 bold, long-term research and process ideas that identify areas for future investment at the frontiers of science and engineering (see https://www.nsf.gov/news/special_reports/big_ideas/index.jsp). The Big Ideas represent unique opportunities to position our Nation at the cutting edge of global science and engineering leadership by bringing together diverse disciplinary perspectives to support convergence research. As such, when responding to this solicitation, even though proposals must be submitted to the Directorate for Engineering (ENG), Office of Emerging Frontiers and Multidisciplinary Activities (ENG/EFMA), once received the proposals will be managed by a cross-disciplinary team of NSF Program Directors.

The Future of Work at the Human-Technology Frontier (FW-HTF), one of the Big Ideas, is one mechanism by which NSF is responding to the challenges and opportunities for the future of jobs and work. The overarching vision is to

support convergent research to understand and develop the human-technology partnership, design new technologies to augment human performance, illuminate the emerging socio-technological landscape, understand the risks and benefits of new technologies, understand and influence the impact of artificial intelligence on workers and work, and foster lifelong and pervasive learning.

The landscape of jobs and work is changing at unprecedented speed, enabled by advances in computer and engineering technologies such as artificial intelligence and robotics, deeper understanding of societal and environmental change, advances in the learning sciences, pervasive, intelligent, and autonomous systems, and new conceptions of work and workplaces. This technological and scientific revolution presents a historical opportunity to the Nation and its people, in the creation of new industries and occupations, enhanced productivity and quality of work life, and the potential for more people to participate in the workforce, ultimately yielding sustained innovation and global leadership. But, as history teaches, such changes also come with risks. Some risks are immediate, such as jobs lost to automation or demand for skills not met by current educational pathways. Other equally important risks include new security threats, algorithmic biases, unanticipated legal consequences including privacy implications, dependence on technology and erosion of human knowledge and skills, inadequate workplace policies and practices, or undesirable impact on the built environment.

The specific objectives of the Future of Work at the Human-Technology Frontier program are (1) to facilitate convergent research that employs the joint perspectives, methods, and knowledge of computer science, engineering, learning sciences, research on education and workforce training, and social, behavioral, and economic sciences; (2) to encourage the development of a research community dedicated to designing intelligent technologies and work organization and modes inspired by their positive impact on individual workers, the work at hand, the way people learn and adapt to technological change, creative and supportive workplaces (including remote locations, homes, classrooms, or virtual spaces), and benefits for social, economic, and environmental systems at different scales; (3) to promote deeper basic understanding of the interdependent human-technology partnership to advance societal needs by advancing design of intelligent work technologies that operate in harmony with human workers, including consideration of how adults learn the new skills needed to interact with these technologies in the workplace, and by enabling broad workforce participation, including improving accessibility for those challenged by physical or cognitive impairment; and (4) to understand, anticipate, and explore ways of mitigating potential risks arising from future work at the human-technology frontier. Ultimately, this research will advance our understanding of how technology and people interact, distribute tasks, cooperate, and complement each other in different specific work contexts of significant societal importance. It will advance the knowledge base related to worker education and training and formal and informal learning to enable all potential workers to adapt to changing work environments. It will advance our understanding of the links between the future of work at the human-technology frontier and the surrounding society, including the intended potential of new technologies and the unintended consequences for workers and the well-being of society.

For the purposes of this solicitation, work is defined as mental or physical activity to achieve tangible benefit such as income, profit, or community welfare. The Future of Work at the Human-Technology Frontier is, in turn, a conceptualization of work in the future that will be enabled or improved by advances in intelligent technology and their synergistic integration with human skill to achieve broad participation in the workforce and improve the social, economic, and environmental well-being of society. To reach this goal, research is sought that is anchored in work. Proposals must clearly define the work and work context addressed by the research. Technology should be integrated with learning sciences, research on education and workforce training, and social, behavioral, and economic science perspectives to advance the science of the human-technology team. Potential results should contribute to fundamental advances in the science and technology of future workforce development and education, work environments, and positive work outcomes for workers and society at large. Proposals are encouraged that are oriented toward the future of work at the human-technology frontier and that are not overly couched in current technology or work practices.

A proposal for a research grant in this program must focus on advancing fundamental understanding of future work, and potential improvements to work, workplaces, workforce preparation, or work outcomes for workers and society. It must be convergent research that addresses the technological as well as the human and societal dimensions and potential impact of future work, and in doing so, make significant contributions to both intellectual merit and broader impact. Achieving this goal requires integration and convergence of disciplines across computer science, engineering, learning sciences, research on education and workforce training, and social, behavioral, and economic sciences. A convergent perspective is essential to understand and shape long-term social and economic drivers, so that advanced intelligent technology will strengthen the social fabric. A convergent perspective also provides insights into education and re-skilling, so that the benefits of emerging technology can be conferred upon all citizens.

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.

- Address General Questions to, telephone: (703) 292-5365, email: fwhtf-contacts@nsf.gov

- Stephanie E. August, EHR/DUE, telephone: (703) 292-5128, email: fwhtf-contacts@nsf.gov

- Amy L. Baylor, EHR/DRL, telephone: (703) 292-5126, email: fwhtf-contacts@nsf.gov

- Jordan Berg, ENG/CMMI, telephone: (703) 292-5365, email: fwhtf-contacts@nsf.gov

- David Corman, CISE/CNS, telephone: (703) 292-8754, email: fwhtf-contacts@nsf.gov

- Shubhra Gangopadhyay, ENG/ECCS, telephone: (703) 292-2485, email: fwhtf-contacts@nsf.gov

- Meghan Houghton, CISE/OAD, telephone: (703) 292-4449, email: fwhtf-contacts@nsf.gov

Sara Kiesler, SBE/SES, telephone: (703) 292-8643, email: fwhtf-contacts@nsf.gov

- Tatiana Korelsky, CISE/IIS, telephone: (703) 292-8930, email: fwhtf-contacts@nsf.gov

- Todd Leen, CISE/IIS, telephone: (703) 292-8930, email: fwhtf-contacts@nsf.gov

- Nancy A. Lutz, SBE/SES, telephone: (703) 292-7280, email: fwhtf-contacts@nsf.gov

- Alexandra Medina-Borja, EHR/DUE, telephone: (703) 292-7557, email: fwhtf-contacts@nsf.gov

- Robert Scheidt, ENG/CMMI, telephone: (703) 292-2477, email: fwhtf-contacts@nsf.gov

- Betty K. Tuller, SBE/BCS, telephone: (703) 292-7238, email: fwhtf-contacts@nsf.gov

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

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

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 30

Up to 15 Planning Grant Awards and up to 15 Research Grant Awards.

The number of awards is dependent upon the proposals received and the degree to which proposals meet the solicitation goals and NSF merit review criteria.

Anticipated Funding Amount: $30,000,000

Two classes of proposals will be considered through this solicitation:

1. FW-HTF Planning Grants (FW-HTF-P) may be requested for a total budget not to exceed $150,000 for a period of 1 year.
2. FW-HTF Research Grants (FW-HTF-R) may be requested at two levels:
   a. Medium FW-HTF-R proposals may request support for a period of up to 3 years, with a total budget not to exceed $1,500,000.
   b. Large FW-HTF-R proposals may request support for a period of up to 4 years, with a total budget between $1,500,001 and $3,000,000.

FW-HTF program funding is pending the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

PIs must hold appointments at U.S.-based campuses/offices of eligible organizations (IHEs or Non-profit, non-academic organizations). There are no restrictions, beyond the eligibility outlined in the PAPPG Chapter I.E, on who may serve as Co-PIs, Senior Personnel or Consultant (see Categories of Proposers in PAPPG Chapter I.E).

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An individual may appear as PI, Co-PI, Senior Personnel, Other Personnel, or Consultant on only one proposal submitted in response to this solicitation. This eligibility constraint will be strictly enforced. In the event an individual exceeds this limit, the first proposal received prior to the deadline will be accepted and the remainder will be returned without review. This limitation includes proposals submitted by a lead organization, collaborative non-lead proposals, and any subawards included as part of a collaborative proposal involving multiple institutions. No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required

- **Preliminary Proposal Submission:** Not required

- **Full Proposals:**

    - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
    - Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
    - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

    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):

    March 06, 2019

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria apply.

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 landscape of jobs and work is changing at unprecedented speed, enabled by advances in computer and engineering technologies such as artificial intelligence and robotics, deeper understanding of societal and environmental change, advances in the learning sciences, pervasive, intelligent, and autonomous systems, and new conceptions of work and workplaces. This technological and scientific revolution presents a historical opportunity to the Nation and its people, in the creation of new industries and occupations, enhanced productivity and quality of work life, and the potential for more people to participate in the workforce, ultimately yielding sustained innovation and global leadership. But, as history teaches, such changes also come with risks. Some risks are immediate, such as jobs lost to automation or demand for skills not met by current educational pathways. Other equally important risks include new security threats, algorithmic biases, unanticipated legal consequences including privacy implications, dependence on technology and erosion of human knowledge and skills, inadequate workplace policies and practices, or undesirable impact on the built environment.

The Future of Work at the Human-Technology Frontier (FW-HTF), one of the Big Ideas, is one mechanism by which NSF is responding to the challenges and opportunities for the future of jobs and work. The overarching vision is to support convergent research to understand and develop the human-technology partnership, design new technologies to augment human performance, illuminate the emerging socio-technological landscape, understand the risks and benefits of new technologies, understand and influence the impact of artificial intelligence on workers and work, and foster lifelong and pervasive learning.

The specific objectives of the Future of Work at the Human-Technology Frontier program are (1) to facilitate convergent research that employs the joint perspectives, methods, and knowledge of computer science, engineering, learning sciences, research on education and workforce training, and social, behavioral, and economic sciences; (2) to encourage the development of a research community dedicated to designing intelligent technologies and work organization and modes inspired by their positive impact on individual workers, the work at hand, the way people learn and adapt to technological change, creative and supportive workplaces (including remote locations, homes, classrooms, or virtual spaces), and benefits for social, economic, and environmental systems at different scales; (3) to promote deeper basic understanding of the interdependent human-technology partnership to advance societal needs by advancing design of intelligent work technologies that operate in harmony with human workers, including consideration of how adults learn the new skills needed to interact with these technologies in the workplace, and by enabling broad workforce participation, including improving accessibility for those challenged by physical or cognitive impairment; and (4) to understand, anticipate, and explore ways of mitigating potential risks arising from future work at the human-technology frontier. Ultimately, this research will advance our understanding of how technology and people interact, distribute tasks, cooperate, and complement each other in different specific work contexts of significant societal importance. It will advance the knowledge base related to worker education and training and formal and informal learning to enable all potential workers to adapt to changing work environments. It will advance our understanding of the links between the future of work at the human-technology frontier and the surrounding society, including the intended potential of new technologies and the unintended consequences for workers and the well-being of society.

II. PROGRAM DESCRIPTION

A. Overview

For the purposes of this solicitation, work is defined as mental or physical activity to achieve tangible benefit such as income, profit, or community welfare. The "future of work at the human-technology frontier" is, in turn, a conceptualization of work in the future that will be enabled or improved by advances in intelligent technology and their synergistic integration with human skill to achieve broad participation in the workforce and improve the social, economic, and environmental well-being of society. To reach this goal, research is sought that is anchored in work. Proposals must clearly define the work and work context addressed by the research. Technology should be integrated with learning sciences, research on education and workforce training, and social, behavioral, and economic

science perspectives to advance the science of the human-technology team. Potential results should contribute to fundamental advances in the science and technology of future workforce development and education, work environments, and positive work outcomes for workers and society at large. Proposals are encouraged that are oriented toward the future of work at the human-technology frontier and that are not overly couched in current technology or work practices.

A proposal for a research grant in this program must focus on advancing fundamental understanding of future work, and potential improvements to work, workplaces, workforce preparation, or work outcomes for workers and society. It must be convergent research that addresses the technological as well as the human and societal dimensions and potential impact of future work, and in doing so, make significant contributions to both intellectual merit and broader impact. Achieving this goal requires integration and convergence of disciplines across computer science, engineering, learning sciences, research on education and workforce training, and social, behavioral, and economic sciences. A convergent perspective is essential to understand and shape long-term social and economic drivers, so that advanced intelligent technology will strengthen the social fabric. A convergent perspective also provides insights into education and re-skilling, so that the benefits of emerging technology can be conferred upon all citizens.

The Project Description should explain why the level of resources requested is appropriate to the project scope. This is especially important for FW-HTF-R Large proposals.

The FW-HTF program welcomes outreach activities, such as those intended to provide undergraduate students with a meaningful research experience. The Project Description should describe these activities, and the Budget should request funds sufficient to carry them out. Post-award supplements to support such activities are not anticipated.

A broad range of possible research themes and questions is sought. Some possible topics are discussed below. These are only meant to be suggestive; they are not the sole topics of interest, nor are they mutually exclusive. Proposals are welcomed from a diverse blend of perspectives and convergent interdisciplinary partnerships, provided they address and advance the overall vision of the FW-HTF program.

One possible set of topics addresses augmenting physical and cognitive abilities and continues and expands the priorities funded by the FY2018 FW-HTF solicitation, NSF 18-548. This set of topics explores the future of the human-technology partnership at work in the context of pervasive, intelligent, and autonomous systems, along with its associated risks and opportunities, encompassing a range of projects such as the symbiosis of human and machine intelligence for promoting efficiency, worker quality of life, environmental health, or community well-being. The FW-HTF program recognizes the importance of learning and cognition, artificial intelligence, and jobs, of developing and assessing ethical standards for intelligent systems and studying ethical risk assessment, and of coupling new technologies with social and behavioral interventions, policies, or study protocols to advance understanding of formal and informal learning, training, and re-training approaches, and their impact on the future of work.

Another possible set of relevant topics emphasizes productivity, work-life quality, and training and education, to contribute to our understanding of fundamental social and economic structures, processes, policies, or institutions. Project objectives could include stronger opportunity for workers and entrepreneurs, greater societal equality, more innovation in technology and job creation, higher economic productivity, and higher standards of living. Topics relevant to the program include, among other subjects, in-depth analyses of legal, cultural, ethical considerations of work at the human-technology frontier, the impact of technology on privacy and security, preferences of the workforce, and worker control and autonomy. Projects could explore advanced learning technologies or cyberlearning in tandem with studies of the impact on the future landscape of work and jobs.

Research projects must address a well-defined form of work or workplace domain with the purpose of creating new or improved partnerships of technology and human workers in the context of pervasive, intelligent, and autonomous systems. Research questions must intentionally target the future of work with a conceptualization of future work at the human-technology frontier that is embedded in its social and economic context. That context includes the immediate workplace environment and community, as well as the larger ethical, societal, and environmental context. The research should acknowledge not just the conceptual and operational challenges of future technology-worker teamwork, but also the potential unintended consequences of new kinds of work and environments at the human-technology frontier. In doing so, the proposed convergent research should contribute not just to broader impact but significantly to the intellectual merit of the research, that is, to better understanding of the fundamental processes and science of work, workplaces, and workforce development, including, for example, understanding how adults learn new skills or adapt skills to new contexts, or how jobs and work fit within society as a whole.

Projects should cross boundaries between science and engineering with strong translational potential for technology development, and the disciplines of cognitive science, learning sciences, research on education and workforce training, and social, behavioral, and economic sciences. Projects are welcome that advance a convergent research approach anchored in any of these areas as a primary discipline, with project leadership representative of project intellectual priorities. Proposal personnel should reflect this diversity of perspectives, including PIs, co-PIs, or other senior personnel with expertise representative of the required range of disciplines. The participation of disciplinary experts and their integration with the project should be suitable for the research questions; team members must have the required skills and training to bring appropriate domain expertise and state-of-the-art methods to the project.

Questions about the suitability of specific projects may be addressed to a FW-HTF Program Director.

B. Components

In addition to the sections required by the PAPPG ("Intellectual Merit," "Broader Impacts," and, if appropriate, "Results from Prior NSF Support"), the Project Description must include the following separate sections, clearly labeled with the headings used below:

Work Context

A "Work Context" section must be included that clearly identifies and defines the future work domain, workers, and workplaces that are the focus of the research, and the scope and scale of work, employment, and/or self-employment outcomes and benefits envisioned. This section must also identify any partnerships with industry or stakeholders. When the work to be investigated has community welfare as its goal, the community must be described in this section.

Integrative Research

Researchers from diverse fields are expected to work collaboratively and interdependently, creating shared visions, models, methods, and discoveries. The "Integrative Research" section must describe how knowledge, techniques, and expertise from multiple fields and sectors will create new and expanded frameworks for addressing the research goals (see Convergence Research at NSF). The proposal should describe the symbiosis within the multidisciplinary team, and how the team will collaborate to illuminate the technological, human, and larger societal dimensions of the future of work and the implications of deploying pervasive, intelligent, and autonomous systems at the human-technology frontier. Thus, the "Integrative Research" section must identify specific collaboration mechanisms that will enable cross-discipline and cross-sector integration of teams and describe how the research will be integrated over the course of the project.

Methods, Measures, and Metrics

The proposal must include a "Methods, Measures, and Metrics" section that describes how progress and outcomes will be assessed. All proposals must specify the measures, metrics, and criteria for testing research hypotheses, validating models, and assessing interventions or policies. These could include one or more systematic methods: qualitative and/or quantitative methods, public participation in data collection, periodic and/or longitudinal analyses, lab or field experiments, or other robust and reliable approaches.

C. Proposal Category

This solicitation will support projects in two categories:

FW-HTF Planning Grants (FW-HTF-P): FW-HTF-P are intended to stimulate research capacity through multidisciplinary team-building and the development of high-impact, fundamental research concepts. FW-HTF-P are appropriate for supporting a range of planning activities intended to foster a convergent research team that can effectively integrate multiple disciplinary perspectives, explore the work context and build collaborations with relevant stakeholders, and hone research gaps, questions, and hypotheses. Activities within scope include, but are not limited to, travel, multidisciplinary workshops, stakeholder meetings, data collection, preliminary experiments, and pilots. At the conclusion of the Planning Grant, researchers should be prepared to pursue a well-defined research agenda responsive to FW-HTF. Each award will provide support for a period of one year and with a total budget not exceeding $150,000.

FW-HTF Research Grants (FW-HTF-R): FW-HTF-R must advance fundamental understanding of the human-technology partnership in the context of future work, describing potential improvements to work, workplaces, workforce preparation, and work outcomes for workers and society. FW-HTF-R proposals should pursue knowledge, techniques, and expertise from multiple fields and sectors to create new and expanded frameworks for addressing the research goals. The proposal should describe the symbiosis within the multidisciplinary team, including stakeholders in the work context, and how the team will collaborate to illuminate the technological, human, and larger societal dimensions of the future of work and the implications of deploying pervasive, intelligent, and autonomous systems at the human-technology frontier.

Medium FW-HTF-R awards will provide support for a period of up to 3 years, with a total budget request not exceeding $1,500,000. Large FW-HTF-R awards will provide support for a period of up to 4 years, with a total budget request between $1,500,001 and $3,000,000.

D. Principal Investigator Meetings

In order to accelerate the rate of dissemination of ideas among researchers, to build an intellectual research core to address FW-HTF challenges, and to enable enhanced research collaborations, the FW-HTF program plans to host principal investigator (PI/Co-PI) meetings every year with participation from all funded projects and other representatives from academia, industry, government, and community organizations. PIs must participate in these PI/Co-PI meetings throughout the duration of the award. This requirement applies both to Research and Planning Grants. For multi-institution projects, investigators from each collaborating institution are expected to participate. A substitute project representative may be designated to attend a PI/Co-PI meeting, but only with prior approval from an NSF Program Officer. As noted in "Budget Preparation Instructions," budgets for all projects must include funding for one or more designated FW-HTF project representatives (PI/Co-PI/senior personnel or NSF-approved replacement) to attend each FW-HTF PI/Co-PI meeting during the proposed lifetime of the award.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards:

Up to 15 Planning Grant Awards and up to 15 Research Grant Awards.

The number of awards is dependent upon the proposals received and the degree to which proposals meet the solicitation goals and NSF merit review criteria.

Anticipated Funding Amount: $30M

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

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

PIs must hold appointments at U.S.-based campuses/offices of eligible organizations (IHEs or Non-profit, non-academic organizations). There are no restrictions, beyond the eligibility outlined in the PAPPG Chapter I.E, on who may serve as Co-PIs, Senior Personnel or Consultant (see Categories of Proposers in PAPPG Chapter I.E).

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An individual may appear as PI, Co-PI, Senior Personnel, Other Personnel, or Consultant on only one proposal submitted in response to this solicitation. This eligibility constraint will be strictly enforced. In the event an individual exceeds this limit, the first proposal received prior to the deadline will be accepted and the remainder will be returned without review. This limitation includes proposals submitted by a lead organization, collaborative non-lead proposals, and any subawards included as part of a collaborative proposal involving multiple institutions. No exceptions will be made.

Additional Eligibility Info:

While industrial partners of all sizes are allowed to participate, only those industrial partners that are small businesses and meet the SBIR program eligibility requirements (see https://www.sbir.gov/faqs/eligibility-requirements) can receive subawards. Note that the lead institution may also allocate funds for subawards to academic institutional partners without restrictions.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

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

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

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted

via the NSF FastLane system. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

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

Special instructions for submitting to this Big Idea solicitation

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

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

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

Cover Sheet:

Proposal Title:

The title of the proposal **must** begin with "**FW-HTF-RM**" to designate a Medium Research Proposal, "**FW-HTF-RL**" to designate a Large Research Proposal, or "**FW-HTF-P**" to designate a Planning Proposal.

The rest of the title of the proposal should describe the project in concise, informative language without acronyms so that a scientifically or technically literate reader can understand what the project is about. The title should emphasize the scientific work to be undertaken and be suitable for use in public press.

Personnel Listed on the Cover Sheet: Provide complete information requested on the cover sheet for the PI and up to four co-PIs.

Project Description:

- Project Descriptions for Research (FW-HTF-R) proposals are limited to 15 pages in length.
- Project Descriptions for Planning Grant (FW-HTF-P) proposals are limited to 10 pages in length.

Both proposal categories—FW-HTF-R proposals and FW-HTF-P proposals—must include all sections required by the PAPPG, including Intellectual Merit, Broader Impacts, and Results from Prior NSF support. In addition, the Project Description *must contain* the following separate sections, clearly labeled with the headings used below, with content as described in Section II.B:

- Work Context
- Integrative Research
- Methods, Measures, and Metrics

In addition, the Project Description should explain why the level of resources requested is appropriate to the project scope. This is especially important for FW-HTF-R Large proposals.

The FW-HTF program welcomes activities, such as those intended to provide undergraduate students with a meaningful research experience. The Project Description should describe these activities, and the Budget should request funds sufficient to carry them out. Post-award supplements to support such activities are not anticipated.

Supplementary Documents: *The following supplementary documents* **are required** and should be uploaded into the Supplementary Documentation Section. **No other supplementary materials are allowed. Proposals that do not contain all of these documents will be returned without review.**

1. *List of Project Personnel and Partner Institutions* **(FW-HTF-R proposals only).** Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list must include all PIs, Co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and 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. Mei Lin; XYZ University; PI
   2. Jak Jabes; University of PQR; Senior Personnel
   3. Jane Brown; XYZ University; Postdoc
   4. Rakel Ademas; ABC Inc.; Paid Consultant
   5. Mary Wan; Welldone Institution; Unpaid Collaborator
   6. Rimon Greene; ZZZ University; Subawardee

2. *Management and Coordination Plan* **(FW-HTF-R proposals only).** The FW-HTF program aims for convergence, in which knowledge, techniques, and expertise from multiple fields and sectors create new and expanded frameworks for addressing the research goals. Such integration and impact requires extra effort in leadership, regular communication, and cross-training. Therefore, a "Management and Coordination Plan" must be submitted as a Supplementary Document and may not exceed three pages. The document must be labeled "Management and Coordination Plan." The plan must describe specific steps the project team plans to take to achieve the goal of convergent research. This includes specifying what team members are responsible for what parts of the planned project, how the team plans to manage the overall effort, how any unpaid

collaborators and industry/non-profit partners (if applicable) will be integrated into the team, and specific activities that will help students involved in the project to develop the skills to work on convergent research efforts.

3. *Letters of Collaboration* **(if relevant to project):** For all substantial collaborations and engagements (included or not included in the budget) with partner institutions, Letters of Collaboration are strongly encouraged. These should be provided in the Supplementary Documents section of the proposal and follow the format instructions specified in the NSF PAPPG. **Letters of Collaboration cannot contain endorsements or evaluation of the proposed project or any other past projects.** This includes any statement about the value of the project to the partner institution. One acceptable format for a letter of collaboration is as follows:

"If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal."

Proposals with Letters of Collaboration that contain any endorsement or evaluation of the proposed project will be returned without review.

Collaborative activities that are identified in the budget should follow the instructions in the NSF PAPPG. Any substantial collaboration with individuals not included in the budget should also be described in the Facilities, Equipment and Other Resources section of the proposal and documented in a Letter of Collaboration from each collaborator.

1. *Postdoctoral Researcher Mentoring Plan:* Proposals that include funding to support postdoctoral researchers must include a Postdoctoral Researcher Mentoring Plan as supplementary documentation. See Chapter II.C.2.j of the PAPPG for further information about the implementation of this requirement.
2. *Data Management Plan:* All proposals must include a Data Management Plan or explain the absence of the need for such a plan. A Data Management plan specifies the procedures you will use for keeping, storing, and sharing *data* with other researchers. Data Management Plans should also include the method for making the data anonymous. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. See Chapter II.C.2.j of the PAPPG for further information about the implementation of this requirement. For Directorate specific guidance on Data Management Plans see https://www.nsf.gov/bfa/dias/policy/dmp.jsp.

Single Copy Documents:

Collaborators and Other Affiliations Information: Proposers should follow the guidance specified in Chapter II.C.1.e of the NSF PAPPG.

FW-HTF Proposal Preparation Checklist:

The following checklist is provided to help ensure the FW-HTF proposal includes all required elements before submission. This is a summary of the requirements described in the sections above. **This is a summary of key items that are *in addition* to the requirements listed in the PAPPG, and *does not replace* the requirements listed in the PAPPG.**

1. The title of the proposal must begin with "FW-HTF-RM" to designate a Medium Research Proposal, "FW-HTF-RL" to designate a Large Research Proposal, or "FW-HTF-P" to designate a Planning Proposal.
2. Limit on number of proposals per PI, Co-PI, Senior Personnel, Other Personnel, or Consultant not to exceed one. This limit also applies to all subawardees.
3. Project description: As stated in Section V.A of this solicitation, the proposal must contain the following separate and clearly labeled sections:
   a. Work Context;
   b. Integrative Research; and
   c. Methods, Measures, and Metrics.
4. Supplementary documents:
   a. List of Project Personnel and Partner Institutions (FW-HTF-R proposals only); and
   b. Management and Coordination Plan (FW-HTF-R proposals only).

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Budgets for all projects must include funding for one or more designated FW-HTF project representatives (PI/co-PI/Senior Personnel or NSF-approved replacement) to attend each FW-HTF PI meeting during the proposed lifetime of the award. This requirement applies both to Research and Planning Grants. For budget preparation purposes, PIs should assume these meetings will be held in the spring of each year in the Washington, DC area.

C. Due Dates

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

  March 06, 2019

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

> To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

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

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

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

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

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

2. Merit Review Criteria

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

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

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

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

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

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

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

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

B. Review and Selection Process

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

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

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

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Special Award Conditions:

For every FW-HTF award, one or more designated project representatives (PI/co-PI/Senior Personnel or NSF-approved replacement) must attend annual FW-HTF PI meetings throughout the duration of the grant.

Attribution of support: Grantees are required to include appropriate acknowledgment of NSF support under the NSF Future of Work at the Human-Technology Frontier Big Idea in any publication (including World Wide Web pages) of any material based on or developed under the project, in the following terms:

"This material is based upon work supported by the National Science Foundation NSF Future of Work at the Human-Technology Frontier Big Idea under Grant No. (Grantee enters NSF grant number.)

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

C. Reporting Requirements

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

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

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

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Address General Questions to, telephone: (703) 292-5365, email: fwhtf-contacts@nsf.gov

- Stephanie E. August, EHR/DUE, telephone: (703) 292-5128, email: fwhtf-contacts@nsf.gov

- Amy L. Baylor, EHR/DRL, telephone: (703) 292-5126, email: fwhtf-contacts@nsf.gov

- Jordan Berg, ENG/CMMI, telephone: (703) 292-5365, email: fwhtf-contacts@nsf.gov

- David Corman, CISE/CNS, telephone: (703) 292-8754, email: fwhtf-contacts@nsf.gov

- Shubhra Gangopadhyay, ENG/ECCS, telephone: (703) 292-2485, email: fwhtf-contacts@nsf.gov

- Meghan Houghton, CISE/OAD, telephone: (703) 292-4449, email: fwhtf-contacts@nsf.gov

- Sara Kiesler, SBE/SES, telephone: (703) 292-8643, email: fwhtf-contacts@nsf.gov

- Tatiana Korelsky, CISE/IIS, telephone: (703) 292-8930, email: fwhtf-contacts@nsf.gov

- Todd Leen, CISE/IIS, telephone: (703) 292-8930, email: fwhtf-contacts@nsf.gov

- Nancy A. Lutz, SBE/SES, telephone: (703) 292-7280, email: fwhtf-contacts@nsf.gov

- Alexandra Medina-Borja, EHR/DUE, telephone: (703) 292-7557, email: fwhtf-contacts@nsf.gov

- Robert Scheidt, ENG/CMMI, telephone: (703) 292-2477, email: fwhtf-contacts@nsf.gov

- Betty K. Tuller, SBE/BCS, telephone: (703) 292-7238, email: fwhtf-contacts@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

> The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.
>
> To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at https://www.nsf.gov

• **Location:**	2415 Eisenhower Avenue, Alexandria, VA 22314
• **For General Information** (NSF Information Center)**:**	(703) 292-5111
• **TDD (for the hearing-impaired):**	(703) 292-5090
• **To Order Publications or Forms:**	
Send an e-mail to:	nsfpubs@nsf.gov
or telephone:	(703) 292-7827
• **To Locate NSF Employees:**	(703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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
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