

Integrative Strategies for Understanding Neural and Cognitive Systems (NCS)

FOUNDATIONS, FRONTIERS, and CORE+ SUPPLEMENTS

PROGRAM SOLICITATION

NSF 18-533

REPLACES DOCUMENT(S):

NSF 17-519



National Science Foundation

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

Directorate for Engineering

Directorate for Social, Behavioral & Economic Sciences

Letter of Intent Due Date(s) (*required*) (due by 5 p.m. submitter's local time):

February 20, 2018

FOUNDATIONS, FY2018 competition

December 07, 2018

FRONTIERS, FY2019 competition

January 08, 2019

FOUNDATIONS, FY2019 competition

January 08, 2020

FOUNDATIONS, FY2020 competition

Supplement Due Date(s) (due by 5 p.m. submitter's local time):

April 17, 2018

CORE+ SUPPLEMENTS, FY2018 competition

February 26, 2019

CORE+ SUPPLEMENTS, FY2019 competition

February 26, 2020

CORE+ SUPPLEMENTS, FY2020 competition

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

April 17, 2018

FOUNDATIONS, FY2018 competition

February 26, 2019

FOUNDATIONS and FRONTIERS, FY2019 competition

February 26, 2020

FOUNDATIONS, FY2020 competition

IMPORTANT INFORMATION AND REVISION NOTES

This solicitation extends the Integrative Strategies for Understanding Neural and Cognitive Systems (NCS) program for three years,

from FY2018 through FY2020, incorporating the following changes:

- The FRONTIERS proposal class, for larger projects, is offered in the FY2019 competition.
- The FOUNDATIONS proposal class (formerly referred to as INTEGRATIVE FOUNDATIONS) now includes proposals for smaller projects, for the purposes described in Section II of this solicitation.
- CORE+ SUPPLEMENT requests will be considered only for existing funded projects (not new projects) in the CISE, EHR, and ENG Directorates. Program officers should be contacted in advance. CORE + Supplements must be submitted as post-award requests.
- Descriptions of the NCS focus areas (formerly referred to as themes), solicitation-specific review criteria, and proposal preparation instructions have been updated.
- Expectations and mechanisms for collaboration and coordination are described in Section II of this solicitation.
- Contact information for general inquiries, directorate representatives, and program liaisons has been updated in Section VIII of this solicitation.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 18-1), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Integrative Strategies for Understanding Neural and Cognitive Systems (NCS)

Synopsis of Program:

The complexities of brain and behavior pose fundamental questions in many areas of science and engineering, drawing intense interest across a broad spectrum of disciplinary perspectives while eluding explanation by any one of them. Rapid advances within and across disciplines are leading to an increasingly interwoven fabric of theories, models, empirical methods and findings, and educational approaches, opening new opportunities to understand complex aspects of neural and cognitive systems through integrative multidisciplinary approaches.

This program calls for innovative, convergent, boundary-crossing proposals that can best capture those opportunities and map out new research frontiers. NSF seeks proposals that are bold and risky, and transcend the perspectives and approaches typical of disciplinary research efforts. This cross-directorate program is one element of NSF's broader effort directed at Understanding the Brain, a multi-year activity that includes NSF's participation in the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative (<https://www.nsf.gov/brain/>). NSF envisions a connected portfolio of transformative, integrative projects that create synergistic links across investigators and communities, yielding novel ways of tackling the challenges of understanding the brain in action and in context.

This solicitation extends the NCS program for three years, from FY2018 through FY2020, and offers the FRONTIERS proposal class, for larger projects, in FY2019. Integrative projects will be supported at scales reflecting increasing levels of collaboration and coordination toward strategic, potentially transformative research goals.

The program focuses on four aspects of neural and cognitive systems that are current targets of converging interdisciplinary interests. NCS projects must advance the foundations of one or more of these focus areas, as described further within the solicitation:

1. **Neuroengineering and Brain-Inspired Concepts and Designs**
2. **Individuality and Variation**
3. **Cognitive and Neural Processes in Realistic, Complex Environments**
4. **Data-Intensive Neuroscience and Cognitive Science**

Proposals must address both risk and reward: **high-risk, high-payoff approaches are expected**. Proposals must also be consistent with the missions of the participating directorates, while going beyond the scope of any NSF core program, or they will not be considered responsive to the solicitation.

NCS will consider three classes of proposals. **FOUNDATIONS** awards (CISE, EHR, ENG, and SBE Directorates; referred to as INTEGRATIVE FOUNDATIONS in earlier NCS solicitations) will support high-risk, high-payoff projects that advance the foundations of one or more NCS focus areas. **FRONTIERS** awards (CISE, EHR, ENG, and SBE Directorates; FY2019 competition only) will support ambitious, highly integrative, interdisciplinary projects that advance and connect multiple integrative research threads to tackle challenges that, without a high level of collaboration and coordination, would remain intractable. **CORE+ SUPPLEMENTS** (CISE, EHR, and ENG Directorates) will provide additional support to existing funded projects in the participating directorates, to enable activities that will connect those projects to significant new integrative opportunities in neural and cognitive systems.

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.

- NCS Program Team, telephone: (703) 292-2485, email: ncs@nsf.gov

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

- 47.041 --- Engineering
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 10 to 25

A range of award sizes is anticipated in each of the above proposal classes, depending on the specific collaborative arrangement and research approach of each project. **Proposers are strongly discouraged from requesting larger budgets than are necessary for the activities being proposed.**

The FY2019 competition will emphasize FRONTIERS projects; NSF anticipates 3 to 5 FRONTIERS awards and up to 10 awards of other classes in FY2019. FRONTIERS proposals will not be accepted in FY2018 or FY2020; NSF anticipates that up to 25 awards of other classes will be made each year in FY2018 and FY2020.

Anticipated Funding Amount: \$11,000,000 to \$15,000,000

It is anticipated that approximately \$11 to \$15 million will be made available each year. Estimated program budget, number of awards, and average award size and duration are subject to the availability of funds.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)*, Chapter I.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: 1

An individual may participate as PI, Co-PI, or Senior Personnel on **only one full** proposal per year in response to this solicitation. Participation as an advisory board member does not count toward this limit. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission (i.e., the first proposal received will be accepted and the remainder will be returned without review). No exceptions will be made.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **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 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:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

February 20, 2018

FOUNDATIONS, FY2018 competition

December 07, 2018

FRONTIERS, FY2019 competition

January 08, 2019

FOUNDATIONS, FY2019 competition

January 08, 2020

FOUNDATIONS, FY2020 competition

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

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February 26, 2019

CORE+ SUPPLEMENTS, FY2019 competition

February 26, 2020

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

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FOUNDATIONS and FRONTIERS, FY2019 competition

February 26, 2020

FOUNDATIONS, FY2020 competition

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

The complexities of brain and behavior pose fundamental questions in many areas of science and engineering, drawing intense interest across a broad spectrum of disciplinary perspectives while eluding explanation by any one of them. Rapid advances within and across disciplines are leading to an increasingly interwoven fabric of theories, models, empirical methods and findings, and educational approaches, opening new opportunities to understand complex aspects of neural and cognitive systems through integrative multidisciplinary approaches.

This program calls for innovative, integrative, boundary-crossing proposals that can best capture those opportunities and map out new research frontiers. NSF seeks proposals that are bold and risky, and transcend the perspectives and approaches typical of disciplinary research efforts. Projects supported by this program will bridge temporal and spatial scales, levels of abstraction, levels of analysis, and disciplinary, methodological, and technological approaches. The aim is to engage a broad community of researchers in creative, interdisciplinary efforts that yield innovations and advances in and across cognitive science, neuroscience, neuroengineering, and education research.

This cross-directorate program is one element of NSF's broader effort directed at Understanding the Brain, a multi-year activity that includes NSF's participation in the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative (<https://www.nsf.gov/brain/>). NSF envisions a connected portfolio of transformative, integrative projects that create synergistic links across investigators and communities, yielding novel ways of tackling the challenges of understanding the brain in action and in context.

NSF's goal is to leverage its existing investments in cognitive science, neuroscience, neuroengineering, and STEM education research, and to tackle previously intractable challenges regarding the brain, cognition, and brain-based technologies through groundbreaking interdisciplinary research collaborations. This program is expected to provide new empirical insights, expand theoretical understanding, facilitate development of computational and bioengineered systems, promote new educational approaches, and generate new hypotheses that connect physical, biological, and cognitive mechanisms. These activities will contribute to development of an interdisciplinary workforce spanning cognitive science, neuroscience, neuroengineering, computing, and education, and to new collaborations, including international collaborations where appropriate.

II. PROGRAM DESCRIPTION

This solicitation extends the NCS program for three years, from FY2018 through FY2020, and offers the FRONTIERS proposal class, for larger projects, in FY2019. Integrative projects will be supported at scales reflecting increasing levels of collaboration and coordination toward strategic, potentially transformative research goals.

All proposals must clearly address how the proposed activity will extend the boundaries of what is currently possible; advance existing literature, knowledge, and technologies; challenge current scientific paradigms, as appropriate; and bridge temporal or spatial scales, levels of abstraction, levels of analysis, or disciplinary or methodological approaches. NCS projects will push beyond predictable outcomes; not all are expected to succeed. Proposals must address both risk and reward: **high-risk, high-payoff approaches are**

expected.

The program focuses on four aspects of neural and cognitive systems that are current targets of converging interdisciplinary interests. NCS projects must advance the foundations of one or more of these focus areas, which are described further below:

1. **Neuroengineering and Brain-Inspired Concepts and Designs**
2. **Individuality and Variation**
3. **Cognitive and Neural Processes in Realistic, Complex Environments**
4. **Data-Intensive Neuroscience and Cognitive Science**

Proposals must also be consistent with the missions of the participating directorates, while going beyond the scope of any NSF core program, or they will not be considered responsive to the solicitation. Questions about appropriateness may be addressed to the directorate representatives listed in Section VIII of this solicitation.

NCS Focus Areas

The NCS focus areas bring together a broad range of scholarly perspectives and highlight research challenges, at all levels of neural and cognitive systems, where novel integrative strategies can be expected to have significant impact. **Each proposal must describe how it will advance the foundations of one or more of these focus areas.** Examples in the descriptions below are meant only to illustrate the focus areas; they are not intended to be restrictive.

1. **Neuroengineering and Brain-Inspired Concepts and Designs:** Proposals must show how computational and/or engineering principles are advanced synergistically with neural and cognitive investigations, leading to significant technical innovations that are inspired by or directed toward the brain. These may include technologies for imaging, sensing, recording, or affecting real-time brain activity and behavior; brain-inspired computing paradigms; brain-computer interfaces; augmented and adaptive systems (e.g., for communication, prosthetics, learning, education, or performance); functional neurotechnologies; and other computational and bioengineered systems.
2. **Individuality and Variation:** Proposals must advance understanding of individuality and/or variation to provide insights into important neural and cognitive properties. These could include inter-individual differences, the role of variability in emergent group action and reaction, understanding of measurement noise and natural variability, or other aspects of functionally important variability. Theoretical and empirical challenges may be considered across temporal and/or spatial scales, context, units of analysis (e.g., neurons, networks, persons, groups), and functionality (e.g., signaling, communication, representation, cognitive strategy, learning, development).
3. **Cognitive and Neural Processes in Realistic, Complex Environments:** Proposals must advance the understanding of cognitive and neural processes by embracing naturally occurring complexity and interactions. Empirically, this includes, but is not limited to, realistic physical, social, and educational interactions; contextual aspects and flexibility of cognitive, biological, and machine learning; experimental paradigms leveraging virtual reality or other simulation or synthesis methods; mobile technologies for cognitive and neural processing and data gathering; and human-robot interactions and symbiosis.
4. **Data-Intensive Neuroscience and Cognitive Science:** Proposals must develop innovative approaches to problems uniquely associated with data-intensive neural and cognitive research. Data-intensive methods and technologies are transforming how neural and cognitive processes can be explored, modeled, and reliably understood. The data pose challenges with respect to scale, heterogeneity, experimental limits, and behavioral and biological richness. Research and innovation to enable large-scale analysis, modeling, aggregation, sharing, and open science must confront these challenges in the service of neural and cognitive discovery goals.

Foundational advances in these focus areas will be synergistic in many cases; proposals can address more than one focus area as appropriate. For all focus areas, advances in theory and methods, technological innovations, educational approaches, workforce development, and research infrastructure are all of significant interest. NCS investigators should leverage existing standards, frameworks, platforms, and resources, and build on synergistic infrastructure efforts to maximize their project's impact.

Proposal Classes

NCS will consider three classes of proposals, for projects at different levels of collaboration and coordination. The motivation and implementation of each proposal class are described here. Please refer to Section V of this solicitation for specific proposal instructions. Please note the participation of specific NSF directorates in each proposal class.

FOUNDATIONS awards (**CISE, EHR, ENG, and SBE Directorates**; referred to as INTEGRATIVE FOUNDATIONS in earlier NCS solicitations) will support high-risk, high-payoff projects that advance the foundations of one or more NCS focus areas. Teams of two or more investigators with distinct but complementary expertise are required. Proposals must demonstrate the transformative potential of the work to be funded and situate it within a broader intellectual context of work to which it will connect and contribute. Each proposal must present a multidisciplinary research plan, a proactive strategy for maximizing the project's impact, and a discussion of potentially transformative payoffs from pursuit of a scientifically risky question or approach and associated issues of feasibility and contingencies. A FOUNDATIONS project may, as appropriate, explicitly build on another **associated project** or projects (see Collaboration and Coordination, below) to synergistically advance its scientific goals. Total budgets for FOUNDATIONS awards will typically range from a total of \$500,000 to \$1,000,000 (including direct and indirect costs), with durations of 2 to 4 years.

The NCS program also welcomes proposals for **smaller FOUNDATIONS projects** (typically requesting less than \$250,000) that would lead to ambitious new research agendas via: (1) achievement of technical proof-of-concept, on which a broader set of further research goals depends; or (2) critical synthesis (e.g., meta-analysis) and/or convening of communities/literatures that have not sufficiently been brought into productive contact. It is expected that such activities could serve as the basis for larger future projects. Investigators wishing to propose smaller FOUNDATIONS projects are advised to discuss their project ideas with an NCS program officer.

FRONTIERS awards (**CISE, EHR, ENG, and SBE Directorates; FY2019 competition only**) will support ambitious, highly integrative, interdisciplinary projects requiring larger teams of investigators engaged in a sustained synergistic effort. These projects will advance and connect multiple integrative research threads to tackle challenges that, without a high level of collaboration and coordination, would remain intractable. The expectations for individual research threads are similar to FOUNDATIONS: high-risk, high-payoff research efforts that will advance the foundations of one or more NCS focus areas. FRONTIERS projects will coordinate component efforts

toward larger shared challenges, such that the value of the coordinated whole greatly exceeds the sum of its parts. Each FRONTIERS proposal must articulate a transformative vision that will drive the coordinated effort and show how the project will provide national and global leadership, contributing to a broad scientific community or communities. Discussion of potential payoffs and risks must cover the project as a whole as well as each component research thread. NCS FRONTIERS projects are strongly encouraged to build on other **associated projects** and must include an **advisory board** (see Collaboration and Coordination, below).

For the first competition in FY2019, NSF anticipates making 3 to 5 FRONTIERS awards with durations of up to 5 years subject to the availability of funds. NSF anticipates that proposing investigator teams will develop a wide range of strategies to address the expectations for FRONTIERS outlined above; thus, hard limits have not been set on the budget range for individual projects. It is anticipated that approximately \$11 to \$15 million will be made available in FY2019 for NCS awards, including FRONTIERS and other classes. Please refer to Section III of this solicitation for more on Award Information.

Prospective FRONTIERS applicants are strongly encouraged to attend an NCS webinar, which will be announced on the program web site, <https://www.nsf.gov/ncs>, in September, 2018.

CORE+ SUPPLEMENTS (CISE, EHR, and ENG Directorates) will provide additional support to existing funded projects in the participating directorates, to enable activities that will connect those projects to significant new integrative opportunities in neural and cognitive systems. These supplements are intended to build on NSF-funded projects in other disciplines, to bring new approaches or capabilities emerging from other fields into cognitive science, neuroscience, and neuroengineering, or to enable other kinds of synergistic connections that will advance one or more NCS focus areas. Investigators holding an existing award managed by CISE, EHR, or ENG may submit a post-award request for supplemental funding of up to 20% of the existing award, not to exceed \$200,000. **Before submitting a supplement request, PIs should contact the cognizant program officer of the existing award and the directorate contact listed in Section VIII of this solicitation. This should be done in advance of the target date listed on this solicitation's cover page to receive full consideration.**

Collaboration and Coordination

In order to achieve their scientific objectives and maximize their impact, NCS projects are expected to build on leading-edge efforts from a variety of perspectives. Well-conceived collaborations and coordination are therefore crucial. Investigators should situate their work in the context of other related efforts and plan proactively to connect and contribute to research across multiple disciplines, infrastructure and resource development, interdisciplinary training and outreach, and international cooperation.

An **advisory board** is required for FRONTIERS projects and recommended for FOUNDATIONS projects. The function of the advisory board is to provide the project team with expert feedback from external perspectives and to foster connections across disciplines. Advisory board members may represent expertise in project-specific disciplines, application areas, or other fields to which the output of the project is directed. The advisory board should provide feedback to the project team at all stages of the project's development, potentially advising on issues including design, applications, dissemination, educational implications, and future activities.

NCS projects should also develop synergistic links to other **associated projects** as appropriate, to coordinate with related efforts and avoid re-invention or duplication. Listed below are selected examples of activities that have been developed to serve and network with research efforts such as those supported by NCS:

- **Big Data Regional Innovation Hubs and Spokes:** A national network established to foster multi-sector collaborations among academia, industry, and government.
- **Cyberinfrastructure:** Advanced computing, data and software infrastructure, and other resources and services aimed at enabling systematic and grand-scale investigations.
- **Next Generation Networks for Neuroscience (NeuroNex):** Innovative research resources, instrumentation, and neurotechnologies, and theoretical frameworks for understanding brain function.
- **Transdisciplinary Research in Principles of Data Science (TRIPODS):** Institutes to develop the theoretical foundations of data science through integrated research and training.
- **International Collaboration Opportunities:** Scientific cooperation that links scientists and engineers from a range of disciplines and organizations across international borders.
- **Dear Colleague Letter: Growing Convergent Research at NSF:** One of the 10 Big Ideas for Future NSF Investments. Through this DCL, NSF seeks to highlight the value of convergence.

Investigators are encouraged to develop links to these and other synergistic activities. Further questions may be addressed to the program liaisons listed in Section VIII of this solicitation and the NCS program team.

III. AWARD INFORMATION

A range of award sizes is anticipated in each of the above proposal classes, depending on the specific collaborative arrangement and research approach of each project. **Proposers are strongly discouraged from requesting larger budgets than are necessary for the activities being proposed.**

The FY2019 competition will emphasize FRONTIERS projects; NSF anticipates 3 to 5 FRONTIERS awards and up to 10 awards of other classes in FY2019. FRONTIERS proposals will not be accepted in FY2018 or FY2020; NSF anticipates that up to 25 awards of other classes will be made each year in FY2018 and FY2020.

It is anticipated that approximately \$11 to \$15 million will be made available each year. Estimated program budget, number of awards, and average award size and duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.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: 1

An individual may participate as PI, Co-PI, or Senior Personnel on **only one full** proposal per year in response to this solicitation. Participation as an advisory board member does not count toward this limit. This eligibility constraint will be strictly enforced. In the event that an individual exceeds this limit, proposals will be accepted based on earliest date and time of proposal submission (i.e., the first proposal received will be accepted and the remainder will be returned without review). No exceptions will be made.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (*required*):

Letters of Intent are required for FOUNDATIONS and FRONTIERS proposals. They are not to be submitted for CORE+ SUPPLEMENT requests.

FOUNDATIONS and FRONTIERS Letters of Intent (CISE, EHR, ENG, and SBE Directorates):

A FastLane Letter of Intent (LOI) is required to submit a FOUNDATIONS or FRONTIERS proposal. The LOI must be compliant with the instructions below and submitted by the LOI deadline. Submitting a Letter of Intent does not oblige potential proposers to submit a full proposal. If a collaborative proposal is planned, a single LOI should be submitted by the lead institution only. LOIs are not subject to merit review but are used for internal planning purposes. Investigators should not expect to receive any feedback on their LOIs. Although there are no restrictions on the submission of multiple LOIs from the same institution, an individual may participate as PI, co-PI, or Senior Personnel in **only one** LOI in response to this solicitation. It is the responsibility of the PI to ascertain that no member of the proposed team is listed as PI, co-PI, or Senior Personnel on any other LOI.

Each letter of intent must include the following information:

1. In the "Synopsis" data field, summarize the work in sufficient detail to convey the high-risk, high-payoff, integrative nature of the project and to permit an appropriate selection of potential reviewers. (limit: 2500 characters)
2. In the Project PI and Other Senior Project Personnel sections, list the names and institutional affiliations for all PIs, Co-PIs, and senior personnel on the project, including those of any collaborative proposals or subawardees. If the project will have an advisory board or consultants, list those names and affiliations with an asterisk (*) after each name. If the number of names exceeds the maximum allowed by FastLane, continue the list at the end of the "Synopsis" data field. The project PI must serve as point of contact for NSF inquiries; the project PI's e-mail should be used as the point of contact e-mail address.
3. In the Participating Organizations section, list all of the institutions involved in the project, and any associated projects if applicable.
4. List the NCS focus area(s) that the project will advance, with the most relevant focus area listed first, and the participating NSF directorates to which the proposal is relevant. (limit: 255 characters; use the focus areas named in this solicitation, and NSF directorate acronyms)
5. Describe why this project would not be suitable **scientifically** as a submission to an NSF core program. (limit: 255 characters)
6. What are the distinct areas of expertise, research approaches, or disciplines represented by the research team, and how do they complement each other in a synergistic fashion? (limit: 255 characters)

Upon successful submission of the Letter of Intent by the Sponsored Projects Office, please save a PDF copy of the submitted LOI for use in the Full Proposal submission.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is required when submitting Letters of Intent.
- A Minimum of 1 and Maximum of 4 Other Senior Project Personnel are permitted
- A Minimum of 0 and Maximum of 10 Other Participating Organizations are permitted

- "NCS Focus Area(s) and NSF Directorates" is required when submitting Letters of Intent
- "Why is this project not suitable scientifically for an NSF core program?" is required when submitting Letters of Intent
- "What are the distinct areas of expertise, research approaches, or disciplines?" is required when submitting Letters of Intent
- Submission of multiple Letters of Intent is permitted

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 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.

FOUNDATIONS Full Proposals (CISE, EHR, ENG, and SBE Directorates):

Full Proposals for FOUNDATIONS projects should be prepared according to the general guidelines contained in the PAPPG, as modified by the additional instructions specified below.

1. On the Cover Sheet, only one **Unit of Consideration** will be available as an option for each competition: ECCS/Intg Strat Undst Neurl & Cogn Sys. for FY2018, BCS/Intg Strat Undst Neurl & Cogn Sys. for FY2019, and IIS/Intg Strat Undst Neurl & Cogn Sys. for FY2020. **Note that this is for administrative purposes only; all scientific review will be handled through a shared, cross-directorate process.**
2. The **Title of Proposed Project** should begin with "NCS-FO:"
3. The **Project Summary** must include three sections: Overview, Statement of Intellectual Merit, and Statement of Broader Impacts. **The Overview must begin by listing the NCS focus area(s) that the project will advance.** The Overview must also include a separate statement labeled "**Integrative Value and Transformative Potential:**" that addresses the potential of the proposed activity to meet the solicitation-specific review criteria (Section VI.A). **Proposals that do not clearly address the solicitation-specific review criteria in the Project Summary will be returned without review.**
4. The **Project Description** must present a vision and multidisciplinary research plan that describe the foundational advances being pursued and their impact on one or more NCS focus areas, and situate the proposed project within a broader intellectual context to which it will connect and contribute. In addition to the required separate sections within the narrative on "**Broader Impacts of the Proposed Work**" as well as a separate section within the narrative labeled "**Intellectual Merit**", and, if applicable, "**Results from Prior NSF Support**," as described in the PAPPG, the project description must contain, as a separate section within the narrative, a section labeled "**Risk and Reward**" that describes the potentially transformative payoffs from pursuit of a scientifically risky question or approach. Issues of feasibility and contingencies should also be addressed. **Proposals that do not contain these required sections will be returned without review.**
5. The Project Description must include a **Collaboration and Coordination Plan**. **Two additional pages are permitted for this purpose only, in addition to the 15 pages for the standard project description, allowing a maximum of 17 pages total. If the Project Description, excluding the Collaboration and Coordination Plan, exceeds 15 pages, the proposal will be returned without review.** The Collaboration Plan must include: 1) the specific roles of the collaborating PIs, Co-PIs, other Senior Personnel and paid consultants at all organizations involved and how their expertise is complementary; 2) how the project will be managed across institutions and disciplines; 3) composition and plans for convening an **advisory board**, if applicable; 4) identification of the specific coordination mechanisms that will enable cross-institution or cross-discipline scientific integration (e.g., workshops, graduate student exchange, project meetings at conferences, use of videoconferencing and other communication tools, mechanisms for sharing of data and software, etc.); 5) plans for coordinating with other **associated projects**, if applicable; and 6) specific references to the budget line items that support these coordination mechanisms.
6. Letters of Collaboration **must follow the template in APPENDIX A below** and be submitted under Other Supplementary Documents. These are not to be letters of endorsement. Collaborations with **associated projects**, if unfunded by the present NCS proposal, must also be documented by letters of collaboration following the template in APPENDIX A. The substantive description of relationships and dependencies among associated projects must be contained within the Collaboration and Coordination Plan, or elsewhere within the Project Description.
7. The **Data Management Plan**, submitted under Supplementary Documents, is a critical part of the proposal, where data management consistent with the project's integrative strategy should be described. It should explicitly state how the data and results generated by the project will be managed and stored, and how broad accessibility and usability will be maximized, including efforts to ensure security. The Plan should also clearly define rights, obligations, roles and responsibilities of all

- parties and, as needed, address possible differences between U.S. and applicable non-U.S. data protection requirements.
8. The **Budget** should include travel funds for the PIs to attend an annual NCS Principal Investigators' meeting.
 9. A PDF copy of the **corresponding letter of intent** must be included as a **single-copy document**.
 10. **Proposals containing special information or supplementary documentation that has not been explicitly allowed in the PAPPG or this solicitation, such as article reprints or preprints, or appendices, will be returned without review.**

FRONTIERS Full Proposals (CISE, EHR, ENG, and SBE Directorates; FY2019 competition only):

Full Proposals for NCS FRONTIERS projects must follow the guidelines for FOUNDATIONS proposals, outlined above, with the following modifications:

1. The **Title of Proposed Project** should begin with "NCS-FR:"
2. The research plan for a FRONTIERS project must describe two or more component research threads coordinated toward a larger shared challenge, and should be organized with distinct descriptions of each research thread. **FRONTIERS proposals that describe only one research thread will not be considered responsive to the solicitation.**
3. Up to 4 pages are permitted for the Collaboration and Coordination Plan. Up to 20 pages are permitted for the Project Description exclusive of the Collaboration and Coordination Plan, allowing a maximum of 24 pages total. **If the Project Description, excluding the Collaboration and Coordination Plan, exceeds 20 pages, the proposal will be returned without review.**

CORE+ SUPPLEMENT Requests (CISE, EHR, and ENG Directorates):

Investigators with current NSF funding managed by CISE, EHR, or ENG may request supplementary funding via the CORE+ SUPPLEMENT. The supplement request should describe specific additional activities that would connect the project to significant new integrative opportunities in neural and cognitive systems, bringing new approaches or capabilities emerging from other fields into cognitive science, neuroscience, and neuroengineering, or enabling other kinds of synergistic connections that will advance one or more NCS focus areas.

Before submitting a supplement request, PIs should contact the cognizant program officer of the existing award, copying the directorate contact listed in Section VIII of this solicitation. This should be done in advance of the supplement target date listed in this solicitation to receive full consideration. The PI's initial communication should identify the existing award to be supplemented and convey (1) scientifically, how the proposed supplement relates to the original project, and the new scientific directions to be pursued; (2) how the supplement relates to one or more NCS focus areas; (3) the extent to which it would be a high-risk, high-payoff approach; and (4) a budget outline summarizing the contemplated additional activities and approximate level of support needed. Formal supplement requests will be invited based on this information and availability of funds.

A request for a CORE+ SUPPLEMENT to an existing award should be submitted as a Supplemental Funding Request in FastLane, prepared according to the instructions below.

1. In the form entitled **Summary of Proposed Work**, enter the following text:

NSF-NCS CORE+ SUPPLEMENT REQUEST

This supplement request has been prepared according to the NSF-NCS solicitation to request funding for additional activities that would connect a project to significant new integrative opportunities in neural and cognitive systems.

2. In the form entitled **Justification for Supplement**, begin with the same title and first sentence as above. The remainder of the narrative, **not exceeding 2 pages**, should discuss specific additional activities proposed in response to the CORE+ SUPPLEMENT opportunity of this solicitation. The last paragraph of the narrative should summarize the costs to be covered and total additional funds requested.
3. The request for supplemental funds may total up to 20% of the original negotiated award, not to exceed \$200,000. **The funding request should be specified in the budget pages** of the supplement request. The budget should include travel funds for the PI(s) to attend an annual NSF-NCS Principal Investigators' meeting.

CORE+ SUPPLEMENT requests are no longer accepted as a component of a new proposal. Separate e-mail notification to the program upon successful submission is no longer needed.

APPENDIX A

Letters of Collaboration

Letters of collaboration must be limited to stating the intent to collaborate and may not contain endorsements or evaluation of the proposed project. Letters of collaboration must use the following format:

Template for a letter of collaboration:

To: Program Management - Integrative Strategies for Understanding Neural and Cognitive Systems

If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding, 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.

My contribution to the project [choose one of the following as appropriate] will be supported by [insert source(s) of support] is under consideration for support by [insert source(s) of potential support] does not depend on external support

[Signature, Organization, and Date]

This statement may be in the form of a signed statement or a statement sent by e-mail to the PI. Such a statement is not needed from individuals included as senior personnel on a project.

Lengthier letters describing collaborative activities or their merits may be included in the Project Description, but must be accommodated within the page limit of the Project Description.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

International activities: NSF funds are not intended to provide support for international partners, but may provide US team members' (including PIs, junior researchers, and students) international travel costs as necessary and within budgetary limits. International partners should obtain support independently from national or regional sources, via normal channels.

Budget Preparation Instructions:

PIs should provide funds in their Budget to attend annual PI meetings.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

February 20, 2018

FOUNDATIONS, FY2018 competition

December 07, 2018

FRONTIERS, FY2019 competition

January 08, 2019

FOUNDATIONS, FY2019 competition

January 08, 2020

FOUNDATIONS, FY2020 competition

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

April 17, 2018

CORE+ SUPPLEMENTS, FY2018 competition

February 26, 2019

CORE+ SUPPLEMENTS, FY2019 competition

February 26, 2020

CORE+ SUPPLEMENTS, FY2020 competition

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

April 17, 2018

FOUNDATIONS, FY2018 competition

February 26, 2019

FOUNDATIONS and FRONTIERS, FY2019 competition

February 26, 2020

FOUNDATIONS, FY2020 competition

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.

Additional Solicitation Specific Review Criteria

The following additional review criteria reflect this solicitation's central emphasis on integrative, potentially transformative research on neural and cognitive systems. Reviewers will be asked to consider the following elements in their evaluations:

Integrative Value and Transformative Potential

- Is the proposed activity bold, risky, potentially transformative, and well beyond a typical disciplinary approach?
- What will its impact be on one or more NCS focus areas?
- Does it bring together complementary expertise, build on leading-edge research across multiple disciplines, connect and

- contribute to a broader intellectual context of work, and develop synergistic links to related efforts as appropriate?
- Does it bridge temporal or spatial scales, levels of abstraction, levels of analysis, or disciplinary, methodological, or technological approaches?
 - To what extent will it advance theory, methods, technological innovations, educational approaches, and research infrastructure?
 - How will it contribute to development of an interdisciplinary workforce spanning cognitive science, neuroscience, neuroengineering, computing, and education?

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=papppg.

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* (PAPP) 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:

- NCS Program Team, telephone: (703) 292-2485, email: ncs@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.

Directorate representatives:

- Mitra Basu, Directorate for Computer & Information Science & Engineering, telephone: (703) 292-8910, email: mbasu@nsf.gov
- Rita V. Rodriguez, Directorate for Computer & Information Science & Engineering, telephone: (703) 292-8950, email: rrodrigu@nsf.gov
- Kenneth Whang, Directorate for Computer & Information Science & Engineering, telephone: (703) 292-5149, email: kwhang@nsf.gov
- Ellen Carpenter, Directorate for Education and Human Resources, telephone: (703) 292-5104, email: elcarpen@nsf.gov
- Gregg Solomon, Directorate for Education and Human Resources, telephone: (703) 292-8333, email: gesolomo@nsf.gov
- Shubhra Gangopadhyay, Directorate for Engineering, telephone: (703) 292-2485, email: sgangopa@nsf.gov
- Aleksandr L. Simonian, Directorate for Engineering, telephone: (703) 292-2191, email: asimonia@nsf.gov
- Kurt Thoroughman, Directorate for Social, Behavioral, and Economic Sciences, telephone: (703) 292-7281, email: kthoroug@nsf.gov
- Betty K. Tuller, Directorate for Social, Behavioral, and Economic Sciences, telephone: (703) 292-7238, email: btuller@nsf.gov

Program Liaisons:

- Beth Plale, Big Data Hubs and Spokes Program Liaison, Directorate for Computer & Information Science and Engineering, telephone: (703) 292-7004, email: bplale@nsf.gov
- William L. Miller, Cyberinfrastructure Liaison, Directorate for Computer & Information Science and Engineering, telephone: (703) 292-7886, email: wlmiller@nsf.gov
- Fahmida Chowdhury, International Programs Liaison, Office of International Science and Engineering, telephone: (703) 292-4672, email: fchowdhu@nsf.gov
- Sridhar Raghavachari, NeuroNex Program Liaison, Directorate for Biological Sciences, telephone: (703) 292-4845, email: sraghava@nsf.gov
- Floh Thiels, NeuroNex Program Liaison, Directorate for Biological Sciences, telephone: (703) 292-8167, email: ethiels@nsf.gov
- Nandini Kannan, TRIPODS Program Liaison, Directorate for Mathematical and Physical Sciences, telephone: (703) 292-8104, email: nakannan@nsf.gov
- Tracy Kimbrel, TRIPODS Program Liaison, Directorate for Computer & Information Science and Engineering, telephone: (703) 292-7924, email: tkimbrel@nsf.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 (FASSED) 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: nspubs@nsf.gov
 - or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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