This solicitation has been archived and replaced by NSF 20-606.

Advanced Computing Systems & Services: Adapting to the Rapid Evolution of Science and Engineering Research

PROGRAM SOLICITATION
NSF 19-587

REPLACES DOCUMENT(S):
NSF 19-534

National Science Foundation

Directorate for Computer and Information Science and Engineering
Office of Advanced Cyberinfrastructure

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

November 05, 2019

IMPORTANT INFORMATION AND REVISION NOTES

The previously identified 4 March 2020 full proposal deadline (in NSF 19-534) is now modified to 5 November 2019 to promote an accelerated community response.

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 February 25, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Advanced Computing Systems & Services: Adapting to the Rapid Evolution of Science and Engineering Research

Synopsis of Program:

The intent of this solicitation is to request proposals from organizations willing to serve as service providers (SPs) within the NSF Innovative High-Performance Computing (HPC) program to provide advanced cyberinfrastructure (CI) capabilities and/or services in production operations to support the full range of computational- and data-intensive research across all of science and engineering (S&E). The current solicitation is intended to complement previous NSF investments in advanced computational infrastructure by provisioning resources, broadly defined in this solicitation to include systems and/or services, in two categories:

- Category I, Capacity Systems: production computational resources maximizing the capacity provided to support the broad range of computation and data analytics needs in S&E research; and
- Category II, Innovative Prototypes/Testbeds: innovative forward-looking capabilities deploying novel technologies, architectures, usage modes, etc., and exploring new target applications, methods, and paradigms for S&E discoveries.

Resources supported through awards from this solicitation will be incorporated into and allocated as part of NSF's Innovative HPC program. This program complements investments in leadership-class computing and funds a federation of nationally-available HPC resources that are technically diverse and intended to enable discoveries at a computational scale beyond the research of individual or regional academic institutions. NSF anticipates that at least 90% of the provisioned system or services will be available to the S&E community through an open peer-reviewed national allocation process and be supported by community and other support services [such as those currently supported through eXtreme Science and Engineering Discovery Environment (XSEDE) 2.0 project-managed allocations recommended by the XSEDE Resource Allocation Committee (XRAC), and other activities intended to foster efficient coordination across resources], or an NSF-approved alternative that may emerge. If this is not feasible for the proposed system/services, proposers must clearly explain in detail why this is the case and how they intend to make the proposed system/services available to the national S&E community.

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.

- Robert Chadduck, Program Director, CISE/OAC, telephone: (703) 292-8970, email: rchadduc@nsf.gov
- Alejandro M. Suarez, Assistant Program Director, CISE/OAC, telephone: (703) 292-7092, email: alsuarez@nsf.gov
- Edward Walker, Program Director, CISE/OAC, telephone: (703) 292-4863, email: edwalker@nsf.gov

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

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 2 to 4

The length of the award may vary depending on the type of resource funded. However, in most cases, it is expected to be up to 5 years. The details are described in the section entitled Program Requirements and should be carefully considered.

Anticipated Funding Amount: $5,000,000 to $10,000,000

per award. A total of $30,000,000 is available for this solicitation, subject to the availability of funds. It is anticipated that 1-2 awards will be made in Category I at up to $10,000,000 per award for up to five years and up to 1-2 awards in Category II at up to $5,000,000 per award for up to five years.

User support and operating costs are expected to be up to 20% of the acquisition cost per year for each deployed Category I or Category II system/service for up to five years. Should the proposed system/service require additional user and operating funds, an additional 5% may be requested along with **very strong justification for the request**. These costs will be provided as a separate supplement to the awarded cooperative agreement. Proposals should provide an analysis of the projected annual operating costs of the proposed system/service for a period of up to five years.

In either Category I or Category II, there is a possibility of a renewal award contingent upon availability of funds and the successful evaluation of the service provider's performance as well as NSF merit review of the renewal proposal. During annual reviews, the Category I or Category II service provider's achievements and future plans will be comprehensively evaluated according to the criteria defined in the initial award, associated metrics, and other relevant criteria. Contingent on a successful third-year review, Category I or Category II service provider may be invited by NSF to submit a renewal proposal in the same Category as the original award, for up to five years commencing at the beginning of the fifth year of the original award.

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.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.

Who May Serve as PI:

No specific eligibility description

Limit on Number of Proposals per Organization: 1

An organization may submit only one proposal but may be a subawardee on other proposals responding to this solicitation. The restriction to no more than one submitted proposal as lead institution is to help ensure that there is appropriate institutional commitment necessary for responsible oversight, by the potential awardee institution, of a national resource.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested (PAPPG Chapter II.D.3.a). The involvement of partner organizations should be supported through subawards administered by the submitting organization.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an organization exceeds this limit, the proposal received within the limit will be accepted based on the 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.**

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

An individual may be the PI or co-PI on no more than one proposal that responds to this solicitation. There is no limit on the number of proposals with which an individual may be associated in other capacities, such as senior personnel.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the 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:** 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 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

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

  November 05, 2019

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

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

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I. INTRODUCTION

Today's research discoveries at the confluence of theoretical, experimental and computational S&E are enabled by the continuing availability of an ecosystem of advanced computational resources. For nearly four decades, NSF has effectively supported the broad availability and innovative use of a diverse set of computational resources to accelerate fundamental advances in S&E. These investments have spanned discipline-specific instruments and facilities; computational systems of varying capabilities and architectures optimized for different applications; virtual organizations for allocating resources and interfacing with users; human expertise in using, developing, deploying and operating resources; and the network backbone that connects and provides access to these resources.

With wide adoption of new modalities of scientific and engineering discovery, the demand for CI capabilities and services has increased significantly over the past two decades – both in terms of the range of capabilities and overall capacity. This demand has been satisfied by increasingly powerful device technologies following "Moore's Law" as well as by continually evolving processor architecture, memory, interconnect, and input/output (I/O) technologies. Concurrently, S&E researchers explore new methods and algorithms, while constantly adapting to rapid technological evolution, in pursuing transformational discoveries across all of S&E.

NSF supports several computational systems delivering peak performance in the multiple petaflops range, matched with comparable data capabilities, to enable a broad range of S&E research applications. In addition, NSF also supports high-throughput computational needs for thousands of researchers across the S&E research community annually. S&E research and education enabled by state-of-the-art CI capabilities and services have a direct bearing on our Nation's competitiveness, security, prosperity, national health, and welfare. Thus, investments in advanced CI capabilities and services have long-term impact on basic research problems of national importance, supporting a wide range of S&E applications and workflows including: researchers developing multiscale models to better understand fundamental biological processes to improve our nation's health; particle physicists investigating the basic building blocks of matter to enhance our fundamental understanding of the natural world and universe; and aerospace engineers exploring aeroacoustics, structural and aerodynamic simulations to invent new products in the global innovation economy. These and other applications and workflows support and further NSF's mission to nurture our Nation's future generations of scientific discoverers and inventors.

In recognition of the strategic importance of computational scientific research and the CI on which many areas of S&E research depends, the 2018 NSF-funded workshop Rethinking NSF's Computational Ecosystem for 21st Century Science and Engineering found that the continued evolution of the NSF CI ecosystem must be shaped by the dramatic increase in the number and nature of S&E research applications in recent years, their growing demands for CI capacity, as well as for different types of resources exploiting new technologies, data locality, and/or new usage modes (e.g., interactive, on-demand, and elastic). Dramatic changes in the landscape of technologies, resources, and delivery mechanisms must be explored. Avenues for future investigation include unprecedented computational and data processing capabilities at all scales; increasingly available capabilities at the network edge; growing roles of distributed and campus CI as a key enabler of all S&E research; and the proliferation of commercial cloud services (and the novel technologies and usage modes that they provide), which are playing an increasingly important and complementary role in supporting S&E applications and workflows.

The intent of this solicitation is to request proposals to provide advanced CI capabilities and/or services to support the full range of computational- and data-intensive research across all of S&E. NSF strongly urges the community to think broadly, including such considerations as ease of access to proposed systems/services by new communities in S&E; new capabilities that will enable new methods and paradigms for S&E discoveries; and opportunities for leveraging the increasing availability and capabilities at the network edge (including campuses) and via commercial cloud services.

A successful proposal must clearly demonstrate how the proposed resource will support transformative discoveries in S&E. This may be done through a combination of analytical models projecting the anticipated performance of the proposed resource, appropriate benchmark results, and compelling empirical evidence validating that the resource will be a valuable scientific instrument for S&E discovery.

In the following descriptions, the term "system" is intended to refer to the entire resource being proposed. Also, the term "resource" is used broadly to also include systems and/or services.

II. PROGRAM DESCRIPTION

The intent of this solicitation is to request proposals from organizations willing to serve as service providers (SPs) within the NSF Innovative HPC program to provide advanced CI capabilities and/or services in production operation to support the full range of computational- and data-intensive research across all of S&E.

To increase the Nation's capacity for transformative S&E discoveries, NSF is interested in continuing to diversify and evolve its portfolio to take advantage of new technologies and services that include capabilities addressing emerging computational- and data-intensive S&E research topics, workflows, and communities, while expanding opportunities for participation by a broader range of potential SPs.

This competition emphasizes the provisioning of an ecosystem of advanced computational resources and services that is responsive to the dramatic increase in the number and nature of applications using NSF-funded resources. Proposals are requested for advanced CI that will deploy capabilities and services, including composable services, to address the increase in demand for computation and data analytics resources in the S&E research community, as well as explore novel paradigms for enabling transformative S&E discoveries.

This solicitation explicitly focuses on the growing scale and diversity of the S&E community, the changing nature of S&E research requirements, as well as the rapidly evolving CI landscape, with the overarching goal of supporting transformational S&E discoveries.

An important aspect of the current solicitation is that funded projects must provide CI capabilities and/or services that demonstrate high degrees of stability and usability during the period of production operations available to the S&E community. NSF strongly urges the community to consider expanding the range of possibilities in enabling S&E communities to leverage the power of computation for transformative research, and to think broadly about the nature and composition of the CI ecosystem. Such consideration may include, but is not limited to, ease of access to proposed systems/services by new S&E communities; new capabilities that will open up new methods and paradigms for S&E discoveries; federated approaches with opportunities for leveraging the increasing availability and capabilities at the network edge (including campuses); and composable services provisioning virtualized on-premise computing infrastructure and commercial cloud services.

The current solicitation is intended to complement previous NSF investments in advanced computational infrastructure through provisioning resources in two categories as described below.

Category I – Capacity Systems

Resources proposed in this category are intended to be operational deployments of production computational resources that will provide maximum capacity and throughput to support the broad range of computation and data analytics needs in S&E research. The proposed resource must be clearly motivated by the current and future demand for computational and data analytics capacity in the broad and diverse S&E research community. This category particularly targets capabilities and/or services for small- to mid-scale jobs (from one to a few thousand cores per job) across broad areas of S&E, including support for "long-tail science" applications, as well as new classes of applications, such as artificial intelligence/machine learning/deep learning applications. Proposers are encouraged to explore novel models that leverage federated and/or distributed resources, regional and/or campus supported resources, and/or commercial cloud services.

Competitive proposals in Category I must address the following requirements in the Project Description:

- A clear plan for provisioning a resource or service that addresses the current and future demand for computation and data analytics capacity in the broad S&E computational research community.
- A forward-looking plan for engagement with other NSF supported efforts in advanced CI where possible, such as domain-specific centers housing software, sensors or instrument data that will enable new advances in S&E research.
- A persuasive articulation as to how the resource will support less traditional computational S&E communities if appropriate and explore models of engagement with campus-supported CI.
- A description of how the resource will support S&E research communities that require a national-scale, on-demand, compute and data-analytics resource with a flexible and user-friendly software environment.
- A clear plan of operations for the project duration with a clear set of operation and science impact metrics to ensure the resource will be an asset for the nation's S&E research community.
- A detailed risk-mitigated deployment plan to ensure that the proposed resource will be in production operations and available for allocation to the open S&E research community no later than 12 months from the time of award.
- A comprehensive set of system-level performance and reliability metrics that will be used by NSF for acceptance of the resource or service.

Relevant parameters contributing to the comprehensive technical description of the proposed system may vary with the nature of the resource. However, all description of the proposed resource must closely adhere to the guidelines provided in section V.A. *Proposal Preparation Instructions*.

Category II – Innovative Prototypes/Testbeds

Resources proposed in this category will be initially deployed as a prototype/testbed system supporting S&E research through delivery of novel forward-looking capabilities and services. Resources proposed in this category can represent the deployment of new technologies, system architectures, or usage modalities at scale, with plans for developing a national S&E user community that will benefit from the proposed capabilities. Proposed systems could include novel processor architectures supporting artificial intelligence applications, distributed systems leveraging edge devices, domain-specific architectures and technologies, such as but not exclusively, reconfigurable and/or software defined systems, systems designed for streaming data and/or real-time processing, etc.

Proposers must clearly define the target classes of S&E applications that will be enabled, as well as a clear plan for ensuring the widespread adoption by these classes of applications on the proposed capabilities and/or services. While the resources in this category may initially include prototypes/experimental testbeds, proposers are expected to present a clear near-term plan for transitioning to high-availability production services broadly available and allocable to the S&E community through open peer-reviewed processes during the final 24 months of the project award period. It is also expected that the initially-deployed prototype/testbed will include active engagements with S&E researchers, and these engagements will be reviewed by NSF in its evaluation of the system. Clear science impact metrics for measuring the performance of the proposed system are required.

Competitive proposals in Category II must address the following requirements in the Project Description:

- A clear plan for provisioning innovative computational and data analysis capabilities or services that will enable new methods and paradigms in support of transformational S&E discoveries;
- A compelling description of how the proposed capabilities or services will address future demand for computation and data analytics capabilities [see the XD Metrics Service (XMS) Workload study] in S&E research;
- A persuasive set of S&E use cases, including quantitative analysis through benchmarks, that clearly motivate how the resource will expand the range of S&E applications that can be currently tackled using existing NSF-funded Innovative HPC resources;
- A forward-looking plan for engagement where appropriate with other NSF-supported efforts in advanced CI, such as with domain-specific centers housing software, sensors, or instrument data, to enable new advances in S&E research;
- A clearly defined set of target S&E application classes that will be enabled, as well as a clear plan for ensuring the widespread adoption by these classes of applications on the proposed capabilities and/or services;
- A clear plan of operations for the project duration, with a detailed set of engagement activities with the S&E research community, to optimize the use of the resource, facilitate application and user transition during the initially-deployed prototype/testbed system phase, and ensure that the resource evolves to a high-availability production utility for a national community of S&E users;
- A detailed risk-mitigated deployment plan to ensure that the proposed resource will evolve to high-availability production services broadly available for allocation to the open S&E research community in the final 24 months of the award period; and
- A comprehensive set of system-level performance and reliability metrics that will be used by NSF for acceptance of the resource or service.

Project duration for both categories will depend on the nature of the resource to be deployed. Resources may be deployed in one step near the beginning of the award period, or progressively in a series of steps or phases during the award period.

Awards anticipate that at least 90% of the provisioned system or services will be available to the S&E community through an open peer-reviewed national

allocation process and be supported by community and other support services [such as those currently supported through eXtreme Science and Engineering Discovery Environment (XSEDE) 2.0 project-managed allocations recommended by the XSEDE Resource Allocation Committee (XRAC), and other activities intended to foster efficient coordination across resources], or an NSF-approved alternative that may emerge. If this is not feasible for the proposed system/services, proposers must clearly explain in detail why this is the case and how they intend to make the proposed system/services available to the national S&E community.

User support and operating costs are expected to be up to 20% of the acquisition cost per year for up to five years for each deployed Category I or Category II system/service. Should the proposed system/service require additional user and operating funds, an additional 5% may be requested along with **very strong justification for the request**. These costs will be provided as a separate supplement to the awarded cooperative agreement. Proposals should provide an analysis of the projected annual operating costs of the proposed system/service for a period of up to five years.

Detailed information on the proposal format is provided in Section V. *Proposal Preparation and Submission Instructions*.

III. AWARD INFORMATION

Anticipated Funding Amount: $5,000,000 to $10,000,000 per award for up to 5 years.

Anticipated Funding Amount: A total of $30,000,000 is available for this solicitation, subject to availability of funds. It is anticipated that 1-2 awards will be made in Category I at up to $10,000,000 per award for up to five years and up to 1-2 awards in Category II at up to $5,000,000 per award for up to five years.

Should the proposed system/services require additional user and operating funds, an additional 5% may be requested along with very strong justification for the request. These costs will be provided as a supplement to the awarded cooperative agreement. Proposals should provide an analysis of the projected annual operating costs of the proposed system/service for a period of up to five years.

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.
- Other Federal Agencies and Federally Funded Research and Development Centers (FFRDCs): Contact the appropriate program before preparing a proposal for submission.

Who May Serve as PI:

No specific eligibility description

Limit on Number of Proposals per Organization: 1

An organization may submit only one proposal but may be a subawardee on other proposals responding to this solicitation. The restriction to no more than one submitted proposal as lead institution is to help ensure that there is appropriate institutional commitment necessary for responsible oversight, by the potential awardee institution, of a national resource.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested (PAPPG Chapter II.D.3.a). The involvement of partner organizations should be supported through subawards administered by the submitting organization.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an organization exceeds this limit, the proposal received within the limit will be accepted based on the 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.**

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

An individual may be the PI or co-PI on no more than one proposal that responds to this solicitation. There is no limit on the number of proposals with which an individual may be associated in other capacities, such as senior personnel.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. In the event that an individual exceeds this limit, the proposal received within the limit will be accepted based on the 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.**

Additional Eligibility Info:

It is recognized that FFRDCs may be positioned to make unique contributions to the Innovative HPC systems environment important to academic researchers. Hence, for the purposes of this solicitation, NSF will consider acquiring and deploying HPC systems at FFRDC sites. However, proposing organizations must assure that open access to the deployed HPC systems or services will be provided to researchers from the broad range of S&E fields supported by NSF.

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 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.

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.

The following provides additional guidance beyond that contained in the PAPPG or NSF Grants.gov Application Guide.

Proposal titles must begin with “Category I” or “Category II”, depending on the type of resource/services proposed.

Only personnel directly connected to the project should be listed as **collaborators**.

Collaborative efforts may **only** be submitted as a single proposal (See PAPPG Chapter II.D.3.a), in which a single award is being requested. The involvement of partner organizations should be supported through subawards administered by the proposing Service Provider organization.

The page limit for the **Project Description** section of the proposal is **30 pages**.

In addition to the instructions described in the *PAPPG* or NSF Grants.gov Application Guide, the Project Description must include the following sections:

- **Intellectual Merit:**
  - **Resource Specification**;
  - **S&E Application Performance**;
  - **Resource Reliability and Usability**;
  - **Project Management and Risk Mitigation**;
  - **Data Infrastructure**;
  - **Security**;
  - **Operations Plan**; and
- **Broader Impacts.**

Information to be provided in each of these sections is described below.

Resource Specification

Proposals must describe the detailed architecture of the resource to be provisioned. This must include a detailed description of any aspects of the proposed resource that are likely to influence the performance of the S&E applications expected to use the resource and/or what unique/novel features will be addressed in its architecture. The resource description should also include a combination of how it will interact with other CI components; attract new user communities; introduce new methods/paradigms; and/or catalyze new scientific opportunities.

Resource descriptions should identify how the proposed resource will complement and extend the current NSF-funded Innovative HPC program ecosystem, highlight components unique to the proposed resource, and describe how the innovative capabilities will be integrated into existing CI supporting S&E research. Proposers should pay particular attention to the issues elaborated earlier as to how the resource will complement and leverage existing NSF-provisioned capabilities.

Resource descriptions should outline any anticipated challenges/risks associated with the proposed resource.

In instances when the proposed resource in either Category I or Category II includes ***services***, a detailed description of the supporting services architecture is required. This description must include a specification of the services enabled which can include, for example, the following service types:

- infrastructure (provisioning of processing, storage, networking, and/or other fundamental computing capabilities);
- platform (services-enabled deployment of applications created using programming languages, libraries, services, and/or tools); and/or

- hosted applications exercising the services environment.

The resource description must also include descriptions of service level agreements (SLA) in measurable and verifiable terms. These can include, for example, the following:

- reliability, availability, and usability operating targets (with consideration for planned and unplanned services “downtime”);
- compliance with the policies and other requirements, including with respect to maintenance of cybersecurity, privacy, confidentiality, intellectual property, location of data and/or computations, disclosure/access, and/or disposition (including potentially appropriate deletion/retention) of all processed data and/or computations, etc.;
- performance targets with relevant metrics (such as, for example, response time, time to issue resolution/mitigation, service performance monitoring, as well as plans for timely notification of proposing organization of changes in supporting services that may affect services delivery and/or resource operations, and mitigation of failures of services to meet specified levels of performance, etc.); and
- assurance quality for services management and data practices.

In instances when the proposed resource in either Category I or Category II includes ***acquisition of hardware resources***, the resource description should include details of the resource to be deployed. Relevant parameters to be considered may vary with the nature of the proposed resource but could include, for example, total number of processors, architecture(s) of the nodes that make up the underlying resource, speed and architecture of individual processors, number of processors sharing the same access to memory, amount of memory, size and number of caches, inter-processor and inter-node bandwidth and latency, communications topology, amount of secondary storage, middleware, tools or application software stacks, visualization capabilities, I/O sub-system, file system(s), operating system(s), compiler(s), debugging tools, performance measurement tools, system administration tools, and modes of parallelism available to users.

The descriptions should further highlight system attributes and components constituting the proposed innovative capabilities, including compute nodes, local disk, data management, any visualization capabilities, middleware, tools, hardware or software support for measuring application and system performance, including I/O, or application software stacks, whether vendor-supplied or open.

S&E Application Performance

Proposals must describe the types of S&E research challenges that motivate the detailed resource design. This description must include the expected impact of the resource to S&E research; the S&E research challenges that motivate the selection for the innovative capabilities; and the expected impact of the specific new innovative capabilities of the resource.

Proposals must describe in detail how the resource will integrate with current NSF-funded Innovative HPC program services and how it will bring additional value to specific S&E research challenges. The description should explain how the resource will be integrated with any other CI, instrument, middleware, or workflow project, and the value it will provide to S&E research and research education communities.

Proposals must provide a detailed analysis of the projected performance of the proposed resource on a set of S&E applications chosen to illustrate the capabilities of the proposed resource.

Proposals must provide a compelling justification that explicitly addresses the new innovative capabilities' relevance to S&E. If motivating applications are presented, the choice of applications should be justified in terms of their scientific merit and their ability to demonstrate the potential of the innovative capability. The features of applications influencing the design and configuration of the proposed innovative capability should be fully explained with respect to how the innovation expands the reach to new S&E research and communities or enables applications that are difficult to address with the current NSF-funded Innovative HPC resources.

Proposals must provide a persuasive set of S&E use cases, including quantitative analyses through benchmarks that clearly motivate how the resource will expand the range of S&E applications that can be currently tackled using existing NSF-funded Innovative HPC resources.

Resource Reliability and Usability

Proposals must describe the following:

- The anticipated mix of applications and their scales that will be supported by the resource, as well as its usability relative to the driving S&E research challenges from the perspectives of both novice and more experienced researchers;
- The system software environment in detail, including any innovative features, and how the anticipated application mix will be efficiently supported; and
- The types of system usage data that will be accessible to and transparently visible from third-party interfaces, such as those currently supported through XSEDE 2.0 project-managed allocations selected by the XRAC, other XSEDE 2.0 project-managed activities, XMS, or other NSF-approved alternatives.

Proposals must include an analysis of the reliability of the proposed production resource with appropriate justifications. It is expected that 96% of applications submitted to the proposed system should complete without having to be resubmitted because of a failure in the hardware or system software. Proposals must provide a detailed analysis of resource utilization goals to ensure that the proposed resource is effective and efficiently used as an instrument for the broader S&E research community.

The award instrument will include a performance requirement on the availability of the resource. NSF requires that, when averaged over a month, production resources should be unavailable as a result of scheduled and unscheduled maintenance no more than 5% of the time. Proposals must provide an analysis of the reasons that the proposed system can be expected to meet this performance requirement.

Project Management and Risk Mitigation

Proposals must provide a detailed implementation plan and corresponding metrics for developing and/or acquiring and deploying the proposed resource, including any innovative capabilities. A detailed month-by-month schedule must be provided, including an early operations phase period of not less than 30 consecutive days to demonstrate and confirm the innovative capabilities of the proposed resource. The proposed implementation plan must include explicit metrics associated with the innovative capability and must include justification of the metrics selection.

Proposals must provide details on the sub-contract(s) with the relevant vendor(s) that describe the contractual terms of any substantial acquisition of hardware, software, or services.

Proposals must describe the availability of experts to address any system integration problems that arise as the resource is deployed. This expertise may be provided by the proposing Service Provider and/or by other vendor, academic, or government partners. Proposers should make clear their previous

associations, if any, with these partners. The breadth of knowledge, depth of interaction, and technical abilities of partners will be considered in the review process. This knowledge and expertise is particularly important in supporting advanced programming or usage paradigms (e.g., compilers for parallel environments, problem-solving environments, distributed computing), tools (e.g., performance visualization, parallel debuggers), system elements (e.g., parallel file systems, virtualization), and services, including composable services.

Proposals must describe S&E community user access to the resource during the deployment phase and prior to system acceptance, including during testing.

Proposals must describe the experience of the proposing organization in the management of awards of this scale and the resources that would be available to manage an award. If the proposal involves a substantial acquisition, describe the experience of the proposing organization in the management of large sub-contracts to vendors for the acquisition of HPC systems. Proposals must describe the organizational resources that would be available to manage any such sub-contract issued under an award made because of this solicitation.

Proposals must provide a detailed risk mitigation plan, identifying both technical and management risks as well as strategies to mitigate such risks. The risk management plan must include risks specific to the innovative capability such as S&E community adoption or sustainability.

Data Infrastructure

Proposals must describe the external network connectivity between the proposed resource and national networks, including potential integration with federated and/or distributed resources, regional and/or campus-supported resources, and/or commercial cloud services.

S&E research applications can produce many terabytes to petabytes of data. The proposal must describe how these data will be handled; how data integrity will be maintained; what backup and contingency procedures and schedules will be implemented; how data accessibility will be facilitated; and how archive storage will be provided.

Security

Proposals must describe both physical and operational security plans for the proposed resource. Proposals must describe project roles and responsibilities with respect to cybersecurity for the facility as well as how risk will be assessed; what technical safeguards will be in place; what administrative safeguards will be maintained; what physical safeguards are planned; how policies and procedures for cybersecurity will be established and maintained; what the plans are for awareness and training; and what procedures will be in place for notification to NSF, the user community, other CI communities, and appropriate authorities (e.g., local police, the Federal Bureau of Investigation). Proposers must describe how the effectiveness of the proposed cybersecurity program will be evaluated and assessed, and what approach will be taken to implement the cybersecurity plan.

Operations Plan

Proposals must provide a plan for user support that includes a description of the anticipated requirements of the S&E research community; a description of how resources will be allocated; and any other operational details likely to have an impact on user access or usage of the proposed system. The plans should describe the number and anticipated qualifications of the types of personnel that will be involved with the provision of user support as well as user training that will be provided.

Proposals must describe the experience of the proposing organization in operating production systems, including any experience in operating in a physically-distributed environment. This section must include a description of whether operational support was provided on a 24/7 basis or was provided on a more limited basis; the number and types of users; the types of computation performed; and the nature of the user support provided.

Proposals must include in the operating plans processes for evaluating management performance, determining user needs, and evaluating user satisfaction.

Proposals must describe the qualifications of the Principal Investigator and co-Principal Investigators regarding her or his ability to manage a project of this size and complexity, as well as manage a resource with a potentially large number of external users.

Proposals must provide an analysis of the annual operating costs of the resource for duration of the award, including the cost of providing user support. Detailed operating cost estimates should include any necessary maintenance contracts. Operating cost estimates should also include (if applicable) the cost of power and physical security, the cost of external network connectivity from the location(s) of the system to other CI projects, national networks, including to potentially integrate effectively with federated and/or distributed resources, regional and/or campus-supported resources, and/or commercial cloud services, and costs associated with leasing machine room space, if necessary. An estimate of the costs associated with the number of full-time equivalents (FTEs) necessary to maintain 24/7 operations of the proposed system should be provided as well as an estimate of the costs associated with the number of FTEs necessary to provide effective user support. Services leveraged from other CI projects and/or commercial cloud services must also be described.

A more detailed explanation of the budget for user support and operating costs should be provided in the Supplementary Documents section of the proposal (this should not exceed 5 pages). Information provided will be used to help NSF assess the operating cost-performance attributes of the proposed system.

Any other factors that are anticipated to have an impact on the Total Cost of Ownership of the proposed resource must also be provided.

Broader Impacts

In addition to the instructions provided in PAPPG Chapter II.C.2, proposals must describe any complementary and leveraged aspects within the CI ecosystem, with emphasis on other NSF-funded CI projects.

Proprietary information

Proposals containing patentable ideas, trade secrets, and/or privileged or confidential commercial or financial information, disclosure of which may harm the proposer, should be clearly marked where appropriate in the proposal and labeled with the following legend:

“The following is (proprietary or confidential) information that (name of proposing organization) requests not be released to persons outside the U.S. Federal Government, except for purposes of review and evaluation.”

Note that proposals submitted to this solicitation will be reviewed by a group of experts that include people who are not U.S. Federal Government personnel.

Supplementary Documents

In addition to other required Supplementary Documents, proposals should include the following as Supplementary Documents:

- Actual or estimated performance benchmark results as described in Section V.A. *Proposal Preparation Instructions*, S&E Application Performance. This section should not be used to continue discussion or analysis of the merits of the Service Provider, vendor or vendors, or system.
- Detailed Projected Operating Costs as described in Section V.A. *Proposal Preparation Instructions*, Operations Plan. This **should not exceed 5 pages.**
- A list of all institutions and companies involved in the project, together with their roles within the project and the levels of funding.
- A plan for user support that includes a description of the anticipated requirements of the S&E research community, a description of how resources will be allocated, and any other operational details likely to have an impact on user access or usage of the proposed system (see Operations Plan above).
- Letters of collaboration from individuals who are described in the Project Description as involved in the project in a senior capacity but who are not members of the lead proposing organization, or from representatives of institutions or organizations collaborating with the lead institution, are allowable, as described in the PAPPG Chapter II.C.2.d(iv). **Note that letters of endorsement should not be included in proposals.**

  Any substantial collaboration with individuals not included in the budget should be described in the Facilities, Equipment and Other Resources section of the proposal (see PAPPG Chapter II.C.2.i) and documented in a letter of collaboration from each collaborator. Such letters should be provided in the Supplementary Document section of the FastLane Proposal Preparation Module and follow the format instructions specified in PAPPG Chapter II.C.2.j. Collaborative activities that are identified in the budget should follow the instructions in PAPPG Chapter II.D.3.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Each proposal should be for the development phase including any acquisition costs as well as the deployment phase of the project. The proposal amount cannot exceed $10,000,000 for a single Category I award and $5,000,000 for a single Category II award. Acquisition and deployment of the full system should be finished before the end of September 2021. The number of years that the proposed system will be deployed can vary with the nature of the system. In most cases, it is anticipated to be part of the NSF-funded Innovative HPC program for up to five years.

Each award will support the acquisition and deployment of hardware, software, and associated personnel costs, including acceptance testing. Detailed budgetary information should be provided in the Budget Justification section of the proposal.

Each proposal may be for an acquisition that occurs in one step near the beginning of the award period or for an acquisition that is deployed in phases during the award period.

User support and operating costs of up to 20% of the initial acquisition costs per year, after acceptance of the proposed system, will be provided in a separate supplement to the awarded cooperative agreement. Should the proposed system/service require additional user and operating funds, an additional 5% may be requested along with **very strong justification for the request**. Detailed budgetary information should be provided in the Budget Justification section of the proposal.

C. Due Dates

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

  November 05, 2019

D. FastLane / Research.gov / Grants.gov Requirements

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. 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: https://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 or Research.gov may use Research.gov 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

Reviewers will be asked to assess the adequacy of the descriptions provided in the required sections of the Project Description (these are described in Section V.A. *Proposal Preparation Instructions* above):

- Intellectual Merit:
    - Resource Specification;
    - S&E Application Performance;
    - Resource Reliability and Usability;
    - Project Management and Risk Mitigation;
    - Data Infrastructure;
    - Security;
    - Operations Plan; and
- Broader Impacts.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, or Site Visit 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) 292-8134 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:

Awards made as a result of this competition will include performance requirements and metrics for the proposed systems. If appropriate, an awardee will include terms and conditions in any subcontract agreement to address schedule and performance expectations and the impact of delays in delivery.

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.

Additional reporting requirements apply, will be negotiated with the Service Provider prior to award, and will be incorporated into the special terms and conditions of the award.

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:

- Robert Chadduck, Program Director, CISE/OAC, telephone: (703) 292-8970, email: rchadduc@nsf.gov
- Alejandro M. Suarez, Assistant Program Director, CISE/OAC, telephone: (703) 292-7092, email: alsuarez@nsf.gov
- Edward Walker, Program Director, CISE/OAC, telephone: (703) 292-4863, email: edwalker@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188

  FastLane Help Desk e-mail: fastlane@nsf.gov.

  Research.gov Help Desk e-mail: rgov@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 https://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 System of Record Notices, NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314