High Performance Computing System Acquisition: Building a More Inclusive Computing Environment for Science and Engineering

PROGRAM SOLICITATION
NSF 13-528

REPLACES DOCUMENT(S):
NSF 11-511

National Science Foundation

Office of Cyberinfrastructure

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

April 15, 2013

IMPORTANT INFORMATION AND REVISION NOTES

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

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

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

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

High Performance System Acquisition: Building a More Inclusive Computing Environment for Science and Engineering

Synopsis of Program:

The NSF's vision for Advanced Computing Infrastructure (ACI), which is part of its Cyberinfrastructure for 21st Century Science and Engineering (CIF21), focuses specifically on ensuring that the science and engineering community has ready access to the advanced computational and data-driven capabilities required to tackle the most complex problems and issues facing today's scientific and educational communities. To accomplish these goals requires advanced computational capabilities within the context of a multilevel comprehensive and innovative infrastructure that benefits all fields of science and engineering. Previous solicitations have concentrated on enabling petascale capability through the deployment and support of a world-class High Performance Computing (HPC) environment. In the past decade the NSF has provided the open science and engineering community with a number of state-of-the art HPC assets ranging from loosely coupled clusters, to large scale instruments with many thousands of computing cores communicating via fast interconnects, and more recently with diverse heterogeneous architectures. Recent developments in computational science have begun to focus on complex, dynamic and diverse workflows. Some of these involve applications that are extremely data intensive and may not be dominated by floating point operation speed. While a number of the earlier acquisitions have addressed a subset of these issues, the current solicitation emphasizes this even further.

Currently the NSF operates, through Blue Waters and the eXtreme Digital (XD) program, a two-tiered

comprehensive distributed Cyberinfrastructure (CI), and one of the largest and most powerful in the world. Through these and related projects the open science and engineering community is currently capable of tackling many of the most challenging scientific problems across multiple science and engineering domains. Both of these tiers are explicitly designed to address needs *beyond* the campus level. With this solicitation, NSF intends to continue this model to broaden the CI capabilities above the campus level. The resources funded under this solicitation will be incorporated into and allocated as part of the XD tier of national shared resources. The XD tier currently consist of;

- The Extreme Science and Engineering Discovery Environment (XSEDE) - Responsible for integration of XD tier shared resources and services
- Technical Insertion Service - Evaluates and makes recommendations on insertion of software and other technologies into the XD environment
- Technical Audit Service - Provides metrics on XD systems and operates XDMoD a publically available and easily usable tool for extracting data and monitoring XD systems
- Two visualization resources, Longhorn (TACC) and RDAV (NICS/University of Tennessee)

The current solicitation requests innovative proposal of two types:

The first is intended to complement previous NSF investments in advanced computational infrastructure. Consistent with the ACI Strategic Plan, the current solicitation is focused on expanding the use of high end resources to a much larger and more diverse community. To quote from the ACI Strategic Plan, the goal is to "...position and support the entire spectrum of NSF-funded communities "....and to promote a more comprehensive and balanced portfolio .... to support multidisciplinary computational and data-enabled science and engineering that in turn supports the entire scientific, engineering and educational community". Thus, while continuing to provide essential and needed resources to the more traditional users of HPC, it is important to enlarge the horizon to include research communities that are not users of traditional HPC systems, but who would benefit from advanced computational capabilities at the national level. Building, testing, and deploying these resources within the collaborative ecosystem that encompasses national, regional and campus resources continues to remain a high priority for the NSF and one of increasing importance to the science and engineering community.

The second type is devoted to the increasing pressure on the existing infrastructure to store and process very large amounts of data coming from simulation and from experimental resources such as telescopes, genome data banks or sensors. As recently stated in BIGDATA (NSF 12-499), "Pervasive sensing and computing across natural, built, and social environments is generating heterogeneous data at unprecedented scale and complexity. Today, scientists, biomedical researchers, engineers, educators, citizens and decision-makers live in an era of observation: data come from many disparate sources, such as sensor networks; scientific instruments, such as medical equipment, telescopes, colliders, satellites, environmental networks, and scanners; video, audio, and click streams; financial transaction data; email, weblogs, twitter feeds, and picture archives; spatial graphs and maps; and scientific simulations and models. This plethora of data sources has given rise to a phenomenal diversity in data types; data can be temporal, spatial, or dynamic and can be derived from both structured and unstructured sources. Data may have different representation types, media formats, and levels of granularity, and may be used across multiple scientific disciplines. These new sources of data and their increasing complexity contribute to an explosion of information."

A critical aspect of the cyberinfrastructure required to deal with this data deluge is that the data must be rapidly available to researchers geographically separated from where those data resources are located. In addition, it is important to ensure that the data is secure. To address this need, the current solicitation is designed to complement these other solicitations and calls for the acquisition and support of a large scale instrument that will have the capability of storing, sustainably accessing, analyzing, disseminating, securing and migrating data across the NSF cyberinfrastructure. The data may come from scientific computation, from scientific instruments/sensors or other sources but once it is generated it often needs to be available to the scientific community independent of where they are located. One final point: this solicitation is not designed to address very long term archival storage issues but proposals that can inform future policy on this issue say, via, some use cases, are certainly welcome.

Service Providers - those organizations willing to acquire, deploy and operate ACI resources in service to the science and engineering research and education community - play a key role in the provision and support of a national Cyberinfrasructure. With this solicitation, the NSF requests proposals from organizations willing to serve as Service Providers within the eXtreme Digital (XD) program who propose to acquire and deploy new, innovative systems features and services to the science & engineering community using the shared services model of the XSEDE project.

Note that proposals to add new and innovative features to currently deployed systems are eligible for consideration provided they are consistent with the goals of the current solicitation.

Competitive proposals should address one or more of the following:

- Complement existing XD capabilities with new types of computational resources attuned to less traditional computational science communities;
- Incorporate innovative and reliable services within the HPC environment to deal with complex and dynamic workflows that contribute significantly to the advancement of science and are difficult to achieve within XD;
- Facilitate transition from local to national environments via the use of virtual machines;
- Introduce highly useable and cost efficient cloud computing capabilities into XD to meet national scale requirements for new modes of computationally intensive scientific research;
- Expand the range of data intensive and/or computationally-challenging science and engineering applications that can be tackled with current XD resources;
- Provide reliable approaches to scientific communities needing a high-throughput capability:
- Provide a useful interactive environment for users needing to develop and debug codes using hundreds of cores or for scientific workflows/gateways requiring highly responsive computation;
- Deal effectively with scientific applications needing a few hundred to a few thousand cores;

Efficiently provide a high degree of stability and usability by January, 2015

In past solicitations benchmarks have played an important role. Two types of benchmarks were required: NSF provided and proposer selected benchmarks. For this solicitation, the NSF has opted not to *require* a specific set of NSF provided benchmarks. One reason for this decision is that the current solicitation is not focused on funding a single, large resource designed to serve tightly coupled scientific applications dominated by floating point operations and needing many thousands of cores. While this is still important in certain contexts, the present call is much broader. As such, we expect that each proposer will provide a convincing demonstration, with hard data, that their system will perform as described in their proposal. The demonstration certainly can address applications that are used by the NSF computational science community but should provide compelling evidence of the expanded scientific diversity resulting from innovative aspects of the proposed resource. Clearly the details of the submitted benchmark results will depend on the nature of the proposed resource and is likely to differ from one submission to the next.

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.

- Barry I. Schneider, Program Director, telephone: (703) 292-7383, fax: (703) 292-9060, email: bschneid@nsf.gov
- Irene Qualters, Program Director, telephone: (703) 292-2339, fax: (703) 292-9060, email: iqualter@nsf.gov
- Robert Chadduck, Program Director, telephone: (703) 292-2736, fax: (703) 292-9060, email: rchadduc@nsf.gov

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

- 47.080 --- Office of Cyberinfrastructure

Award Information

Anticipated Type of Award: Cooperative agreement. Resources acquired and fully deployed by end of FY15 (3 year award)

Estimated Number of Awards: 2 to 3 : 1-2 for the computational resource(s) and 1 for the data resource if proposed as a stand-alone system. An integrated system designed to address both computational and data needs is acceptable.

Anticipated Funding Amount: $30,000,000 A total of up to $30,000,000 in FY 2013, subject to availability of funds, is available to fund up to three awards. The computational resource awards will be capped at $12,000,000 each and the data resource award at $6,000,000. With this solicitation, the NSF encourages the community to think broadly and not simply rely on older concepts focused on delivering compute cycles. Project durations should be for up to 4 years. An acquisition associated with the upgrade of an existing system is permissible. Each award will support the acquisition and deployment of hardware, software, and the personnel costs associated with the acquisition and deployment of the proposed system, including acceptance testing. 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. Although there are no NSF provided benchmarks that need to be met, proposals should clearly address the manner in which any innovative capability will be part of the final award by providing data on the performance of the proposed system on that innovative capability. A successful proposal should provide compelling evidence that the resource will deliver significant added value to the XD environment. User support and operating costs are *expected* to be 20% of the acquisition cost per annum for each deployed HPC system. Should the proposed resource require *additional* user and operating funds, an additional 5% can be requested but the proposal must provide **very strong justification** for such a request. These costs will be provided in a separate funding action. The proposal should provide an analysis of the projected annual operating costs of the proposed system for a period of up to four years. The estimate should include the cost of providing user support, operating cost estimates, a maintenance contract for up to 4 years, the cost of power and physical security, the cost of network connectivity from the location of the system to XSEDE, and costs associated with leasing machine room space, if necessary. Provide an estimate of the costs associated with the number of FTEs necessary to maintain 24/7 operations of the proposed system.

Awards will require that 90% of the capacity/capability of the delivered system, be part of the XSEDE allocations process (XRAC) and available to the open science community.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- U.S. institutions of higher education and Federally Funded Research and Development Centers are eligible to apply as Service Providers. It is recognized that FFRDCs may be positioned to make unique contributions to the HPC 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 HPC systems deployed will be provided to researchers from the broad range of science and engineering fields supported by NSF.

PI Limit:

None Specified

Limit on Number of Proposals per Organization: 1

An organization may submit only one proposal but may be a sub-awardee on other proposals responding to this solicitation.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested. The involvement of partner organizations should be supported through sub-awards administered by the submitting organization.

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** 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. proposer's local time):

  April 15, 2013

Proposal Review Information Criteria

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

Award Administration Information

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

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

TABLE OF CONTENTS

I. INTRODUCTION

Many research communities are operating at the confluence of theoretical, experimental and computational science and engineering. Examples of scientists and engineers whose research require advanced computational and data resources include: climate scientists developing high resolution unified climate and weather models with fidelity at national and regional levels; biomolecular researchers developing reliable multiscale models for macromolecular folding, biochemical binding and reaction mechanisms, macromolecular pathways, and supramolecular cellular processes; researchers involved with massive genome sequencing data and computation; physicists, engineers and behavioral scientists engaged in hazard analysis and management through coupling of ensemble simulations and behavioral models; astrophysicists investigating Einstein's Theory of General Relativity building beyond the ability of observational astronomy; particle physicists investigating the fundamental building blocks of matter; aerospace engineers exploring wind turbine aerodynamics as well as coupled aeroacoustical , structural and aerodynanmic simulations.

Science and engineering research and education enabled by state-of-the-art HPC tools also have been shown to have a direct bearing on the Nation's competitiveness and security. If investments in HPC are to continue to have a long-term impact on basic research problems of national need, then HPC resources must deliver high performance capability to a wider range of science and engineering applications and workflows.

Academic researchers currently have access to a rich mix of HPC systems that:

- Deliver sustained performance in the 10s of teraflops to > 1 petaflop range on a variety of science and engineering codes capable of generating and analyzing petabyes of data
- Offer a variety of homogenous and heterogenous systems suitable for a broad range of computational science research
- Include storage appropriate for advanced multiscale, multiphysics 3D simulations
- Introduce resources appropriate to complex graph analytics, high speed 3D image analysis, and workflows that require high speed queries for large datasets
- Are integrated into a national cyberinfrastructure environment; and are supported at national, regional and/or campus level.

It is likely that NSF will continue to directly support several systems delivering peak performance > 1 petaflop across a range of increasingly broad science and engineering research applications matched with comparable data capabilities. In addition, NSF is currently supporting one system capable of exceeding well over a petaflop of sustained performance on the most computationally-challenging and data-intensive research codes. However, resources to sustain data-driven analysis, specialized computation, visualization tasks and reliable data repositories have not grown at the comparable rate and NSF intends to begin to address some of these shortfalls in this solicitation.

II. PROGRAM DESCRIPTION

The purpose of this solicitation is to generate proposals from Service Provider organizations who are committed to the delivery of world leading High Performance Computing and Data enabled (HPC&D) resources through the XD environment described in the *Introduction*. This competition emphasizes the provision of system and services that deliver significant levels of performance for many different types of science and engineering applications while also introducing new capabilities and significant innovation which will expand the value of HPC&D to the science and engineering community.

Competitive HPC&D proposals will:

- Provide capabilities that are either absent or difficult to use with the current portfolio of resources such as real-time workflows, virtualization, cloud service;
- Expand the range of data intensive computationally-challenging science and engineering research that can be tackled with XD and Blue Waters services by broadening the portfolio of capabilities beyond what is currently available;
- Facilitate the movement/staging of large amounts of data from instruments or computational resources to the campus, national shared, and/or leadership level resources;
- Provide an effective migration path to researchers scaling data and code beyond the campus level;
- Incorporate reliable, robust system software and services essential to optimal sustained performance;
- Complement and leverage existing XD capabilities and services while providing a high degree of stability and usability by January, 2015.

For the purposes of this solicitation, an acquisition **may** include: *computing hardware*, including processors, and main memory, inter-connects, I/O sub-system(s); *local on-line storage* of sufficient size to support science and engineering research applications that use the full extent of the computing hardware; *archival storage* of a size and with performance characteristics appropriate to a system of the scale proposed; a wide-area *network connection*; any other hardware typical of a modern supercomputing system; *system software* including, one or more operating systems, one or more file systems, a set of compilers and run-time libraries, software libraries that support access to the full memory model of the system proposed including one that offers a standard MPI interface, and mathematical libraries, debugging and program development tools, system administration and job scheduling software, user accounting software, any other software typical of a modern supercomputing system; either dedicated nodes or small satellite systems that provide for interactive access, job preparation and staging, system management and/or remote visualization; any additional hardware or software associated with innovative aspects of the acquisition. Acquisitions directed towards data-intensive computing should focus on how the resource will enable applications that need access to specialized hardware/software or other innovative capabilities atypical of more standard HPC systems.

The NSF is interested in receiving innovative proposals for production XD computational and data resources capable of complementing recent NSF HPC investments. The objective is to continue to diversify the NSF portfolio to include capabilities suitable for addressing emerging computationally intense scientific and engineering research topics, workflows and communities that are not optimally served by current XD or Blue Waters resources.

Submissions must introduce one or more major new capabilities, such as

- A novel data-intensive, high-performance computing capability suitable for new science and engineering communities as well as existing applications.
- An innovative, power efficient, highly usable, high-performance computing capability with sustained, high throughput

performance for a broader range of science and engineering applications and application frameworks.
- An innovative high performance computing capability that expands the boundaries of the current XD research community, for example, by the introduction of domain specific capabilities, high throughput capabilities, time-sharing, efficient use of virtualization and/or clouds
- An innovative high performance computational and/or data resource supporting dynamic interactive research workflows across XD resources or between other cyberinfrastructure resources (e.g. telescopes, sequencers) and XD resources.
- An innovative high performance data processing capability that significantly advances the current state of the art in computer system architectures, contributing system components, novel file systems, and/or information processing approaches contributing to optimize overall effective: "end to end" processing and sustainable throughput of ultra-large, heterogeneous data collections across the demonstrated full system processing data path.
- A storage resource designed to enable rapid access and movement of data across the NSF Service Providers.

In past solicitations benchmarks have played an important role. Two types of benchmarks were required: NSF provided and proposer selected benchmarks. For this solicitation, the NSF has opted not to *require* a specific set of NSF provided benchmarks. One reason for this decision is that the current solicitation is not focused on funding a single, large resource designed to serve tightly coupled scientific applications dominated by floating point operations, needing many thousands of cores, that typically place the most stringent computational demands on the system to be provisioned. While this is still important in certain contexts, the present call is much broader. As such, we expect that each proposer will provide a convincing demonstration, with hard data, that their system will perform as described in their proposal. This demonstration certainly can address applications that are used by the NSF computational science community but should focus on the special and/or innovative aspects of the submitted proposal. Clearly the details will depend on the nature of the proposed resource and is likely to differ from one submission to the next.

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

It is anticipated that NSF will receive questions about the solicitation from prospective proposers between the release of the solicitation and the deadline for proposals. Answers to questions that may be of general interest to prospective proposers will be posted on a "Frequently Asked Questions" page accessible through the OCI webpage. Prospective proposers are encouraged to check this page periodically for updates.

The system and services deployed as a result of this solicitation will become part of the portfolio of resources supported by NSF for shared use by the national science and engineering research and education community within XD. The NSF expects that 90% of the funded resources will be allocated for open scientific use. Accordingly, the proposal should leverage and complement the shared capabilities currently provided by the existing national infrastructure, resources and services such as XSEDE and XDMoD. It is expected that at least 90% of the available system resources will be allocated via the XRAC process.

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement.

Estimated Number of Awards: 2-3, to be made in July of the same year of the proposal deadline, subject to availability of funds.

Anticipated Funding Amount: A total of up to $30,000,000 in FY 2013, subject to availability of funds, is available to fund up to three awards. The computational resource awards will be capped at $12,000,000 each and the data resource award at $6,000,000. With this solicitation, the NSF encourages the community to think broadly and not simply rely on older concepts focused on delivering compute cycles. Project durations should be for up to 4 years. An acquisition associated with the upgrade of an existing system is permissible. Each award will support the acquisition and deployment of hardware, software, and the personnel costs associated with the acquisition and deployment of the proposed system, including acceptance testing. 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. Although there are no NSF provided benchmarks that need to be met, proposals should clearly address the manner in which any innovative capability will be part of the final award by providing data on the performance of the proposed system on that innovative capability. A successful proposal should provide compelling evidence that the resource will deliver significant added value to the XD environment. User support and operating costs are *expected* to be 20% of the acquisition cost per annum for each deployed HPC system. Should the proposed resource require *additional* user and operating funds, an additional 5% can be requested but the proposal must provide **very strong justification** for such a request. These costs will be provided in a separate funding action. The proposal should provide an analysis of the projected annual operating costs of the proposed system for a period of up to four years. The estimate should include the cost of providing user support, operating cost estimates, a maintenance contract for up to 4 years, the cost of power and physical security, the cost of network connectivity from the location of the system to XSEDE, and costs associated with leasing machine room space, if necessary. Provide an estimate of the costs associated with the number of FTEs necessary to maintain 24/7 operations of the proposed system.

Awards will require that 90% of the capacity/capability of the delivered system, be part of the XSEDE allocations process (XRAC) and available to the open science community.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- U.S. institutions of higher education and Federally Funded Research and Development Centers are eligible to apply as Service Providers. It is recognized that FFRDCs may be positioned to make unique contributions to the HPC 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 HPC systems deployed will be provided to researchers from the broad range of science and engineering fields supported by NSF.

PI Limit:

None Specified

Limit on Number of Proposals per Organization: 1

An organization may submit only one proposal but may be a sub-awardee on other proposals responding to this solicitation.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested. The involvement of partner organizations should be supported through sub-awards administered by the submitting organization.

Limit on Number of Proposals per PI:

None Specified

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf). 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.

Important Proposal Preparation Information: FastLane will check for required sections of the proposal, in accordance with *Grant Proposal Guide* (GPG) instructions described in Chapter II.C.2. The GPG requires submission of: Project Summary; Project Description; References Cited; Biographical Sketch(es); Budget; Budget Justification; Current and Pending Support; Facilities, Equipment & Other Resources; Data Management Plan; and Postdoctoral Mentoring Plan, if applicable. If a required section is missing, **FastLane will not accept the proposal.**

Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions. If the solicitation instructions do not require a GPG-required section to be included in the proposal, insert text or upload a document in that section of the proposal that states, "Not Applicable for this Program Solicitation." Doing so will enable FastLane to accept your proposal.

Exceptions to guidelines in the GPG or NSF Grants.gov Application Guide follow.

- The page limit for the Project Description section of the proposal is ***30 pages.***
- There is no page limit for the Budget Justification section.
- Certain information other than that described in the GPG should be submitted as Supplementary Documents (see below for details).
- Collaborative efforts may **only** be submitted as a single proposal, in which a single award is being requested. The involvement of partner organizations should be supported through sub-awards administered by the proposing Service Provider organization.

In addition to the required sections described in the GPG or NSF Grants.gov Application Guide, the Project Description must include the following seven sections:

- **Resource Specification**
- **Performance and Innovation for Science and Engineering Applications**
- **Reliability and Usability**
- **Implementation, Project Management, and Risk Mitigation**
- **Quality of the Physical Infrastructure**
- **Plan for Operations, including User Support and Training**
- **Broadening Participation**

Information to be provided in each section is described below. ***In the following descriptions, t****he term "system" is intended to refer to the entire resource being proposed.*

Resource **Specification**

Specify the detailed architecture of the resource to be acquired and deployed. Include a detailed description of any aspects of the proposed resource that are likely to influence the performance on the science and engineering applications that will be run on the resource and/or what unique/novel features will be addressed in its architecture or its ability to interact with other cyberinfrastructure components. Proposers should pay particular attention to the issues elaborated earlier as to how the resource will complement and

leverage existing XD capabilities. As always, parameters to be considered include total number of processors, the architecture 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, amount of archival storage, I/O sub-system, file system(s), operating system(s), compiler(s), debugging tools, performance measurement tools, system administration tools, modes of parallelism available to users, filesystem.

Describe in detail the system aspects that are associated with the innovative capability of the proposal. Identify system attributes and components that constitute the proposed innovative capability, including storage, data management, any visualization capabilities, middleware, tools or application software stacks, whether vendor supplied or open. Identify how the proposed system complements and extends current XD capabilities. Identify components common to XSEDE and importantly, components unique to this resource. Identify how the innovative capability will be integrated into the existing infrastructure.

Describe how the compute nodes, local disk, and longer term mass storage systems will be integrated.

Describe any vendor-supplied hardware or software support for measuring application and system performance, including I/O.

Describe any visualization aspects of the system.

Describe how the system complements, leverages, integrates to, and extends existing XD and XD node technologies, capabilities, resources and services.

Describe any anticipated challenges associated with implementing the capabilities proposed.

Performance and Innovation for Science and Engineering Applications

Describe the types of science and engineering research challenges that drive the specific choice of the resource design. Describe the expected impact of the resource on science and engineering. Describe the science and engineering research challenges that drive the selection for the innovative capability. Describe the expected impact of the new science and engineering enabled by the introduction of the specific new innovation capability of the resource

Describe in detail how the resource integration with XSEDE will bring additional value to specific science and engineering research challenges. Describe in detail system integration with any other cyberinfrastructure, instrument, middleware or workflow project, and how resulting value is accrued to science and engineering research or education communities.

Provide a detailed analysis of the projected performance of the proposed resource on a set of science and engineering applications chosen to illustrate the capabilities of the proposed resource. Performance will be a factor in the selection of the awards.

Proposers must provide solid data that explicitly address the new innovative capability's relevance to science and engineering. 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 of XD to new science and engineering research and communities or enables applications that are difficult to address with current XD resources.

Resource Reliability and Usability

Describe the availability of system software and tools to effectively use the capabilities of the system. Depending on the type of resource being proposed, system software features of particular importance may include the operating system or systems, the file system or systems, compilers, message-passing libraries, other libraries (including standard system and mathematical libraries), debugging tools, application tuning tools, performance monitoring tools, system administration and resource management, job scheduling and accounting, networking software, middleware, data management and workflow orchestration tools. For the types of science and engineering research challenges that drive the choice of system design, describe usability aspects of the system from the perspective of both new and existing researchers and educators. Describe which types of system data will be transparently and dynamically visible directly from XSEDE interfaces.

Describe the job mix that the Service Provider expects to represent the usage of the system for science and engineering research applications, as well as jobs associated with system operation and maintenance. This should include applications that scale to a large fraction of the system, as well as smaller jobs, and should include a mix of durations. Include data considerations. It is anticipated that one of the performance requirements included in the award document will be that, in production mode, when averaged over one month, 96% of jobs submitted to the system should complete without having to be resubmitted as a result of a failure in the hardware or system software, including failures as a result of a compiler failing to correctly implement code that complies with the relevant language standard. Include an analysis of the reliability of the proposed production resource and the reasons that the proposed system can be expected to meet this performance requirements.

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. Provide an analysis of the reasons that the proposed system can be expected to meet this performance requirement.

Implementation, Project Management, and Risk Mitigation

Provide a detailed implementation plan and corresponding metrics for developing and/or acquiring and deploying the proposed resource, including any innovative capability. A detailed month-by-month schedule must be provided. Explicit metrics associated with the innovative capability must be included along with justification of the metrics selection.

The resource acquired will become integrated into the XD program. Within this context, describe which elements of the proposed resource will be integrated into XD via XSEDE and what steps such integration will require. This description should be based on the current XSEDE architecture.

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.

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) and system elements (e.g. parallel file systems, virtualization).

Describe user access to the resource during the deployment phase and prior to system acceptance, including during testing.

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. Describe the resources that would be available to manage any such sub-contract issued under an award made as a result of this solicitation.

Provide a detailed risk mitigation plan, identifying both technical and management risks as well as strategies to mitigate such risks. Include risks specific to the innovative capability such as adoption or sustainability.

Quality of the Physical Infrastructure

Describe the physical facility or facilities that will house the proposed system and any schedule implications of the provision of computer-ready space, including floor space, power, cooling, fire suppression, and any other emergency equipment, for the system and its supporting hardware. Include a description of the physical security that will be provided. Include a description of the expected power and heat budgets of the proposed system and explain how these will be managed. Describe the expected impacts of power interruptions and how these will be managed. Please provide an analysis of the implications of a sudden loss of power to, or catastrophic failure of, either the computing, storage or primary cooling systems and describe what emergency systems will be required to minimize damage to personnel and equipment.

Describe the external network connectivity between the proposed resource and national networks.

High-performance applications are expected to produce many terabytes of data. Describe how these data will be handled, how data integrity will be maintained, what backup and contingency procedures and schedules, if any, will be provided and how will they be implemented.

Plan for Operations, including User Support and Training

Provide a plan for user support that includes a description of the anticipated requirements of the science and engineering 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. Describe the number and anticipated qualifications of the types of personnel that will be involved with the provision of user support. In addition, describe the user training opportunities that will be made available. Describe the expected availability of dedicated time on the resource for both science and engineering applications and systems testing, and what fraction of system resources will be consumed in moving users on and off the system, or reconfiguring it for dedicated use, if applicable.

Describe the experience of the proposing organization in operating production systems, including any experience in operating in a physically and distributed environment. Include a description of whether operational support was provided on a 24/7 basis or was provided on a more limited basis. Please describe the number and type of users, the types of computation performed, and the nature of the user support provided. Describe the processes used to evaluate management performance, determine user needs, and evaluate user satisfaction.

Describe the qualifications of the Principal Investigator(s) with regard to her or his ability to manage a project of this size and complexity, and, in proposals for production resources, to manage a resource with a large number of external users.

Provide an analysis of the annual operating costs of the proposed 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 network connectivity from the location(s) of the system to XSEDE, and costs associated with leasing machine room space, if necessary. Provide an estimate of the costs associated with the number of FTEs necessary to maintain 24/7 operations of the proposed system. Provide an estimate of the costs associated with the number of FTEs necessary to provide effective user support. Estimate the costs and personnel required to maintain operation of the system within the XSEDE and address any issues anticipated with supporting the current XSEDE core software stack or any other aspects of participating in XSEDE. Describe services leveraged from XSEDE/XD.

Include a more detailed explanation of the budget for user support and operating costs ***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.***

Describe any other factors that are anticipated to have an impact on the Total Cost of Ownership of the proposed system.

Broadening Participation

The Project Description must contain, as a **separate section within the narrative** , a discussion of the broader impacts of 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 the 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. In addition, describe any complementary and leveraged aspects of existing XD, Blue Waters or other NSF projects, with particular emphasis on other cyberinfrastructure projects.

Proprietary information

Proposals containing patentable ideas, trade secrets, 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 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. Government personnel.

For further information please refer to the Grant Proposal Guide at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg

Supplementary Documents

In addition to other required supplementary documents, proposals should include the following sections as Supplementary

Documents:

- Actual or estimated performance benchmark results as described in Section V.A. *System Performance on Science and Engineering Applications* of this solicitation. 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. *Plan for Operations, including User Support and Training* of this solicitation. 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 single, alphabetically ordered list of all people, in the academic or professional computing community, who have collaborated with (within the last 48 months), or have been a Ph.D. advisee or advisor of, any of the personnel involved in the proposed project. In this list, please include, next to the name of each conflicted individual, that individual's institution or company and the name of the project member with whom he or she has the conflict of interest. It is not necessary to list, as collaborators, personnel who are employees of an institution or company involved in the project.
- **Letters of endorsement should not be included in proposals.** Letters of commitment 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 Grant Proposal Guide, Section II.C.2.j, such letters of commitment should be included in the Supplementary Documents section and do not count toward overall page limits. If letters of endorsement are included, NSF may choose to return the proposal without review.

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 should total no more than $12,000,000 for a computational resource, no more than $6,000,000 for a stand-alone storage resource and no more than $18,000,000 if a combined computational and storage resource is proposed. Acquisition and deployment of the full system should be finished before the end of FY15. The resource itself is anticipated to be part of XD for at least 4 years.

An acquisition associated with the upgrade of an existing system is permissible. 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

Each proposal must address what fraction of the requested budget is being targeted to the innovative capability discussed in the solicitation.

User support and operating costs of up to 20-25% of the initial acquisition costs per year, after acceptance for the proposed HPC system will be provided in a separate funding action. User support and operating cost greater than 20% require **strong justification.**

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. proposer's local time):

  April 15, 2013

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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

- **For Proposals Submitted Via Grants.gov:**

  Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016* . These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the core strategies in support of NSF's mission is to foster integration of research and education through the programs, projects and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the variety of learning perspectives.

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i. , prior to the review of a proposal.

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

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

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

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

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

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

Additional Solicitation Specific Review Criteria

Proposals for this solicitation will also be subject to the additional review criteria described below. These criteria parallel specific sections in the Project Description.

- **Meeting the Needs of the Challenging Science and Engineering Applications.** How well does the resource proposed match the known and anticipated requirements of the science and engineering research and education community for HPC resources and services? How well does the resource proposed respond to the broadening of the current portfolio of XD spelled out in the Program Description? Will the innovative capability stimulate new research and education? Will the innovative aspects attract both existing and new science and engineering communities? Does the proposer data convincingly demonstrate the value of the innovative capability? Will the proposed system and services complement the existing XD resources? Can the proposed resource provide the necessary capability required to generate new, breakthrough, science and engineering discoveries? Where benchmark results have been estimated, are these estimates credible?

- **System Reliability and Usability** . Are the system and the operation of the system likely to provide a robust, reliable, high-productivity computational environment for new and existing XD users? What is the commitment of the vendor or vendors to meet the agreed performance goals and to provide post-acquisition support? Does the environment in which the system will be embedded include adequate capability for the remote analysis of output from high-end computations? Does the system, operations and support plan expand XSEDE/XD capabilities for researchers and educators? Will existing XSEDE/XD users be able to easily migrate to/from this system? Will the resource attract new research communities?

- **Implementation, Project Management and Risk Mitigation** . Is there an adequate procedure for ensuring that the proposed resource will be available for use by the science and engineering research and education community? Does the proposing organization have the capability to manage the award and any associated sub-contracts? Does the PI have the capability to manage the project? Is the PI's time commitment sufficient to ensure success of the project? Is the detailed implementation plan for acquisition and deployment adequate and realistic? Is the implementation of the innovative capability sufficiently detailed? Are the metrics appropriate to the outcome defined for the innovative component? Are the plans for integration into the XD and the associated costs reasonable? Does the proposing organization and its partners have the expertise to meet any challenges likely to be encountered while deploying the complete system (including data storage, communications and core software environment) and bringing it to production status? Has there been a reasonable assessment of potential risks and does the proposal include an adequate risk management strategy?

- **Quality and Availability of the Physical Infrastructure** . Are the physical facilities described by the proposing organization adequate to accommodate the system proposed?

- **Effective User Support.** What are the qualifications and experience of the PI and the proposing organization in regard to managing a production resource for national use and providing effective user support? Are they tightly integrated to XSEDE/XD user services? Has user support for the innovative capability been adequately considered?

- **Total Cost of Ownership.** Are the budget and roster of personnel for operations and user support adequate and reasonable? Do they highly leverage the common services of XSEDE/XD? Assess the total cost of ownership of the proposed system. Is this reasonable in light of the advances in science and engineering likely to result?

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.

A combination of ad-hoc and panel review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

Special Award Conditions:

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 at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

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

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

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF

awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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:

- Barry I. Schneider, Program Director, telephone: (703) 292-7383, fax: (703) 292-9060, email: bschneid@nsf.gov
- Irene Qualters, Program Director, telephone: (703) 292-2339, fax: (703) 292-9060, email: iqualter@nsf.gov
- Robert Chadduck, Program Director, telephone: (703) 292-2736, fax: (703) 292-9060, email: rchadduc@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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

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

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of

awards, visit the NSF Website at http://www.nsf.gov

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center) **:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230