Network for Computational Nanotechnology (NCN)

A Competition to Reconfigure the NCN

PROGRAM SOLICITATION
NSF 12-504

National Science Foundation

Directorate for Engineering
Division of Chemical, Bioengineering, Environmental, and Transport Systems
Division of Civil, Mechanical and Manufacturing Innovation
Division of Engineering Education and Centers
Division of Electrical, Communications and Cyber Systems

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

Office of Cyberinfrastructure

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

December 16, 2011

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

January 17, 2012

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide (GPG)* Chapter II.C.2.g(xi) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Network for Computational Nanotechnology (NCN)
A Competition to Reconfigure the NCN

Synopsis of Program:

NSF established the Network for Computational Nanotechnology (NCN) in 2002 at Purdue University as part of the National Nanotechnology Initiative (NNI). The NCN was established as a service facility to offer researchers the tools to explore nanoscale phenomena through theory, modeling, and simulation while also developing enhancements to science and engineering education. Through its cyber platform, nanoHUB.org, NCN has become a powerful resource for the worldwide nanoscience and nanoengineering community and currently serves over 170,000 researchers, educators, students, and other professionals worldwide. For more information on NCN, please see http://nanohub.org/about#funding

NSF's NCN award expires in September 2012. Through this solicitation, NSF provides an opportunity for the broader community to compete to reconfigure the NCN. The configuration of the new Network for Computational Nanotechnology will be restructured as a stand alone Cyber Platform awardee, which will provide computation, simulation and educational services to the nanoscience and engineering communities, including the current nanoHUB tools and educational materials. This platform will be funded by one award to a single university. Linked to that platform will be three new Nodes that will develop new tools and content that will be delivered to Cyber Platform for worldwide dissemination. NSF will fund the Cyber Platform and these new Nodes through four separate awards, which will be joined through their respective cooperative agreements to constitute the new reconfigured NCN.

The goals of the reconfigured NCN will continue to be those of the original NCN to: 1) engage an ever-larger and more diverse cyber community sharing novel, high-quality nanoscale computation and simulation research and educational resources; 2) accelerate the transformation of nanoscience to nanotechnology through the integration of simulation with experimentation; 3) develop open-source software to stimulate data sharing; and 4) inspire and educate the next generation workforce.

The new content development Nodes will combine theory and experimentation to develop the computation and simulation tools, and educational materials for delivery on the Cyber Platform. The new content development Node areas will be:

- **NanoBIO** - Create integrated computational tools to simulate biological phenomena across length scales, for the design of devices and systems;
- **NanoMFG** - Computation and simulation software to address the challenges of scaling up nanoscale in manufacturing;
- **Nano-Engineered Electronic Device Simulation Node (NEEDS)** - Computation and simulation tools to facilitate the development of nanoelectronic-based circuits, devices, and systems.

Proposals will be accepted only for the Nodes defined above and any proposal for another Node content area will be returned without review.

There will be one award per Node and the configuration of each Node may involve more than one university. By linking these NCN Nodes to the NCN Cyber Platform, the result will be a comprehensive and integrated service delivery system, which links theory, simulation, and experimentation to continue to strengthen and support nanoscience and nanoengineering research and education.

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.

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

- 47.041 --- Engineering
- 47.070 --- Computer and Information Science and Engineering
- 47.080 --- Office of Cyberinfrastructure

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4 - One Cyber Platform and three nano Nodes awards.

Anticipated Funding Amount: $5,200,000 This support is provided by the NSF Directorate for Engineering (ENG), the Directorate for Computer & Information Science & Engineering (CISE), and the Office of Cyberinfrastructure (OCI). The Cyber Platform will be funded at up to $2.9M per year for five years, renewable for an additional five years. To enable continued service to the community, if the award is made to a new institution, the first year of support to the new awardee for the new NCN Cyber Platform may be approximately $1.45M and the current awardee may be provided with approximately $1.45M to enable a transition phase depending upon the scope of the new award and the available funds. Thereafter, the annual support level to the new awardee will be $2.9M, pending quality of proposals and availability of funds. The individual new Nodes will be funded at up to $700,000 each per year for five years, pending quality and availability of funds. The Node awards are not renewable.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- Only U.S. universities with Ph.D. degree granting programs in science and engineering may serve as the lead institution for each award. The Cyber Platform award will be submitted as a single university proposal with no partner universities or other institutions. For the Node proposals, the lead university may be joined by a small number of partner domestic universities/institutions (e.g. federal labs) but may not be joined by foreign universities/institutions. It should be noted that a multi-university configuration is not required[1].If a multi-university proposal is submitted, the lead university must submit the proposal. Separately submitted collaborative proposals are not acceptable and will be returned without review.

[1] If a partner is a Federal lab, NSF funds cannot be used to support the laboratory.

PI Limit:

The PI of the Cyber Platform proposal and the Node proposals must be tenured faculty members at the lead university of each proposal.

The PI and co-PI(s) on the full proposal must be the same as those named in the Letter of Intent.

Limit on Number of Proposals per Organization: 4

One cyber platform proposal and up to three Node proposals may be submitted.

A university may submit only one Cyber Platform proposal. A university may submit only one proposal per Node request in this solicitation. Therefore, one university might submit one Cyber Platform proposal and up to three separate Node proposals, but only one to each Node.

Limit on Number of Proposals per PI: 1

An investigator may serve as PI or co-PI on only one proposal, either the Cyber Platform or one of the Node proposals.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not 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:** Not Applicable

C. Due Dates

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

  December 16, 2011

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

  January 17, 2012

Proposal Review Information Criteria

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

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

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

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I. INTRODUCTION

The purpose of this solicitation is to reconfigure the Network for Computational Nanotechnology (NCN), currently housed at Purdue University. The reconfiguration of NCN is an opportunity for the NSF to continue to join the nanoscience and engineering theory, simulation, experimentation and educational communities together through a Cyber Platform to advance computation and simulation in nanoscience and nanoengineering fields and enrich the nano educational materials available to a broader spectrum of students, faculty, and industry. The new NCN Cyber Platform will continue to provide the materials that are now provided by the Purdue Cyber Platform, nanoHUB.org, as authorized by the authors. It also will be linked to three separate new Nodes where new tools and educational materials will be developed and delivered to the Cyber Platform for disseminated to the broader community.

NCN is part of one of the Signature Initiatives of the National Nanotechnology Initiative (NNI) (http://www.nano.gov/initiatives/government/signature). A complementary NNI activity is the NSF Nanoelectronics for 2020 and Beyond (NEB 2020) Signature Initiative. It is aimed at discovering and using novel nanoscale fabrication processes and innovative concepts to produce revolutionary materials, devices, systems, and architectures to advance the field of nanoelectronics beyond the scaling limits of Moore's Law. The reconfigured NCN would be critical to serving the NEB 2020 and other expanding nano communities of users. NCN provides a suite of computational and simulation tools and educational materials through its cyber platform to a nanoscience and nanoengineering community of 170,000 users world wide. More information can be found at nanoHUB.org. Thus, NCN has an established global community and outreach, which NSF has determined must be continued.

II. PROGRAM DESCRIPTION

The National Science Foundation (NSF), through its Directorate for Engineering (ENG) in partnership with the Directorate for Computer and Information Science and Engineering (CISE), and the Office of Cyber Infrastructure (OCI), plan to jointly reconfigure the Network for Computational Nanotechnology (NCN). The Division of Engineering Education and Centers (EEC) leads the effort in the development of the solicitation, the review of proposals, and post-award oversight.

The purpose of the solicitation is to reconfigure the NCN. The goals of the new NCN will be to: 1) engage an ever-larger and more diverse cyber community sharing novel, high-quality nanoscale computation and simulation research and educational resources, 2) accelerate the transformation of nanoscience to nanotechnology through the integration of simulation with experimentation; 3) develop open-source software to stimulate data sharing; and 4) inspire and educate the next generation workforce.

Ten years of support to NCN have proven that simulation is an important research methodology in the emerging fields of nanoscience and nanoengineering. The current NCN Cyber Platform has enabled broader use of modeling and simulation, joining theory with experimentation through simulation, which has accelerated advances in the understanding of nanoscale phenomena, and facilitate advances in technology and education. The current NCN Cyber Platform, nanoHUB.org, has lowered barriers to the pervasive use of simulation and created cyber communities united by common conceptual frameworks embodied in easily accessible simulation, modeling and design tools, educational modules, and information dissemination. Although simulation is especially effective when used in conjunction with experimentation, simulation is often challenged to keep up with the volume of data generated from large-scale experiments in fast moving, emerging fields of research. At the same time, it is further recognized that simulation can play a more important role in education and business practice- especially since resource sharing lowers the cost of education and production in business.

Through this solicitation, NSF will continue to provide this important service to the nanoscience and nanoengineering community worldwide for the next decade through the reconfigured Network for Computational Nanotechnology. The reconfigured NCN will be structured as a Cyber Platform that provides computation, simulation and educational services through content provided by the following Nodes:

- One Node, nested in the Cyber Platform award, will deliver the current NCN tools and educational materials to the community, at the discretion of the current authors. The cost of the transfer of these materials to the new Cyber Platform will be born by the Cyber Platform awardee.
- Three separately funded new Nodes will develop new content to be offered to users through the Cyber Platform. These new content development Nodes will combine theory and experimentation to develop the computational tools, simulations, and educational materials for delivery on the Cyber Platform. The new Nodes will be:
    - **NanoBIO** - Computation and simulation tools to address the challenges of scaling up from the nanoscale to devices in biological media;
    - **NanoMFG** - Computation and simulation software to address the challenges of scaling up nanoscale in manufacturing;
    - **Nano-Engineered Electronic Device Simulation Node (NEEDS)** - Develop computation and simulation tools to facilitate the development of nanoelectronic-based devices and integrate them into circuits and systems.

See Figure 1 for a visual representation of this construct.

The result will be a comprehensive and integrated service delivery system, which will link theory, simulation, and experimentation to strengthen and support nanoscience and nanoengineering research and education.

The new Cyber Platform will be funded through one award, which will be linked to this network of three content-providing Nodes funded separately and directly funded by NSF. These Nodes will support interdisciplinary research and education teams to develop user-tested new simulation tools and educational content to deliver to the Cyber Platform for delivery to the broader community. The Cyber Platform will serve as the service delivery arm of the NCN providing a suite of user-friendly tools and state-of-the art middleware to enable high-speed, interactive tool use. The Cyber Platform team will make node-delivered content user friendly and post it on the platform for public access; carry out special tasks to improve the educational utility of the educational materials

provided by the Nodes; study the utility of the site for users; and the assessment team will study patterns of use, gain input from users to improve the services provided.

Each of the three new content development Nodes will be separately funded, through separate cooperative agreements, and will be linked to the platform through requirements in their separate cooperative agreements. Each Node will be required to deliver user-tested content to the Cyber Platform. The Cyber Platform also will be responsible for determining areas where the content development Nodes could collaborate to improve the overall effectiveness of the NCN.

The intent is to support the Cyber Platform for a period of five years, renewable for a period of an additional five years. The three new Nodes will be funded for up to five years with no opportunity for renewal. Materials delivered to the NCN Cyber Platform by these Nodes will remain available to the community through the Cyber Platform once the Node awards expire.

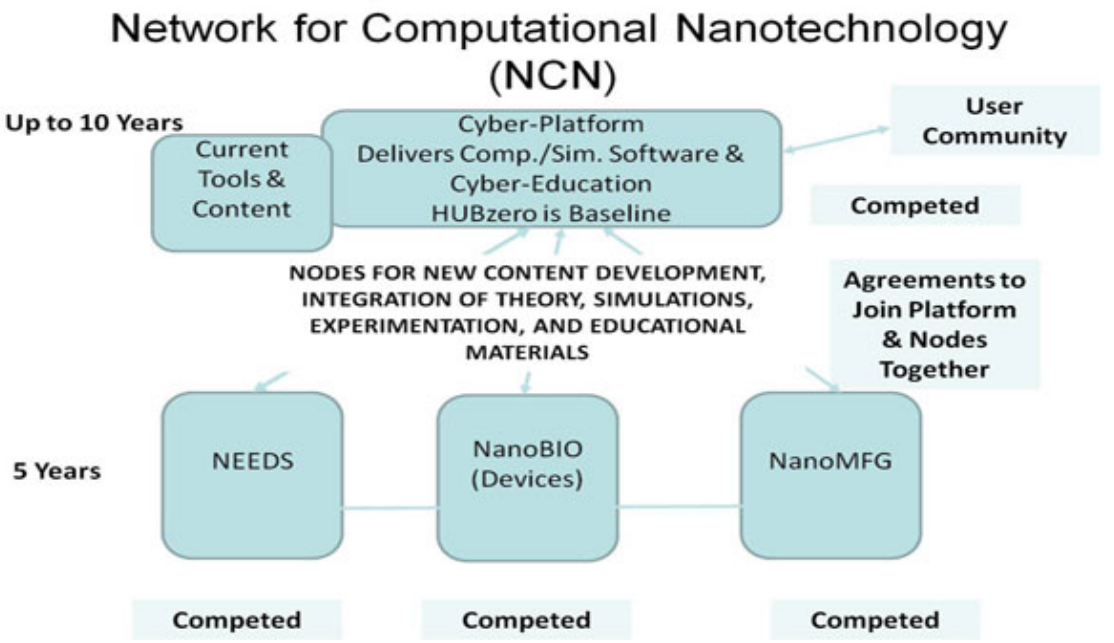

Figure 1.Visual Construct of the NCN

A. **NCN Cyber Platform**

1. **Goals and Key Features of the NCN Cyber Platform**

The new NCN Cyber Platform will continue the role of NCN by enabling broader use of modeling and simulation, joining theory with experimentation through simulation to accelerate advances in the understanding of nanoscale phenomena and facilitate advances in technology and education. The new Cyber Platform will continue to lower barriers to the pervasive use of simulation and maintain and create cyber communities united by common conceptual frameworks embodied in easily accessible simulation; modeling and design tools; educational modules; and information dissemination. Although simulation is especially effective when used in conjunction with experimentation, simulation is often challenged to keep up with the volume of data generated from large-scale experiments in fast moving, emerging fields of research. At the same time, it is further recognized that simulation plays an important role in education and business practice; especially since resource sharing lowers the cost of education and production in business.

Cyber Platform Goals, Requirements, and Deliverables

Computation and Simulation Tools

- Computation and simulation tools currently provided by the nanoHUB.org platform, which will be ported to the new platform as authors will permit;
- Computation and simulation tools developed from the following new NCN Nodes: NanoBIO, NanoMFG, and NEEDS;
- Computation and simulation tools developed by other contributors.

Software

- The software will support access to core computational equipment and to other capabilities as needed to provide seamless computational and simulation service to the users;
- Ongoing analyses of middleware needs in light of current and future user needs and of cyber infrastructure to:
  - support a software engineering and development plan that will include and/or enable the integration of relevant research activities, and
  - ensure the software is responsive to new computing developments;
- Mechanisms for maintaining and periodically upgrading the platform to provide state-of-the-art services to the nano community, including metrics to measure the success of any software developed and the steps necessary to take the software from prototype to dissemination into the community as reusable software resources;
- Proof-of-concept demonstration of any key software elements that would be developed under the award, with metrics for success and milestones;
- Sustainability, manageability, usability, and composability/ interoperability are integrated into the software;

- Identity management system and trust fabric between providers and platform host;
- Plan to integrate content and tools so as not to preclude sharing and future porting without renegotiation of proprietary agreements;
- Plan to link to the NSF OCI Software Infrastructure for Sustained innovation (SI^2) (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503489&org=NSF&sel_org=XCUT&from=fund) program and link to SI^2 awards, especially the SI^2 Institutes as they come on line; including plans for attending and contributing to SI^2 PI meetings with associate travel costs included in the budget.

Education and Workforce Training

- Providing current nanotechnology education modules, courses, and other educational materials important for nanoscience and nanoengineering education at the pre-college, undergraduate, and graduate levels currently provided by the nanoHUB.org platform, which will be ported to the new platform as authors will permit;
- New nanotechnology education modules, courses, and other educational materials important for nanoscience and nanoengineering education at the pre-college, undergraduate, and graduate and workforce levels developed by the new NCN Nodes;
- Specialized web-based learning tools developed by the educational team of the Cyber Platform based on the educational materials provided by the Nodes;
- Tool-powered curricula to augment existing courses and enhance student learning by using turnkey simulations to teach concepts, design, and optimization, without requiring extensive training or software installation;
- Virtual immersive environments for development of insights and intuition in the nanoworld;
- Telepresence and remote experimentation frameworks, e.g. for re-training of the professional workforce in nanotechnology for industry.

User Support

- User-friendly tools developed from tools and content delivered by the NCN Nodes;
- A forum and platform for vetting the quality of tools and educational materials;
- Support for the established community of users, including developing user guides;
- Expanding the involvement of users across a wide range of academic institutions and industry;
- A question and answer forum, as well as a forum for collecting wish lists for tool and educational module improvements;
- Specification of minimum quality and functionality requirements for acceptance to the site;
- Assure computational capabilities to augment the computational capacity of the users.

Assessment of User Needs and Service Quality

- Collections of data on platform usage by sector and by purpose;
- Assessment of the quality and utility of services based on that data.

Requirements and Deliverables

All PI's submitting proposals to the Cyber Platform section of this solicitation must provide an analysis of the current service capabilities and capacity of the NCN platform; identify gaps in the current architecture and services; and project emerging needs in the nanoscience and nanoengineering community for computation and simulation support, as well as anticipated gaps in service given future computing needs and trends.

The anticipated outcome is a proposal to reposition the new NCN Cyber Platform to best serve the emerging needs of the nano community while leveraging ongoing developments in cyberinfrastructure (CI). The importance and immediacy of such a rethinking of NCN is accentuated by the current and future trends in CI (e.g., disruptive hardware trends such as hybrid many cores and accelerators, increasing data volumes, complex application structures and behaviors, and emerging first-order concerns such as fault-tolerance and energy efficiency). Furthermore, it is NSF's assumption that the Cyber Platform will not be static and must evolve as the community develops richer tools with increasing data volumes and computational requirements.

The Cyber Platform will be used to increase the use of modeling and simulation in both research and education across a diverse set of universities and other user communities. The new Cyber Platform must be robust enough to provide online simulation capabilities and a broad range of tools to very large communities of users through browser-based portals. For example, nanoHUB currently supports over 170,000 users; of whom over 9000 ran 374,863 simulations last year using over 170 tools, 25% of which have heavy usage. While all of these tools appear to run as applets in the user's browser window, they are powered by a much more sophisticated middleware that lets the user transparently tap into university and national grid resources. Once operational, the Cyber Platform is expected have an uptime of over 99.6% over the year to match the efficiency of the current nanoHUB.

Access to the Cyber Platform should be through an identity management system that is based on the users' local identity, a trust fabric between the local resource provider and the Cyber Platform host, and attributes (student, classroom user, etc.) provided by the user. NSF expects that the awardee will be a leader in supporting resource access in a federated identify setting mode, for example, by joining the In Commons federation. See http://www.incommonfederation.org/

Based on the analysis provided in the proposal about the current state of the art, the future of CI, and the emerging needs of the community, the proposal must clearly outline how the platform will evolve to address these aspects during the first five years of the effort, and deliver the next-generation platform to support the emerging application needs and infrastructure capabilities. It must also address how the proposed platform will leverage national scale cyberinfrastructure such as eXtreme Digital (XD), Open Science Grid (OSG), and commercial cloud services.

The proposal must address how new software will be assessed using tangible metrics to measure success and failure and the tasks necessary to take the software from prototype to dissemination as a reusable software resource. In addition, the proposal must demonstrate a strong software engineering and development plan that includes and/or enables the integration of relevant research activities to ensure the software is response to new computing development. That plan will include a project plan and timeline for proof-of-concept demonstration of any key software element to be developed.

NSF is committed to effectively linking the NCN to the SI^2 activities of the Office of Cyberinfrastructure and the NSF Computational Infrastructure for 21st Century Science and Engineering (CIF21). See http://www.nsf.gov/about/budget/fy2012/pdf/40_fy2012.pdf. Therefore, the NCN will link to the SI^2 program and link to SI^2 awards, especially the SI^2 Institutes as they come on line. The proposal will include plans for attending and contributing to SI^2 PI meeting, with associate travel costs included in the budget.

NSF is committed to providing a seamless transition, so the user community is not impacted by the renewal effort. As a result, it is imperative that proposals outline a clear path for ensuring continuity of service. For example, proposers may consider initially using the current NCN middleware platform, hubZERO, which is available at http://hubzero.org, and then transitioning hubZERO to the next-generation architecture and middleware to meet the evolving and expanding user requirements. If there is an alternative middleware platform that already provides the same or improved services, the PI may propose to begin operation using that middleware platform. In either case, it is expected that the awardee will start with the capability that exists today in hubZERO, operate a fully functional infrastructure, serve users, and upgrade the middleware to better serve future needs. The proposal must provide evidence of access to sufficient computing resources to host the current platform and improve upon it. The proposal must provide clear interface and easy to use pathways for content population and maintenance.

If the proposing team is not the current awardee, the proposing team must develop their Cyber Platform with a different name, as nanoHUB.org is registered to the current awardee.

Note that if the award is made to a new institution, NSF will support the current awardee during the first year to enable a ramp down through a transition phase as the new awardee ramps up. Part of this transition phase will include the new awardee working with preexisting tool providers to adapt and port the existing sets of tools and other content to the new environment. There currently are 170 simulation tools on nanoHUB, and only 10% are open source. The remaining tools are not in the public domain and their hosting on nanoHUB is now under one-on-one agreements with nanoHUB and NCN@Purdue. The new awardee will have to negotiate new arrangements to host the tools on the new platform. About 50% of the ~2,300 educational materials reside in one-on-one agreements with nanoHUB and NCN@Purdue and the same arrangements will have to be made with these providers.

For all proposing institutions under the new award, all content and tools must be integrated in a way that does not preclude their sharing and future porting and use across other platforms. Further, if a transition to a different platform becomes necessary in the future, the awardee will be responsible for making sure that all content and tools are fully transitioned to that platform without requiring any renegotiation of proprietary agreements.

To support these functions, the Cyber Platform team will come from one university and comprise

- PI skilled in cyber platform development and management and motivated by service; and, if that person is not knowledgeable about nanoscale computation and simulation, the co-PI must be;
- Staff Cyber Platform Leader with skills relevant to the challenges of delivery;
- Staff team of computer scientists and computer engineers;
- Staff skilled in making software user friendly;
- A faculty Education Program Leader with a background in web-based education.

B. **General Goals, Requirements, and Deliverables for the New Nodes**

The following sections describe the general goals, requirements, and deliverables that are common to each of the required nodes.

1. **Goals and Requirements for each new Node**:

   - Function with a driving goal motivated and structured by the three Node descriptions below;
   - Derive and update those goals through interaction with a community of interested academic, government laboratory and industrial personnel and other users of the simulations to address broad based user needs, including those of small businesses;
   - Specify expected deliverables to the Cyber Platform, develop a strategic plan to achieve the deliverables and provide a milestone chart showing the timing of the deliverables;
   - Assemble and assess existing computation and simulation tools, develop new computation and simulation tools that enable analyses of scaling up from the nanoscale to devices and systems, including design and manufacturing constraints, resulting in:
     - A database of existing tools that are user-tested to assure baseline quality; and
     - Needed new computational and simulation tools grounded in theory
   - Link theory to experimentation to improve these tools - some funding of experimentalists will be provided by the Node, and the Node will be expected to link in a collaborative non-funded mode to the already funded experimentalists in the area through connectivity with the National Nanotechnology Infrastructure Network (NNIN), the Nanoscale Science and Engineering Centers (NSEC), the Nanosystems Engineering Research Centers (NERC) to be funded in 2012, and relevant ongoing Engineering Research Centers (ERC), etc.;
   - Develop educational materials that link the nanoscale to applications to encourage the use of simulation for students at the high school, community college, and university levels as well as in workforce training;
   - Deliver user-tested simulation tools and educational materials to the Cyber Platform, where they will be made more user friendly (once released, the platform would let the "market place" vet the quality and relevance to user needs);
   - Develop a community of collaborators, post award, who while not directly funded by the Node, share the commitment to the goals of the Node and will provide their tools and educational materials to the Node for delivery to the Cyber Platform;
   - Function as an integrated team of investigators across needed disciplines and capabilities; if the team is cross-university, the other universities will be funded through subawards.

2. In collaboration with the Cyber Platform, all Nodes will be expected to share relevant findings and organizational lessons learned across the other Nodes.

3. All Node awards involving NSF funds will be subject to the intellectual property provisions of the Bayh-Dole

Act.

C. **Node Overviews, Goals, and Requirements**

The following sections describe the specific goals, requirements, and deliverables for the three node topic areas.

1. **NanoBIO Node** - Create integrated computational tools to simulate biological phenomena across length scales, for the design of devices and systems.

   Overview

   Much of biology can be considered at the nano and meso-scales. Proteins, DNA, cellular organelles, phospholipids membranes, and virus are examples of nanometer scale biological components. Towards developing theory and computational tools that can be used to describe or design macroscale or microscale biological systems, some notable successes include the development of models of cellular networks based on genomic information, protein structure, docking, and design algorithms, and tools to facilitate synthetic biology. In the past several decades, investigators have made significant advances in developing theory, computational, and experimental tools to both understand and design new functions into biological systems. By exploring scale-dependent cell features (e.g. nano, meso), multiscale and multifunctional biological systems may be explored.

   There have been parallel advances in theory, computational and experimental techniques to design and synthesize optically, mechanically, and electrically active nanoscale devices. However, many challenges still remain in the development of tools for the design and understanding of how the biological component interacts with the nanoscale device. Moreover, a better synergy between experiments and simulations needs to emerge. For instance, theory/computations need to inform biological experiments and vice-versa.

   Goals and Requirements

   To advance the field of nanobiotechnology, new theory, computational tools, and experimental systems need to be developed which can be used to describe structural, mechanical, electrical, chemical, and photonic features of nanoscale biological component and biological components-device systems. In some instances, small-scale biological problems cannot be directly validated by experiments alone. In this case, multiscale computational modeling and simulation can provide a "measurement" of quantities that are not accessible experimentally. Thus, new knowledge may be created by the synergistic integration of experiments and modeling. The developed tools and theory should cross scales (e.g. from the atomic level to the molecular, and cellular/device level). They should address problems including but not limited to:

   - The structure of nanoscale biological components and how structure changes as those components interact with nanoscale device;
   - The tailoring of complex material architecture to enhance the properties of biological materials;
   - Light (photon) harvesting, transfer, and conversion to electrons in nano-bio devices;
   - Mechanical features of a nanoscale bio-device system and mechanotransduction of signals between device and biological component;
   - Design/prediction of biological device function, interference with surrounding biological systems, and orthogonality of components.

   The NanoBIO Node will bring together different communities of researchers to connect experiment, theory, and computation in new ways. The investigators developing modules for this thrust are expected to deliver tools that can be integrated across the Node such that components can be used together to design or analyze novel multifunctional (e.g. mechanical, thermal, electrical) nano-bio systems. Tools developed should be grounded in experimental data. Thus, NanoBIO Node funding will support experiments needed to validate and/or develop theory and computational tools and their integration across length scales. The Node should also be used to collect, and where possible, integrate existing tools, and build upon the developments in computational, systems and synthetic biology communities as well as the computational nanoscience and nanoengineering community.

   The proposed efforts should include developing educational materials that link nanobiological knowledge and nanotechnology, in general, to applications. User-friendly modules that stimulate access to these materials and allow students at the high school and university levels as well as the workforce to utilize them are desirable and strongly encouraged.

2. **NanoMFG Node** - Computation and simulation software to address the challenges of scaling up from the nanoscale in manufacturing.

   Overview

   Nanomanufacturing is a comprehensive approach to using advanced cyberinfrastructure tools to design integrated manufacturing facilities incorporating knowledge from the full spectrum of length scales, from the molecular to the enterprise-wide, using state-of-the-art theoretical (analytical) formulations and computational (numerical) techniques. This includes introducing novel abstract concepts and representations, mathematical algorithms and analysis methods, and bridging from the atomistic to continuum domains, inspired by or mimicking the multifaceted synthetic manufacturing aspects of the natural and engineered manufacturing enterprise. To help advance nanomanufacturing, NSF is soliciting proposals that address the challenge of incorporating data and information from the nano to the meso scales. The key is incorporating the concept of continuous feedback loops among all the length scales and stages of the simulation using atomistic scale information to design and synthesize the nanoscale building blocks while simultaneously developing either batch or continuous global manufacturing schemes, products and services.

   Goals and Requirements

   The NanoMFG Node will include research and educational efforts to address these objectives. It may include but is not limited to the areas discussed below.

Computational simulations for predictive modeling to advance nanomanufacturing technologies and platforms, particularly their:

- Scalability (producibility, predictability, productivity), especially via parallel processing and continuous manufacture and integration;
- Focus to develop methodologies for the conversion of available raw materials to commercially important intermediates to final consumer products incorporating natural factors such as the availability of feedstocks, ambient manufacturing conditions such as temperature, local environmental and legal constraints, global markets, etc.;
- Multi-scale and multi-dimensional character of such simulations in space and time;
- Hybrid multi-disciplinary nature, cutting across conventional mechanical, thermal, electrical, optical, chemical, and biological approaches;
- Multi-domain manufacture, involving deposition, removal and transformation of matter, energy and information through combined bottom-up and top-down pathways;
- Unconventional approaches, such as probabilistic versus deterministic constructions; and
- Hierarchical complexity and system-level architectures.

Causal inversion of the modeling framework for control, optimization, and decision making in designing and manufacturing at the nanoscale, especially via:

- Nano- and multi-scale design environments and software tools for computer-aided design, manufacturing and engineering (nano-CAD/CAM/CAE);
- Feedback-based approaches and algorithms for real-time and statistical process control, adaptation and intelligence across topological and bandwidth scales; and
- Systems engineering and operations research methodologies for nano-/micro-factory platforms including process planning, supply chain and industrial engineering aspects.

Synergistic coupling of computation with experimental instrumentation and automation research in nanomanufacturing, such as:

- Hardware-software interfacing and reconstruction algorithms for sensing, imaging and metrology, as well as actuation, manipulation, and nanorobotic guidance and navigation;
- Experimental calibration, validation and verification of computational simulations, as well as computational design of experiment methods for nanomanufacturing;
- Software databasing of laboratory properties of elemental/composite nanomaterials in various shapes and aspect ratios ("periodic table" of nanomaterials for manufacturing);
- Knowledge-bases of manufacturing processes, platforms and technologies for virtual integration, benchmarking, and evaluation before industrial implementation;and
- Human-machine interfacing for nanomanufacturing operations and cognition.

The furtherance of advanced nanomanufacturing is also based on developing an interdisciplinary virtual community that interacts via the NCN platform. This community would consist of academic and industrial collaborators, as well as other members of the general public interested in availing themselves of the information that is developed.

The proposed efforts should include developing educational materials that link nanomanufacturing and nanotechnology, in general, to applications. User-friendly modules that stimulate access to these materials and allow students at the high school and university levels and the workforce to utilize them are desirable and strongly encouraged.

3. **Nano-Engineered Electronic Device Simulation Node (NEEDS) -** Develop computation and simulation tools to facilitate the development of nanoelectronic-based devices and integrate them into circuits and systems.

   Currently, SPICE, **S**imulation **P**rogram with **I**ntegrated **C**ircuit **E**mphasis, is a general-purpose open-source circuit simulator. It is widely used by circuit designers and engineers to numerically predict the behavior of electronic circuits. It was initially developed at the University of California at Berkeley and first made public in 1973. The typical SPICE package is capable of predicting the electric response of circuits of varying complexities and speeds ranging from DC to a few hundred MHz. The simulator's accuracy is mostly determined by the models installed in the general-purpose simulator. Therefore, conventional SPICE packages are not capable of simulating circuits that include advanced nanoelectronic devices. This is a serious limitation and one of the obstacles that hinders the use of nanotechnology in modern applications and the penetration of nanodevices in commercial products.

   The NSF recognizes the need to expand SPICE capabilities and facilitate the development of nanoelectronic-based circuits and applications. This goal can be achieved by developing simulation and modeling tools capable of analyzing electric properties and electron-transport physics of nanostructures, incorporating them in device simulators to enable accurate predictions of nanodevice characteristics, and evolving them into compact models that feed into existing circuit and system simulators. Hence, the NSF is soliciting proposals for developing a Nano-Engineered Electronic Device Simulation (NEEDS) Node**,** which comprises SPICE-like and SPICE-compatible simulation packages. The NEEDS Node will consist of an open-source user-friendly platform, which accepts user-defined modules. NEEDS should be developed with the intent to satisfy the needs of researchers and engineers working on nanoelectronics and promote the integration of nanodevices in circuits and products.

   The NEEDS Node is expected to have the ability to simulate nano-based components ranging from the most basic passive elements, such as resistors and capacitors, to sophisticated semiconductor devices, such as transistors. Using these intrinsic nanocomponents as the basic building blocks for larger models, designers, and chip manufacturers should be able to define a vast and diverse pool of compact models and eventually simulate complex systems with an assortment of nanocomponents. All materials used in fabricating nanodevices are of interest, including silicon, III-V semiconductors, metallic nanowires and nanospheres, and carbon in all forms, such as graphene, nanotubes, etc. The ability to simulate and model the three-dimensional aspects of nanostructures is of particular interest. This includes the capability to incorporate heterogeneous layers such as GaAs and carbon-based electronics onto complementary metal-oxide-semiconductor, CMOS, (at different technology Nodes) platforms.

   The NEEDS Node should include and must be able to accommodate modules that simulate various aspects of nanoelectronic devices, including, but not limited to,

- Properties of nano-materials in their zero-, one-, two- and three-dimensional forms;
- Physics of nano-structures and nanodevices;
- Simulations of nanodevices from the first principles;
- Electrical characteristics of nanodevices and their models;
- Responses of circuits that include nanodevices;
- Effects of interconnects, parasitic elements and other factors that may influence the actual nanodevice and circuit performance;
- Compact models for nanostructures;
- Characteristics of nanocomponents, such as sensors, detectors, modulators, amplifiers, etc.; and
- Visualization and user interfaces.

Device and circuit characteristics can be simulated under DC conditions, transients, and in multiple frequency bands including microwave, infrared, and optical signals, as appropriate. Separate simulation modules may be needed to cover the broad spectrum of interest. The mature NEEDS Node is envisioned to include operating-point solutions, transient analysis, and various small- and large-signal analyses with the circuit elements and nanodevice models needed to successfully simulate many circuits and systems.

NEEDS should accept models based on theories and/or founded on experimental data. The development of NEEDS tools may require funding theoretical studies of basic electrical properties of materials and their adaptation to nanoscale devices. Necessary experiments to verify developed theories, models, and simulation modules are also included. Investigators and researchers developing modules for NEEDS are expected to deliver simulation tools and materials to the cyber platform, where they will be made user-friendly.

The NSF strongly emphasizes the requirement that NEEDS be compatible with SPICE. The NEEDS-SPICE combination is expected to become the industry-standard tool to verify nanodevice and circuit operations, from materials to system response, before committing to manufacturing an integrated system.

The success of NEEDS will strongly depend on developing a community of interested researchers, industry personnel, and other users of the simulator. A key outcome of this effort is fostering a community of not only users but also module developers who will capitalize on their related research by developing their final findings into modules that can be integrated into NEEDS, regardless of the initial source of funding. This requires persistent efforts to broaden the dissemination of information, such as forming discussion groups, developing websites and newsletters, and organizing conferences and workshops.

The proposed efforts should include developing educational materials that link nanoelectronics and nanotechnology, in general, to applications. User-friendly modules that stimulate access to NEEDS and allow students at the high-school and university levels to utilize it are desirable and strongly encouraged.

It should be noted that NEEDS is intended to be an enabler for developing circuits and systems that incorporate nanocomponents. Therefore, the NSF anticipates that the majority of the NEEDS Node's contribution will be at the fundamental level such as modeling properties of materials, physics of nanostructures and nanodevice characteristics. The circuit and system aspects of NEEDS are expected to be similar to SPICE and should benefit from the wealth of knowledge and programming experience gained during the several decades of SPICE development. In developing NEEDS, the awardee would build on but not duplicate the circuit and system simulators of SPICE to achieve several objectives. This would serve as an effective use of available resources by directing most of the efforts to the basic levels, which require the greatest contributions to advance the NEEDS Node. It will also enhance the compatibility between NEEDS and SPICE, and exploit the users' familiarity with SPICE, which ensures faster penetration into the user communities. However, these expectations should not be construed as restrictions on the investigators and module developers, who would have the latitude to make modifications, warranted by the conditions at hand, as they see fit.

III. AWARD INFORMATION

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4 - One Cyber Platform and three nano Nodes awards.

Anticipated Funding Amount: $5,200,000 This support is provided by the NSF Directorate for Engineering (ENG), the Directorate for Computer & Information Science & Engineering (CISE), and the Office of Cyberinfrastructure (OCI). The Cyber Platform will be funded at up to $2.9M per year for five years, renewable for an additional five years. To enable continued service to the community, if the award is made to a new institution, the first year of support to the new awardee for the new NCN Cyber Platform may be approximately $1.45M and the current awardee may be provided with approximately $1.45M to enable a transition phase depending upon the scope of the new award and the available funds. Thereafter, the annual support level to the new awardee will be $2.9M, pending quality of proposals and availability of funds. The individual new Nodes will be funded at up to $700,000 each per year for five years, pending quality and availability of funds. The Node awards are not renewable.

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

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- Only U.S. universities with Ph.D. degree granting programs in science and engineering may serve as the lead institution for each award. The Cyber Platform award will be submitted as a single university proposal with no partner universities or other institutions. For the Node proposals, the lead university may be joined by a small number of partner domestic universities/institutions (e.g. federal labs) but may not be joined by foreign universities/institutions. It should be noted that a multi-university configuration is not required[1]. If a multi-university proposal is submitted, the lead university must submit the proposal. Separately submitted collaborative proposals are not acceptable and will be returned without review.

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[1] If a partner is a Federal lab, NSF funds cannot be used to support the laboratory.

PI Limit:

The PI of the Cyber Platform proposal and the Node proposals must be tenured faculty members at the lead university of each proposal.

The PI and co-PI(s) on the full proposal must be the same as those named in the Letter of Intent.

Limit on Number of Proposals per Organization: 4

One cyber platform proposal and up to three Node proposals may be submitted.

A university may submit only one Cyber Platform proposal. A university may submit only one proposal per Node request in this solicitation. Therefore, one university might submit one Cyber Platform proposal and up to three separate Node proposals, but only one to each Node.

Limit on Number of Proposals per PI: 1

An investigator may serve as PI or co-PI on only one proposal, either the Cyber Platform or one of the Node proposals.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent*(required):*

A Letter of Intent (LOI) is required to facilitate the NSF review process. The letter should be submitted via FastLane (not Grants.gov) no later than the LOI deadline date specified in this solicitation. The LOI allows NSF to screen the proposals with respect to eligibility requirements, to categorize the proposals, and identify conflicts-of-interest so as to prepare for the proposal review processes. Follow these steps for the LOI preparation and submission:

Submit information for your LOI through FastLane under these categories and only under these categories (note the character limits, which include spaces, as stated below):

- **Project Title:** For Cyber Platform Proposals, the project title should be Network for Computational Nanotechnology Cyber Platform. For Node proposals the project title should be: one of the following as appropriate
  - Network for Computational Nanotechnology - NanoBIO Node
  - Network for Computational Nanotechnology - NanoMFG Node
  - Network for Computational Nanotechnology - NEEDS Node
- **Synopsis (max 2,500 characters in this section, including any spaces):** Provide brief statements of the vision, goals, and features of the Cyber Platform or Node as appropriate at a sufficient level of detail to understand the proposed Cyber Platform or Node.
- **Other Comments (max 2,500 characters including any blank spaces):** Continue Synopsis as needed in this section.
- **Organizational Attribute:** Select the appropriate organizational attribute for the lead university from the drop down list.
- **Key Academic Participants (max 255 characters including any blank spaces):** In this section, identify the core academic participants (people). Include the titles/roles in the Cyber Platform or Node, and their departmental and institutional affiliations for the lead PI, co PIs and any other key academic faculty or staff.
- **Key Academic Participants Continued (max 255 characters including any blank spaces):** Continue the list of "Key Academic Participants (people)" as needed.
- **Point of Contact for NSF Inquiries:** Lead PI
- **Project PI Information:** Lead PI's Contact Information
- **Submitter Information:** This section does not require input from LOI author. FastLane automatically adds this information to the final LOI submission.
- **Senior Project Personnel (maximum of five official Co-PIs):** In this section identify your PI and up to four additional Co-PIs. Include their names, universities, departments, and locations (city, state, country). Because the coversheet only allows a total of five PIs (the PI and up to four Co-PIs), any additional Co-PIs will be shown as "Senior Personnel" in any subsequent proposal and should be identified in the "Key Academic Participants" section above.
- **Participating Organizations:** This section will list the lead university for the Cyber Platform or Node proposal. In this section for each university include the name and location (city, state, and country), then the appropriate heading for each: 1) the lead university (LU) 2), partner university(ies) (PU), if any, and 3) other types of partner institutions. Each entry can have up to 76 characters (including any spaces) to show all of information you are asked to provide (university name, city, state, country and abbreviation for type of partner, (i.e. LU). You can abbreviate information, as needed. You can also do a search for the organization and if FastLane finds it you can then add the additional text information asked for above (i.e. LU), after you have selected the searched organization.

Letter of Intent Preparation Instructions:

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

- Sponsored Projects Office (SPO) Submission is required when submitting Letters of Intent
- A Minimum of 1 and Maximum of 4 Other Senior Project Personnel are allowed
- Key Academic Participants is required when submitting Letters of Intent
- Submission of multiple Letters of Intent is allowed

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 nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

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

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

The text of the project description must follow the spacing, font and formatting requirements of the NSF Grant Proposal Guide (GPG). Tables and lists in the project description may be in smaller type but be sure the type is readable when the page is printed out. Both will include the items listed below in the order indicated.

If the proposal has a multi-university configuration (which is not required), the proposal must be submitted as an integrated proposal by the lead university, with proposed sub awards to the other partner institutions. Separate proposals from each partner will not be accepted since separately submitted collaborative proposals are not allowed.

Required Proposal Format:

1. **Cover Sheet.** Select the NCN solicitation number from the pull down list. If submitting via Grants.gov, the program solicitation number will be prepopulated by Grants.gov on the NSF Application Cover Page. Where asked to identify the NSF Unit of Consideration, select the Division of Engineering Education and Centers. The proposal title should follow the guidance in the Letter of Intent instructions. For planning purposes, September 1, 2012 should be shown as the start date.

   Proposers are reminded to identify the NCN solicitation number in the program solicitation block on the NSF Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

2. **Project Summary (limited to one page).** The summary should be written in the third person (i.e. the use of the pronoun "it" not "we") and should make a compelling case for the proposed NCN Cyber Platform or Node. The summary should be informative to persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate lay reader.

   At the top of the first page include the proposal title, the lead PI's name, the submitting university's name, and the names of any partner universities/institutions. Write a clear description of the proposed Cyber Platform or Node, stating its vision, goals, and program of research and service. Under the headings "Intellectual Merit" and "Broader Impact" as relevant, provide highlights of the proposal relevant to NSF's Intellectual Merit and Broader Impacts review criteria. **A proposal that does not include titled sections (Intellectual Merit and Broader Impacts) referencing the NSF review criteria and does not also provide specific reference to how the proposal will address these criteria will be returned without review.**

3. **Table of Contents** will be generated automatically by FastLane or Grants.gov.

4. **Project Description.**

   The project description must contain sections 4.a to 4.f and is limited to 25 pages for full proposals, including all figures, tables, and charts. These page limits are extended only by the length of the Table of Academic and Other Participants (see 4.a below). The project description should be prepared with reference to the review criteria and the guidance provided in this and the preceding sections of this solicitation. The intellectual merit and broader impacts of the project must be addressed and described as an integral part of the narrative.

   Start the project description with the Word Table of Academic and other Participants (see 4.a below). NSF will extend the page limits above by the number of pages taken up by this table. For example, a three-page table extends the page limit for the narrative for a full proposal to 28 pages. These page limits include other charts, figures, and tables required as a part of the narrative and others the proposers wish to include. **If the Project Description section exceeds these extended page limits, the proposal will be returned without review.**

   (4.a) Word Table of Academic and other Participants. The table should be inserted into the front of the Project Description using the Word table format available on the ERC Program's Website (http://www.erc-assoc.org) under the button "NCN Solicitation Information." Be sure to submit all of the required information and use the Word table format. The table will list: 1) the academic and other partners carrying out the research, education, and service functions of the project, and 2), the individuals who will receive support from the award. NSF will use this table to determine whether potential reviewers have conflicts-of-interest and as a reference for the staffing of the proposed award. Insert the table at the beginning of the Project Description.

   (4.b) Goals, Mission, and Features of the Cyber Platform or Node

   Cyber Platform

   Given the guidance and requirements above, develop the proposal narrative to provide the following information at a minimum:

The goals, mission, and deliverables of the new NCN;
- Overall strategic plan, with milestone chart, to deliver computation and simulation tools and curricular and other educational materials to a world-wide community of users;
- Analysis of the sufficiency of hubZERO middleware to meet near-term and long-term delivery needs;
- Based on that analysis, plans for ongoing platform support and developing the next-generation platform to meet emerging needs and integrate new research and computing developments, including proof-of-concept demonstration of key software elements with appropriate tangible metrics;
- Plans to transition current tools and content to the new platform;
- Plans for identity management, trust, user support, and use data collection;
- Plans for collaboration and communication with each Node and expected cross-Node collaboration;
- Plans for validation and testing of materials delivered by the Nodes to assure quality and ease of use;
- Plans for enhancing the educational materials delivered by the Nodes to create augmented educational tools and materials for students, the workforce and the broader community;
- Plans for building a community of users in academe and industry, including small businesses;
- Plans for linking to the NSF/OCI SI^2 program and SI^2 awards, especially the SI^2 Institutes as they come on line; including plans for attending and contributing to SI^2 PI meetings with associated travel costs included in the budget;
- Plans for assessing and evaluating the quality of services delivered and the use patterns;
- Budgets will include costs for preparing reports, gathering user data, and annual site visits that include the three NSF-supported Nodes.

Nodes

Given the guidance and requirements for the Node chosen, develop the proposal narrative to provide the following information at a minimum:

1. Goals
    - Driving goal, motivated and structured by the three Node descriptions above;
    - Plans to augment and update those goals through interaction with a community of interested industry personnel and other users of the simulations to address broad based industry needs, including those of small businesses;
    - Expected deliverables to the Cyber Platform, strategic plan to achieve the deliverables and a milestone chart showing the timing of the deliverables;
    - Plans to assemble and assess existing computation and simulation tools, develop new computation and simulation tools that enable analyses of scaling up from the nanoscale to devices and systems, including design and manufacturing constraints, specifying the following deliverables:
        - Database of existing tools and that are user tested to assure baseline quality, and
        - Needed new computational and simulation tools grounded in theory;
    - Plans to link theory to experimentation to improve these tools - some funding of experimentalists will be provided by the Node and the Node would be expected to link in a collaborative non-funded mode to the already funded experimentalists in the area through connectivity with the National Nanotechnology Infrastructure Network (NNIN), the Nanoscale Science and Engineering Centers (NSEC), the Nanosystems Engineering Research Centers (to be funded in 2012) and relevant ongoing Engineering Research Centers (ERC), etc.;
    - Plans to develop educational materials that link the nanoscale to applications and encourage simulation for students at the high school and university levels as well as workforce training;
    - Methods to user-test simulation tools and educational materials to the Cyber Platform;
    - Plans to develop a community of collaborators, post award, who while not directly funded by the Node, share the commitment to the goals of the Node.
2. Plans for ongoing collaboration with and delivery to the NCN Cyber Platform and plans for assessing findings and lessons that might be shared across the other new Nodes.

(4.c) Infrastructure for both the Cyber Platform and an NCN Node

A. Institutional Configuration

Justify the institutional configuration of the Cyber Platform or the Node given its goals and deliverables.

B. Leadership and Team

Briefly discuss the background of the leaders, faculty and staff and justify the relevance of that background to the goals of the Cyber Platform or Node. Provide a table of the diversity of the proposed team.

C. Diversity

Provide the Cyber Platform's or the Node's diversity strategic plan, including goals, non-quantitative milestones, and intended actions for success in building diverse leadership, faculty, graduate and undergraduate student teams. Plans may not include quantitative targets. However, upon award, annual reports will include quantitative information on impacts benchmarked against engineering-wide averages.

Proposals will include a table (sample below) showing the current diversity of the leadership team, faculty and staff (who are U.S. citizens and permanent residents) using the following sample format. Note, NSF is committed to providing equal opportunities for participation in its programs and promoting the full use of the Nation's research and engineering resources. To aid in meeting these objectives, NSF requests information on the gender, race, ethnicity and disability status of individuals named as PIs/co-PIs on proposals and awards and this solicitation extends that requirement to include other faculty and staff (if they are already hired). Submission of the information on this table is voluntary.

Platform/Node Name	Total #*	Male	Female	African American	Native American, Pacific Islander	Hispanic American	Persons with Disabilities

Leadership Team							
Faculty							
Staff on board							
Totals							

** It is understood that the total will equal the total of males and females and the totals for racial and ethnic minorities and persons with disabilities will be larger than that total due to double counting. A person with a disability is someone who has one or more impairments that affects substantially one or more activities of daily living that is/are not completely correctable with assistive devices.*

D. Organizational Structure and Management

Describe the proposed organizational structure and include an organization chart. If the proposal includes more than one university/institution discuss how the participants will be developed into a team to deliver the proposed goals/milestones. Discuss how the internal oversight system for the Cyber Platform or Node. Discuss how the project will be managed.

E. Financial Support and Functional Allocation of Resources

Discuss how the funding will be allocated to the proposed tasks and provide a functional budget table, showing for year one how the funding will be distributed by major task, with a row for each major task, including overhead charges as the last row before the row showing the total.

F. Headquarters and Equipment Infrastructure

Discuss the headquarters space for the Cyber Platform or Node, its size and functionality. Generally describe the equipment infrastructure supporting the Cyber Platform or Node, referring the reader to the required section of the FastLane proposal template on "Facilities, Equipment and Other Resources" for more detail.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

C. Due Dates

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

  December 16, 2011

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

  January 17, 2012

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 where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

> **What is the intellectual merit of the proposed activity?**
> How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?
>
> **What are the broader impacts of the proposed activity?**
> How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

Additional Solicitation Specific Review Criteria

Cyber Platform Review Criteria

Vision and Platform

- Strong and effective vision to serve as the premiere Cyber Platform to enable modeling, simulation and education for the nano science and engineering community worldwide;
- Strong analysis of middleware needs in light of current and future user needs and cyber infrastructure;
- Strong software engineering and development plan that includes and/or enables the integration of relevant research activities to ensure the software is responsive to new computing developments;
- Middleware that will be sufficiently robust in the short-term with appropriate upgrades through time to provide state-of-the art services to the nano community to more than 170,000 users worldwide;
- Strong project plan and suitable timeline including a proof-of-concept demonstration of any key software element that may be developed;
- Appropriate tangible metrics described to measure the success of any software that may be developed, and the steps necessary to take the software from prototype to dissemination into the community as reusable software resources;
- Effectively addresses issues of sustainability, manageability, usability and composability/interoperability, which are integrated into the proposed software;
- Access to core computational equipment and other capabilities to provide seamless computational and simulation services to the users;
- Strong identity management system and trust fabric between providers and platform host;
- Content and tools effectively integrated so as not to preclude sharing and future porting without renegotiation of proprietary agreements;
- Strong plan to link to the SI^2 program and link to SI^2 awards, especially the SI^2 Institutes as they come on line; including plans for attending and contributing to SI^2 PI meetings with associate travel costs included in the budget.

Education

- Effective strategy to augment the educational content delivered by the new Nodes to develop and deliver:
  - Specialized web-based learning tools;
  - Tool-powered curricula to teach concepts, design, and optimization without extensive training or software installation;
  - Virtual immersive environments to teach nano-science and nano-engineering;
  - Teleprescence and remote experimentation frameworks for retraining the professional workforce.

Delivery to Users

- Effective user strategy to:
  - Deliver current NCN content so user community is not negatively impacted by the reestablishment of NCN;
  - Expand the involvement of users across a wide range of academic institutions and industry;
  - Work with the new NCN Nodes to assure appropriate and user tested content delivery;
  - Expand the involvement of users across a wide range of academic institutions and industry;

- Validate the quality of the Node-delivered tools and content;
- Support user interaction and develop a community-driven approach, with a timeline of new feature releases;
- Deliver user-friendly tools to the community and expand the user communities.

Assessment

- Effective strategy for assessment and evaluation of the quality of services provided and patterns of use including but not limited to:
  - Gathering input from the user community for needs and improvements;
  - Gathering and analyzing user data on platform usage and quality and utility of services.

Node Review Criteria

- Proposed goals strongly motivated and structured by the chosen Node descriptions;
- Strong plans to augment and update those goals through interaction with a community of interested industry personnel and other users of the simulations to address broad based industry needs, including those of small businesses;
- Strong set of expected deliverables to the Cyber Platform;
- Effective strategic plan to achieve the deliverables and strong milestone chart showing the timing of the deliverables;
- Strong analysis of the state of the art, development of a database of existing user-tested tools for baseline quality and identification of needs grounded in theory;
- Given that analysis, effective plans to develop needed new computation and simulation tools that enable analyses of scaling up from the nanoscale to devices and systems, including design and manufacturing constraints;
- Strong plans to link theory to experimentation to improve these tools, including appropriate lings to already funded groups/centers of experimentalists;
- Strong plans to develop needed educational materials that link the nanoscale to applications and encourage simulation for students at the high school and university levels as well as workforce training;
- Strong methodology for user-testing deliverables for the Cyber Platform;
- Strong plans for developing a community of collaborators, post award, who while not directly funded by the Node, share the commitment to the goals of the Node;
- Plans for ongoing collaboration with and delivery to the NCN Cyber Platform;
- Plans for extracting relevant findings and lessons that might be shared across the other new Nodes.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals 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 diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

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 Reverse Site Review.

The Cyber Platform proposals will be reviewed by *ad hoc* and panel review that will determine a subset of finalists, who will return to brief that same panel later in the process. That panel will recommend an award. The three sets of Node proposals will be reviewed by separate panels that will make recommendations for an award.

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.

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 before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after 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 that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational), publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report 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.

Provide post-award performance data and information to a standard database system managed by NSF.

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:

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.
- Lynn Preston, NCN Chair, ENG/EEC, telephone: (703) 292-5358, email: lpreston@nsf.gov
- Mihail C. Roco, ENG/OAD, telephone: (703) 292-7032, email: mroco@nsf.gov
- Gabrielle Allen, OD/OCI, telephone: (703) 292-2598, email: gdallen@nsf.gov
- Sankar Basu, CISE, telephone: (703) 292-2418, email: sabasu@nsf.gov
- Clark Cooper, telephone: (703) 292-7899, email: ccooper@nsf.gov
- Eduardo A. Misawa, Cyber Platform Team Leader, ENG/CMMI, telephone: (703) 292-5353, email: emisawa@nsf.gov
- Kevin Thompson, OD/OCI, telephone: (703) 292-4220, email: kthompso@nsf.gov
- Theresa A. Good, NanoBIO Node Team Leader, ENG/CBET, telephone: (703) 292-7029, email: tgood@nsf.gov
- Usha Varshney, ENG/ECCS, telephone: (703) 292-8339, email: uvarshne@nsf.gov
- Maria K. Burka, ENG/CBET, telephone: (703) 292-7030, email: mburka@nsf.gov

- Bruce M. Kramer, NanoMFG Node Team Leader, ENG/CMMI, telephone: (703) 292-5348, email: bkramer@nsf.gov
- Samir El-Ghazaly, NEEDS Node Team Leader, ENG/ECCS, telephone: (703) 292-8339, email: selghaza@nsf.gov

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, 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 40,000 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:

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