

International Research Network Connections (IRNC)

PROGRAM SOLICITATION

NSF 09-564

REPLACES DOCUMENT(S):
NSF 04-560



National Science Foundation

Office of Cyberinfrastructure

Office of International Science and Engineering

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

August 21, 2009

REVISION NOTES

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

In addition:

- Program theme extended to allow experimental and special project work.
- Additional monitoring and compatibility requirements for production network awards stipulated.
- Changes to proposal preparation requirements included.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

International Research Network Connections (IRNC)

Synopsis of Program:

The United States research and education community communicates, cooperates, and collaborates with colleagues in the global community. Members of this community access remote instruments, data, and computational resources located throughout the world, often as part of international collaborations. Similarly, major NSF investments in large-scale science and engineering facilities located both inside and outside the United States are utilized by multi-national research and education collaborations. To support such activities, NSF solicits proposals for International Research Network Connections (IRNC).

NSF expects to make a set of awards to: provide network connections linking U.S. research networks with peer networks in other parts of the world; leverage existing international network connectivity; improve the quality of end-to-end networking on international paths; explore experimental networking; stimulate the deployment and operational understanding of emerging technologies such as IPv6 in an international context. Links funded by this program are intended to support science and engineering research and education applications, and preference will be given to solutions which provide the best economy of scale and demonstrate the ability to support the largest communities of interest with the broadest services. Funded projects will assist the U.S. research and education community by enabling state-of-the-art international network services and access to increased collaboration and data services. Through extended international network connections, additional research and production network services will be enabled, complementing those currently offered or planned by domestic research networks.

This program supports international research network connections across three areas: Production network environments (IRNC:ProNet); Experimental networking activities in support of cyber-science applications

(IRNC:Exp); and special projects including advanced network development, deployment, security, monitoring, and other approaches (IRNC:SP).

Cognizant Program Officer(s):

- Jennifer M. Schopf, telephone: (703) 292-8970, email: jschopf@nsf.gov
- William Y. B Chang, telephone: (703) 292-8970, email: wychang@nsf.gov

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

- 47.079 --- Office of International Science and Engineering
- 47.080 --- Office of Cyberinfrastructure

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement

Estimated Number of Awards: 10 to 15 Because of the nature and geographic extent of the efforts involved, interested parties are encouraged to form consortia of organizations that can work together to provide the needed services. Consortia may consist of any number of U.S. and foreign, profit and not-for-profit entities. All awards resulting from responses to this solicitation will be made to U.S. organizations as cooperative agreements, standard or continuing grants. IRNC:ProNet awards will be up to a five-year duration. IRNC:Exp and IRNC:SP awards will be two- to three-year duration.

Anticipated Funding Amount: \$32,500,000 total over FY10-FY14, pending availability of funds. Number of awards and average award size/duration are subject to the availability of funds; however NSF expects to make approximately 5 IRNC:ProNet awards, each at approximately \$1M/year for 5 years, and a total of 5 to 10 awards for IRNC:Exp and IRNC:SP funded at a level of \$250K to \$750K per year over 2-3 years.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

Single lead PI for each proposal.

Limit on Number of Proposals per Organization: 3

Organizational limit of 3 applies to IRNC:ProNet only.

There is no organizational limit for IRNC:Exp or IRNC:SP.

Limit on Number of Proposals per PI: 3

An individual may be the PI or co-PI in no more than three proposals submitted in response to this solicitation, which may be any combination of IRNC:ProNet, IRNC:Exp or IRNC:SP. There is no limit on the number of proposals with which an individual may be associated as senior personnel to provide specific expertise.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

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

August 21, 2009

Proposal Review Information Criteria

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

Award Administration Information

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

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

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I. INTRODUCTION

The United States research and education community communicates, cooperates, and collaborates with colleagues in the global community. Members of this community access remote instruments, data, and computational resources located throughout the world, often as part of international collaborations. Similarly, major NSF investments in large-scale science and engineering facilities located both inside and outside the United States, are utilized by multi-national research and education collaborations. To support such activities, NSF solicits proposals for International Research Network Connections (IRNC).

NSF expects to make a set of awards to: provide network connections linking U.S. research networks with peer networks in other parts of the world; leverage existing international network connectivity; improve the quality of end-to-end networking on international paths; explore experimental networking; stimulate the deployment and operational understanding of emerging technologies such as IPv6 in an international context. Network links funded by this program are intended to support science and engineering research and education applications, and preference will be given to solutions which provide the best economy of scale and demonstrate the ability to support the largest communities of interest with the broadest services. Funded projects will assist the U.S. research and education community by enabling state-of-the-art international network services similar to and interconnected with those currently offered or planned by domestic research networks. Funded projects will assist the U.S. research and education community by enabling state-of-the-art international network services and access to increased collaboration and data services. Through extended international network connections, additional research and production network services will be enabled, complementing those currently offered or planned by domestic research networks.

This program supports international research network connections across three areas: Production network environments (IRNC:ProNet); Experimental networking activities in support of cyber-science applications (IRNC:Exp); and special projects including advanced network development, deployment, security, monitoring, and other approaches (IRNC:SP).

Each proposal should clearly identify and justify the focus area to which it is being submitted (one and only one), as described in the proposal preparation instructions.

II. PROGRAM DESCRIPTION

The program is divided into three distinct but related areas: (1) IRNC:ProNet - Production level network connections and services; (2) IRNC:Exp - Experimental networking activities; and (3) IRNC:SP - Special projects including advanced network development and

deployment.

A. General Information

The infrastructure and associated services proposed in response to this solicitation must address U.S. research and education needs with respect to international collaboration and communication that advance science and engineering. The science that will be enabled by the proposal should be detailed. Plans for meeting the evolving service needs of the research and education community should also be described.

The Project Description for all proposals, which can be up to 15 pages, should include discussions of the criteria detailed in the following sections for each of the three programs in addition to addressing the science impact of the project. There must also be a discussion of risk mitigation and post-award management (additional details below). The number of support letters from third parties is limited to eight. Inclusion of additional supplementary materials (appendixes, etc.) will be allowed only after discussion with a relevant program officer.

See Section V, Proposal Preparation and Submission Instructions, for further guidance on proposal titles.

A.1. General Organization Description

Because of the nature and geographic extent of the efforts involved, interested parties may choose to form consortia of organizations that can work together to provide the needed services. Consortia may consist of any number of U.S. and foreign, profit and not-for-profit entities. Awards resulting from this solicitation will be made to eligible lead U.S. organizations.

Proposals in any of the three areas should describe the organizations that are involved including:

- Experience and qualifications applicable to the provisioning, operation, and management of the proposed projects and, for the lead organizations, evidence of effective project management experience including management of sub-awards (if any);
- Experience the consortia members have had working together in similar projects;
- Planned organization and governance of the proposing consortia;
- A description of each organization's proposed facilities (in appropriate amount of detail to reflect the relative role of each organization); and
- Documentation of technical and managerial qualifications of key personnel, including those who are part of any sub-awards.

A.2. General Budget Narrative

The budget narratives should be included in the Project Description for all proposals, and should include sufficient detail to explain and justify the proposed cost and value over the period of the award. Any co-funding of resources must be explained in this section.

A.3. General Security Plan

The awardee is responsible for all information technology (IT) systems security and associated equipment and information, funded directly or indirectly by this award. The awardee shall present to the cognizant NSF Program Officer and Grants and Agreements Officer an IT security plan addressing policies and procedures for review and approval within 60 days of award. The plan should include evaluation criteria that will measure the successful implementation and deployment of the plans, policies and procedures.

B. IRNC Program Area 1: Production Network Connections and Services (IRNC:ProNet)

The highest priority is enabling and enhancing communication and collaboration between the U.S. and international science and engineering research and education communities. The availability of limited resources means that preference will be given to solutions which provide the best economy of scale and demonstrate the ability to link the largest communities of interest with the broadest services. Proposals should describe how this will be accomplished over a five-year period.

NSF is also interested in innovative and forward-looking approaches to promote the development of a rational global network architecture. In this regard, proposals should address the question of how their international links will become an integral component of the global science and engineering research and education network environment and how they will fit into a rational global network architecture. For example, solutions which offer incentives to foreign connection points to share circuits or encourage the establishment of national or regional distributed exchange points might be considered.

Leveraging existing infrastructure is encouraged. Successful proposals will address how their activities blend consistently into, and enhance, the existing end-to-end domestic and international network infrastructure and emerging services and best practices.

Experimental networking activities are not directly supported in the IRNC:ProNet portion of the solicitation, but are addressed separately below as part of the IRNC:Exp proposals.

B.1. IRNC:ProNet Services and System Design

Proposals should describe the services to be provided, the technologies on which they are based, and relevant timelines for service activation and enhancements.

The IRNC connections must use technologies (including protocols) that provide a reliable, leading-edge service for research and education. For example, some of the links to key continents must support individual sessions at end-to-end data transfer rates approaching ten gigabits per second in an uncongested use mode. The system design should provide this capability consistent with high-capacity and long-distance delay products. Proposed technologies must also be compatible with the research networks of the countries that are to be connected, and with their plans (where available) for the introduction of new technologies.

Hybrid network services have matured to the point that they are considered for the time period supported in this solicitation to be production services; thus, dynamic circuit networking capabilities in combination with shared IP services must be supported. Specifically, proposals should address interoperability with emerging production dynamic switching network services, or explain in detail why such interoperability is not feasible. For proposals whose services include the explicit operation of a layer 3 (shared IP) service, and therefore router equipment to be managed, support for the current Internet Protocol (IPv4), the next generation Internet Protocol (IPv6), and multicast IP is required. Service provisioning will require management and operations at multiple protocol levels.

Proposals should describe the overall system design including: connection plans on both ends of the international links; (briefly) the networks to be connected, and the technical characteristics of the IRNC links; supported layer 1-3 technologies; routing and switching strategies; security mechanisms and privacy policies; and relevant timelines for technology deployment and service activation. Alternate designs, each separately priced, for providing reliable services may also be provided.

In addition to the description of the initial technologies and equipment to be employed, proposals should outline how the proposed

IRNC should evolve and specify the plans for introducing new networking technologies, equipment, and services. Proposals should assess the risks and benefits of adopting such new technologies including plans to assure high quality services during the transition to any proposed future deployments.

B.2. IRNC:ProNet Operations, Monitoring, Quality Assurance, and Security Plan

Proposals should describe procedures and facilities, with special emphasis on Network Operations Centers (NOCs), for monitoring the quality, availability, and effectiveness of the services provided. Procedures for fault isolation, timely problem resolution, and service assurance should be described. Recognizing the end-to-end context of the program's role, the NOC discussion should address the relationship and coordination with international partners' NOCs as well as the U.S. domestic NOC for Internet2 and NLR, or detail why this isn't feasible. The cost of NOC-specific functions, whether supported internally in the project or handled via a sub-contract, should be clearly identified. Proposals should describe procedures for working with personnel from interconnected networks to identify and to resolve problems and to support end-to-end service guarantees. Special attention should also be given to plans for measuring and ensuring end-to-end performance for high-end applications.

Proposals should also include a description of the targeted performance and quality of service guarantees, and a discussion of the rationale for and validity of the proposed service metrics for providing reliable end-end service. Such metrics for service use, availability, and performance might include: utilization (averaged over appropriate timescales), packet drop rate, round trip time, jitter and time sensitive latency, for example. Possible control methods, where applicable, for guaranteeing IRNC resources to U.S. researchers and educators in a shared link environment should also be outlined. Proposals should leverage existing measurement and analysis tools to support gathering service metrics and troubleshooting performance.

All network measurement activities must address interoperability with emerging best practice international research and education network performance monitoring, or explain in detail why this is not feasible. This should include the deployment of compatible bandwidth and latency measurement services, as well as compatible measurement archives, and details about access to these archives by relevant parties. Additional services such as monitoring for flow analysis are also encouraged if feasible. These services may be part of the security plan for the project and should be addressed as such.

Security plans should include, in addition to the general requirements listed above, a detailed control plane integrity plan and a security incident response plan in this section.

B.3. IRNC:ProNet Use of International Links

Links funded by this program are intended to support science and engineering research and education applications. Therefore, the networks they connect must also be primarily for these purposes. These networks typically have appropriate use policies and those policies shall govern traffic flow over the IRNC links. Known or expected usage policies, along with processes for enforcing or implementing the policies, should be described. Gathering of metrics should be included, and where appropriate, compatibility with emerging best practice international research and education should be addressed. In addition, connection points may enforce their own routing policies. Proposers should describe their proposed U.S. and international connection policies.

B.4. IRNC:ProNet Shared Infrastructure Proposals

Sharing infrastructure and services can improve the economics for users and institutions. This includes not only use of research network resources provided by others but also the use of network resources for non-research use. If services or infrastructure are shared, measures must be taken to ensure that IRNC communities are provided with their fair share of capacity, priority, and reliability subscribed under IRNC awards, and on terms that are at least as favorable as those received by any other customer of the service provider. Discussion of capacity allocation and performance monitoring to ensure fair sharing should be clearly presented.

If a shared-link or other common infrastructure environment is utilized, proposals must include descriptions of service metrics, control methods, and related service guarantees for providing IRNC to the research and education community.

B.5. IRNC:ProNet Budget Narrative

For the IRNC:ProNet proposals, each year's budget narrative must contain information about the specific services proposed and explain the significant prices-to-NSF associated with each service/facility provided. This pricing information must include a quantifiable basis for determining the reasonableness of the proposed price to be funded by NSF. Examples of supporting information include:

- Documented estimates of the value, or current market price of the proposed services;
- Measurable criteria such as, price per unit of bandwidth made available to the U.S. research community;
- Service metrics and/or quality-of-service parameters of this solicitation and their relation to proposed pricing; and
- Market value of special supplies, over and above the service provider's standard equipment, needed to provide the required services.

C. IRNC Program Area 2: Experimental Networking (IRNC:Exp)

Proposals may be submitted with a focus on experimentation with next generation network infrastructure technologies to meet emerging requirements of e-Science and other advanced applications which have yet to be supported in production by today's international research networks. Patterned after the NSF Experimental Infrastructure Networks (EIN) program (NSF 03-539), IRNC:Exp encourages international collaboration among application scientists and scientific projects, and the networking community. IRNC:Exp projects focus on end-to-end connections and services of leading-edge sites and facilities, with project activities focused on enabling one or more applications using pre-market technologies. Industry participation is encouraged.

Since the application will define the requirements of infrastructure experiment(s) to be conducted and its functionalities, all aspects and types of new and different networking infrastructure will be considered. Thus, supported experimental infrastructure includes, but is not limited to, wireless deployments, hybrid technologies, alternate protocols, sensor networks, lambda configurations, optical networks and so forth. The key is not necessarily specific technology implementations, but integration of the technologies and related infrastructure to support the application. This includes some focus on vertical integration (e.g., from hardware to application to user interface and social factors) as well as horizontal integration (e.g., other geographic sites, applicability to other disciplines).

IRNC:Exp proposals have several options in how they address availability and use of international network connectivity with their partners. For example, the proposal may request support for dedicated international connectivity as part of their activities, the proposal may explicitly refer to use of connections and services proposed separately into the IRNC Production Network Area (IRNC:ProNet) but must include alternative plans if the specific IRNC:ProNet award is not made, and/or the proposal may seek to leverage existing international network connectivity. Specific international interactions must be clearly identified, and where possible, a letter of support from the network link collaborator should be included.

In addition, under IRNC:Exp, NSF encourages demonstration projects linking networks to cyber-science applications for the explicit purpose of bridging to other directorates and agencies (and/or other country funding). In this case, proposals would be seeking "seed money" to do initial work in developing a demonstration in short order (~18 month duration) to allow the proposer to seek additional support from other sources.

Where appropriate, projects should address deploying emerging best practice international research and education compatible bandwidth and latency measurement services, as well as compatible measurement archives, and proposals should include details about access to these archives by relevant parties. In addition, a security plan (as listed in the General section (A.3) above) is required.

Specific deployment goals and associated timelines are required.

Awards with significant software development or application interactions will be subject to the following conditions:

- NSF requires a working prototype to be successfully demonstrated before the 18-month mark of award activities (12 month mark for 2-year awards), and the software's open source license to be listed by the Open Source Initiative (see www.opensource.org) as an approved open source license. Where applicable, these milestones must be documented in the Year 2 Annual report before Year 3 spending is authorized (or Year 1 Annual report for 2-year awards).
- Awards are required to use NMI Build and Test services, or an NSF-designated alternative, to support their software development and testing. Details of the NMI Build and Test facility can be found at <http://nmi.cs.wisc.edu>.

D. IRNC Program Area 3: Special Projects (IRNC:SP)

Proposals in the IRNC:SP category focus on special projects addressing a single technical or programmatic capability with a near term goal of deployment and use. Smaller in scale, these projects address a clear need in networking technologies unmet due to a shortage of resources in development, integration, deployment, engineering, or operations. In contrast to IRNC:Exp projects, SP projects are smaller, singularly focused, and expected to result in a fielded production capability in a one to three year time frame. Proposals are encouraged in, but not limited to, the following emphasis areas:

- Education and outreach opportunities;
- IPv6 deployment and application;
- Advanced network measurement and reporting capabilities;
- CyberSecurity capabilities, such as DNSSEC deployment and coordination (<http://www.dnssec.net>);
- Pilot projects investigating pre-production use of botnet or worm detection;
- Demonstration projects working with large data transfers such as smart mobile devices or cloud computing applications; and
- Other topics as appropriate.

Where appropriate, specific deployment goals and timelines are required, as is a security plan as detailed in the General section (A.3) above. In addition, when appropriate, the proposal must address the collection of network measurements in emerging best practice international research and education compatible formats.

IRNC:SP proposals have several options in how they address availability and use of international network connectivity with their partners. For example, the proposal may request support for dedicated international connectivity as part of their activities, the proposal may explicitly refer to use of connections and services proposed separately into the IRNC Production Network Area (IRNC:ProNet) but must include alternative plans if the specific IRNC:ProNet award is not made, and/or the proposal may seek to leverage existing international network connectivity. Specific international interactions must be clearly identified, and where possible, a letter of support from the network link collaborator should be included.

Awards with significant software development or application interactions will be subject to the following conditions:

- NSF requires a working prototype to be successfully demonstrated before the 18-month mark of award activities (12 month mark for 2-year awards), and the software's open source license to be listed by the Open Source Initiative (see www.opensource.org) as an approved open source license. Where applicable, these milestones must be documented in the Year 2 Annual report before Year 3 spending is authorized (or Year 1 Annual report for 2-year awards).
- Awards are required to use NMI Build and Test services, or an NSF designated alternative, to support their software development and testing. Details of the NMI Build and Test facility can be found at <http://nmi.cs.wisc.edu>.

Proposals should include the following sections as Supplementary Documents:

- A list of all organizations involved in the project;
- A single, alphabetically ordered list of all people, in the academic or professional community, who have collaborated with (within the last 48 months), or have been a Ph.D. advisee or advisor of, any of the personnel involved in the proposed project. In this list, please include, next to the name of each conflicted individual, that individual's institution or company and the name of the project member with whom he or she has the conflict of interest. It is not necessary to list, as collaborators, personnel who are employees of an institution or company clearly involved in the project; and,
- Letters of commitment from individuals who are from organizations other than the proposing organization or proposed sub-awardees and who are described in the Project Description as involved in the project in a senior capacity, or from authorized representatives of institutions or organizations collaborating with the lead institution.

The number of support letters from third parties is limited to eight. Inclusion of additional supplementary materials (appendixes, etc) will be allowed only after discussion with a relevant program officer.

III. AWARD INFORMATION

Estimated program budget is a total of \$32.5M over FY10-FY14, pending availability of funds. Number of awards and average award size/duration are subject to the availability of funds; however we expect to make approximately 5 IRNC:ProNet awards, each at approximately \$1M/year for 5 years, and a total of 5 to 10 awards for IRNC:Exp and IRNC:SP funded at a level of \$250K to \$750K per year over 2-3 years.

IV. ELIGIBILITY INFORMATION

Organization Limit:

None Specified

PI Limit:

Single lead PI for each proposal.

Limit on Number of Proposals per Organization: 3

Organizational limit of 3 applies to IRNC:ProNet only.

There is no organizational limit for IRNC:Exp or IRNC:SP.

Limit on Number of Proposals per PI: 3

An individual may be the PI or co-PI in no more than three proposals submitted in response to this solicitation, which may be any combination of IRNC:ProNet, IRNC:Exp or IRNC:SP. There is no limit on the number of proposals with which an individual may be associated as senior personnel to provide specific expertise.

Additional Eligibility Info:

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified 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-PUBS (7827) or by e-mail from pubs@nsf.gov.

Proposals must identify the focus area in the title. Production network related proposals must start with "IRNC:ProNet". The titles of experimental networking proposals must start with "IRNC:Exp". Special project proposals must start with "IRNC:SP".

Refer to Section II, Program Description, for specific proposal preparation information and instructions.

Proposers are reminded to identify the program solicitation number (NSF 09-564) 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.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

C. Due Dates

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

August 21, 2009

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: <http://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>.

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>.

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.

Additional Review Criteria:

Additional Criteria for IRNC:ProNet Proposals

Proposals in the production networking category should address the following additional criteria:

- Organizational description;
- Services and system design, including use of hybrid network services and evolution plans;
- Interaction plan with existing NOCs;
- System monitoring and archiving approach (including compatibility with emerging best practice international research and education monitoring approaches);
- Security plan;
- Known or expected usage policies for shared links;
- Budget narrative as described above.

Additional Criteria for IRNC:Exp Proposals

Proposals in the experimental networking category should address the following additional criteria:

- Integration of technology and related infrastructure to support a specific or group of cyber-science applications;
- Networks being leveraged (or collaboration with IRNC:ProNet submissions);
- Tangible metrics described to measure the success of the developed work and approach;
- A project plan including proof-of-concept demonstration of the key application concepts within the first 12 to 24 months;
- If seeking "seed" funds, the expected directorate, agency, or country for further investigation;
- If appropriate, the system monitoring and archiving (including compatibility with emerging best practice international research and education monitoring approaches);

Additional Criteria for IRNC:SP Proposals

Proposals in the special projects category should address the following additional criteria:

- Networks being leveraged (or collaboration with IRNC:ProNet submissions);
- Tangible metrics described to measure the success of the developed work and approach;
- If appropriate, the steps necessary to take the software from prototype status to production use;
- A project plan including proof-of-concept demonstration of the key application concepts within the first 12 to 24 months;
- If appropriate, the system monitoring and archiving (including compatibility with emerging best practice international research and education monitoring approaches);

Please see the full text of this solicitation for further information.

B. Review and Selection Process

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

Reviewers will be asked to 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 pubs@nsf.gov.

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

Special Award Conditions:

Please see Section II, Program Description for further information.

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.

Failure to provide the required annual or final project reports 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 following additional reporting requirements apply to awards made in IRNC:

For two-year IRNC:Exp and IRNC:SP awards, NSF requires a working prototype to be successfully demonstrated before the 12-month mark of award activities, and the software's open source license to be listed by the Open Source Initiative (see www.opensource.org) as an approved open source license. Where applicable, these milestones must be documented in the Year 1 Annual report before Year 2 spending is authorized.

For three-year awards IRNC:Exp and IRNC:SP, NSF requires a working prototype to be successfully demonstrated before the 18-month mark of award activities, and the software's open source license to be listed by the Open Source Initiative (see www.opensource.org) as an approved open source license. Where applicable, these milestones must be documented in the Year 2 Annual report before Year 3 spending is authorized. In addition, awardees are expected to participate in a PI meeting held in Year 2 or 3 with travel costs supported by the award.

For IRNC:ProNet awards, NSF requires additional quarterly reporting. Awardees are expected to participate in a PI meeting held in Year 2 or 3 with travel costs supported by the award.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Jennifer M. Schopf, telephone: (703) 292-8970, email: jschopf@nsf.gov
- William Y. B. Chang, telephone: (703) 292-8970, email: wychang@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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](http://www.nsf.gov).

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 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: pubs@nsf.gov
 - or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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

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