Informal Science Education (ISE)

PROGRAM SOLICITATION
NSF 09-553

REPLACES DOCUMENT(S):
NSF 08-547

National Science Foundation

Directorate for Education & Human Resources
Research on Learning in Formal and Informal Settings

Preliminary Proposal Due Date(s) ***(required)*** (due by 5 p.m. proposer's local time)***:***

June 25, 2009

except CRPA proposals

June 24, 2010

except CRPA proposals

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

November 19, 2009

except CRPA proposals

November 18, 2010

except CRPA proposals

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).

The Informal Science Education (ISE) program solicitation has been revised to allow five categories of proposals: Research; Pathways; Full-Scale Development; Broad Implementation, and Communicating Research to Public Audiences. The required information, project duration, and maximum award amount vary for each project type. Each submission must clearly indicate, at the beginning of both the Project Summary and Project Description, which project type is being proposed. Only one project type per proposal is allowed.

The Communicating Research to Public Audiences program (CRPA), previously NSF 03-509 , has been incorporated in this solicitation. CRPA proposals may be submitted at any time by Principal Investigators of active NSF-funded research grants.

The ISE program now has one round of proposal reviews each year with mandatory Preliminary Proposals, for all proposal types except Communicating Research to Public Audiences.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Informal Science Education (ISE)

Synopsis of Program:

The ISE program invests in projects that promote lifelong learning of STEM in a wide variety of informal settings. Funding is provided for projects that advance understanding of informal STEM learning, that develop and

implement innovative strategies and resources for informal STEM education, and that build the national professional capacity for research, development, and practice in the field.

There are five categories of ISE program grants: Research; Pathways; Full-Scale Development; Broad Implementation; and Communicating Research to Public Audiences.

Cognizant Program Officer(s):

- Address Questons to the Program, telephone: (703)292-8616, email: DRLISE@nsf.gov

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

- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 40 Approximately 6 Research, 6 Pathways, 20 Full-Scale Development, 3 Broad Implementation, and 5 Communicating Research to Public Audiences awards will be made per year.

Anticipated Funding Amount: $25,000,000 in FY 2010 and FY 2011 for new awards, pending availability of funds.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

For Communicating Research to Public Audiences projects ONLY: PI must hold an active NSF-funded research award in any NSF directorate or program.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **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:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Preliminary Proposal Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time)***:***

  June 25, 2009

  except CRPA proposals

  June 24, 2010

  except CRPA proposals

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

  November 19, 2009

  except CRPA proposals

  November 18, 2010

except CRPA proposals

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.

TABLE OF CONTENTS

I. INTRODUCTION

About the National Science Foundation and the Directorate for Education and Human Resources

The National Science Foundation (NSF) is charged with promoting the vitality of the nation's science, technology, engineering and mathematics (STEM) research and education enterprises. As part of this mission, the Directorate for Education and Human Resources (EHR) has primary responsibility for providing national and research-based leadership in STEM education. EHR emphasizes six themes in fulfilling this responsibility:

1. Furthering public understanding of science and advancing STEM literacy;
2. Broadening participation to improve workforce development;
3. Promoting learning through research and evaluation;
4. Promoting cyberlearning strategies to enhance STEM education;
5. Enriching the education of STEM teachers; and
6. Preparing scientists and engineers for tomorrow.

To address these themes, the Directorate sponsors programs in the Divisions of Research on Learning in Formal and Informal Settings (DRL), Undergraduate Education (DUE), Graduate Education (DGE), and Human Resource Development (HRD). The ISE program is managed in DRL.

The Division of Research on Learning in Formal and Informal Settings

DRL invests in projects to enhance STEM learning for people of all ages. Its mission includes promoting innovative and transformative research, development, and evaluation of learning and teaching in all STEM disciplines in both formal and informal learning settings. New and emerging areas of STEM must play prominent roles in efforts to improve STEM education. The integration of cutting-edge STEM content and the engagement of scientists, engineers, and educators from the range of disciplines represented at NSF is encouraged in all DRL initiatives. DRL's role is to be a catalyst for change by advancing theory, method, measurement, development, evaluation, and application in STEM education. The Division seeks to support both development of promising ideas and large-scale implementation of proven educational innovations. The Division's programs offer a set of

complementary approaches for advancing research, development, and improvement of practice.

- The *Informal Science Education* (ISE) program invests in projects that promote lifelong learning of STEM by the public, advance the knowledge and practice of informal STEM education, and expand professional capacity to improve informal STEM education.
- The *Innovative Technology Experiences for Students and Teachers* (ITEST) program invests in projects designed to enhance participation in the U.S. STEM workforce through the design, implementation, scale-up, and testing of technology-intensive educational experiences for students and teachers, and through research studies about issues related to STEM workforce participation.
- The *Discovery Research K-12* (DR-K12) program enables significant advances in preK-12 learning of the STEM disciplines through research and development on innovative resources, models, and technologies for use by students, teachers, administrators and policy makers.
- The *Research and Evaluation on Education in Science and Engineering* (REESE) program advances research at the frontiers of STEM learning and education in order to provide foundational knowledge for improving STEM teaching and learning at all educational levels and in all settings.

Each of these programs is intended to improve the capacity of their respective fields to further STEM learning. They are central to NSF's strategic goals of *Learning* and *Discovery,* helping to cultivate a world-class, broadly inclusive STEM workforce, expanding the scientific literacy of all citizens, and promoting research that advances the frontiers of knowledge (NSF, 2006). While the ISE program solicitation focuses entirely on informal science education, other DRL solicitations promote related aspects. PIs are encouraged to study all DRL solicitations for their applicability.

DRL and Innovation

All research and development activities within DRL aim at generating knowledge and transforming practice in STEM education. DRL's programs are designed to complement each other within a cycle of innovation and learning (see Figure 1) that forms the conceptual framework for its programs (adapted from American Statistical Association, 2007; NSF, 2005; RAND, 2003). All DRL programs are concerned with all five components of the cycle, to different degrees.

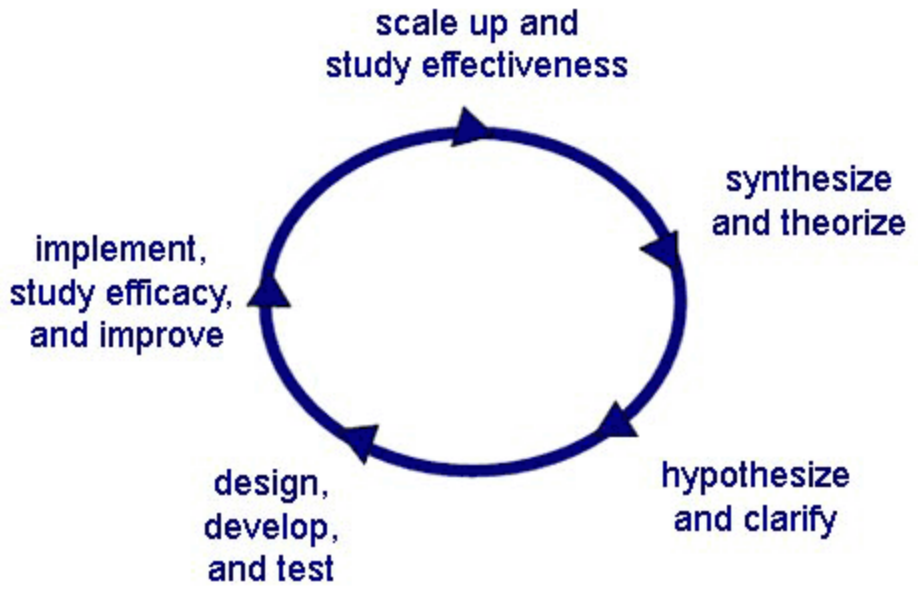

Figure 1. Cycle of Innovation

Each part of the cycle, represented in the activities of DRL's programs, forms the vital and compelling foundation for transition to the next part of the cycle. The research, development, and implementation activities need to be rigorous as appropriate. From challenging the STEM educational and research communities with transformative ideas, to conducting the pioneering and pragmatic research necessary to advance those goals, to developing world-class instructional materials and resources for teachers and students to advance their knowledge of STEM teaching and learning, to engaging all citizens and residents of the U. S. in learning and as future technologists, scientists and engineers, DRL is providing the ideas, resources, and human capacity to advance STEM learning and education in the 21st century.

II. PROGRAM DESCRIPTION

A. **Informal Science Education Program**

Scientific discoveries and technological innovations have profound impact on individuals and societies. Science, technology, engineering, and mathematics (STEM) shape our everyday lives and hold the potential to produce solutions to daunting problems facing our nation. This prospect calls for unprecedented energy and innovative efforts to promote public understanding of--and engagement with--STEM, its processes, and implications. "Informal" learning settings, those outside the formal education system, offer learners of all ages enjoyable opportunities to become interested in STEM and more knowledgeable about the world around them. Such learning experiences foster a better informed citizenry and inspire young people to consider STEM careers in which they

may help address societal challenges.

The Informal Science Education (ISE) program supports projects that promote lifelong learning of science, technology, engineering, and mathematics by the public through voluntary, self-directed engagement in STEM-rich informal learning environments and experiences.

The ISE program invests in projects that:

- advance knowledge through research and evaluation about STEM learning in informal environments;
- design, implement, and study models, resources, and programs for STEM learning in informal environments; and/or
- expand the capacity of professionals engaged in the work of informal STEM education programs.

The ISE program seeks to expand its portfolio of projects conducting research about informal STEM learning, in order to build the theoretical and empirical foundations for effective informal learning activities and to inform strategic investments in the future. Such research projects could pursue a variety of key questions. For example the National Research Council report *Learning Science in Informal Environments: People, Places, and Pursuits* (National Research Council, 2009) provides a current synthesis of research and indicates a number of fruitful and important possible directions for continued research focus. Some topics include: What are the characteristics of informal learning experiences that have demonstrable impact on public STEM understanding and literacy? What are the features of existing learning environments, materials, programs, or techniques that affect learning? What are appropriate cognitive and affective outcomes of informal science education initiatives (e.g., motivation, engagement, scientific identity) and can valid and reliable measurement tools be developed for those outcomes?

Core to the ISE program have been investment in models, resources, and programs for STEM learning in a range of informal environments. Proposals for the design and implementation of innovative exhibitions, films, multimedia learning resources, virtual learning environments, after-school programs, and other products, tools and programs for learning in informal settings are essential to the portfolio and are invited in this solicitation. Particular challenges include: How can learning opportunities be designed to reach diverse learners traditionally underserved and under-represented in STEM? What informal education strategies are effective for reaching specific audiences? Are developers' assumptions about informal STEM learning well supported by research and theory about learning? Can cyberlearning environments enable or even necessitate the learning of new STEM content, new modes of reasoning, or new STEM problem- solving processes (Borgman et al., 2008)? Investigators should make a case for innovative and novel contributions of such products and tools. They should provide for systematic testing and evaluating their effectiveness. These projects must also contribute to knowledge about promising practices for engaging the public in STEM learning by applying appropriate research and/or evaluation methods to study the effects of their approaches.

Given the broad scope of the informal learning environment, the professional community that engages in research, development, and practice focused on informal science education requires a wide range of experience and expertise. The ISE program seeks proposals to create innovative methods of building the STEM and education expertise of this wide-ranging community of professionals. Questions of particular interest include: How can partnerships among ISE professionals, STEM teachers from the formal education sector, and research scientists, mathematicians, and engineers help build the national capacity for informal learning and interest in STEM?

Appropriate STEM content can be drawn from any NSF program area, and Principal Investigators (PIs) are encouraged to take advantage of the expertise and potential resources available from NSF-funded research projects in any of the Foundation's directorates and offices. ISE proposals must provide innovative solutions to the challenges of advancing knowledge, designing resources, or building capacity in support of the overarching goal of promoting lifelong learning of STEM by the public. We are particularly interested in proposals that have the potential to transform thinking about and practice of informal STEM learning.

B. **ISE Project Types**

The ISE program invests in five types of projects: **Research**; **Pathways; Full-Scale Development**; **Broad Implementation,** and **Communicating Research to Public Audiences.** These project categories relate to the DRL cycle of innovation, and are not listed in any order of priority. Although all require a foundation in prior work and research, the cycle sequence is not meant to be taken literally. For example, Full-Scale Development projects must build on extant literature and the state of the informal learning field, but they do not necessarily require completed prior Research or Pathways projects.

1. **Research projects** contribute to the "hypothesize and clarify" and "synthesize and theorize" components of the DRL cycle of innovation. Their primary goal is to advance knowledge in the informal STEM learning field rather than to develop specific deliverable for implementation. A research project may involve the creation of new learning materials, media, artifacts, programs, or environments if these are necessary to answer the research questions or test hypotheses that are posed. However, the primary objective is to answer the research question, not to produce learning materials. Research projects may be empirical studies, syntheses of research, or theoretical studies intended to move the field forward.

   ISE Research projects are distinguished from proposals submitted to the REESE program by their emphasis on the connections between research and practice in informal science education. ISE program Research projects should be grounded in academic literatures that are relevant to their research questions (e.g., in cognitive science, motivation theory, developmental psychology, environmental design, informal learning research, sociology, political science), but may also draw explicitly from the wisdom of practice (as captured in visitor studies, project evaluations, surveys of best or common practices, etc.). Research projects should have implications for learners, care-givers, practitioners, designers, policymakers, or professionals who communicate science or science education to others.

   Research projects can be funded for up to $1.5 million and five years in duration.

2. **Pathways projects** relate to the "design, develop, and test" component of the DRL cycle of innovation. They include planning activities, pilot studies, and feasibility studies, or, in general, work that is on a path toward a major project (Research, Full-Scale Development, or Broad Implementation) but that need to address critical issues or decisions before major projects can be formulated. Such projects can be on the path toward any type of informal science education activity that would be appropriate for ISE program funding based on this solicitation. Examples include: demonstration of the proof of concept of a new technology; audience front-end evaluation where there is a significant gap in the literature; a focused planning effort for a large complex collaboration, especially where the collaborators may be from different

professional communities; early-stage development of new assessment instruments; and pilot programs for broadcast media. *Pathways proposals cannot request funds for upfront work normally required for submission of a major proposal.* Not all of the Pathways projects will necessarily result in a subsequent proposal. However, for those that do, the results and implications of the Pathways work must be explicitly described.

Pathways projects can be funded for up to $250,000 and two years in duration.

3. **Full-Scale Development projects** relate to the "implement, study efficacy, and improve" component of the DRL cycle of innovation. The main purpose of these projects is to generate an innovative idea or approach to informal science education, create a version that can stand alone in the public or professional arena, and evaluate its effectiveness. Such initiatives can be directed towards improving STEM learning by public audiences, increasing capacity of the professional audience, or both. They can create integrated products, programs, or experiences that contribute in measurable ways to informal science education, including, but not limited to, exhibitions, television, radio and film productions, community educational programs, cyberlearning resources and tools for the public, and programs and networks for professionals.

   While Full-Scale Development projects create complete STEM learning products, programs, or experiences, they need to be guided by an explicit conceptual framework and should generate significant knowledge about impact, efficacy, or effectiveness. The ISE program's expectation is that the final products of Full-Scale Development projects will make innovative contributions to the field. They can include research components if tightly coupled to the products or programs being developed.

   Full-Scale Development proposals typically will be funded in the $1 million to $3 million dollar range and may be up to five years in duration.

4. **Broad Implementation** projects relate to the "scale up and study effectiveness" component of the DRL cycle of innovation, proposing strategies for maximizing prior ISE program investments. Projects are expected to substantially broaden the reach of products or programs in the informal science education field that have demonstrated success with the audience they reach without sacrificing quality. "Reach" may be expanded in terms of geography, age, socio-economic status, cultural / linguistic group, or gender. Broad Implementation projects will generally extend work done with prior ISE program funding. Such prior work may have been done by the institution(s) submitting the proposal or by others (assuming intellectual property rights are not infringed). Combining and extending the educational products of more than one prior project is encouraged if such a combination may significantly increase the intended impact.

   Broad Implementation proposals must describe substantive evidence from summative evaluations or efficacy studies that the already-developed educational products are effective in some settings and are ready for wider distribution to a broader population. It is likely that such projects will involve innovative integration or incremental improvements or adaptations.

   Broad Implementation projects will normally be funded in the $1 million to $3 million dollar range and may be up to five years in duration. In order to encourage wide distribution, budgets may include up to $500,000 for making these products available to interested organizations and communities at no cost or with much reduced rental or similar costs.

5. **Communicating Research to Public Audiences** (CRPA) projects relate to the "implement, study efficacy, and improve" component of the DRL cycle of innovation by proposing informal learning activities based on currently funded NSF research. CRPA projects must be based on active research projects in good standing in any NSF directorate or office.

   Effective projects assist in the broader dissemination of research findings and promote STEM learning by the general public, especially as it relates to the understanding of and engagement with cutting edge research findings and methodology. As with other categories of ISE awards, CRPAs may include the design and implementation of exhibitions, films, television, radio, web, and youth and community projects. While these projects will be less extensive than Full-Scale Development projects, they should be similarly guided by a conceptual framework and include an evaluation plan that is commensurate with the scope and depth of the proposed activities. The proposal should clearly describe the NSF-funded research upon which the project is based, the educational need that is met, and the informal learning strategies that will be employed to engage the targeted public audiences. *Collaboration between NSF-funded researchers and informal science organizations is strongly encouraged to ensure use of best practices.*

   CRPA proposals can be a maximum of $150,000 and up to two years in duration. The award size, however, will be consistent with the project scope and the size of the original research award. They may be submitted at any time and do not require preliminary proposals.

C. **Other Funding Opportunities**

Like other NSF programs, the ISE program also funds Conferences, Symposia, and Workshops; EAGER and RAPID grants; and Grant Supplements for existing awards, as described in the Grant Proposal Guide (GPG), NSF 09-29:
http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp . These proposals may be submitted at any time.

- **Conferences, Symposia and Workshops.** See GPG, II.D.8.
- **Early-concept Grants for Exploratory Research (EAGER).** See GPG II.D.2
- **Grants for Rapid Response Research (RAPID).** See GPG, II.D.1.
- **Grant Supplements:** See GPG, I.E.4.

D. **Resources and References**

Resources

http://www.nsf.gov/ : Information about the NSF Education and Human Resources (EHR) Directorate and the Division of Research on Learning in Formal and Informal Settings (DRL).

http://www.caise.insci.org/ : General resource for informal science education professionals.

http://www.informalscience.org/ : Resource for research, evaluation, and techniques related to informal science learning, as well as examples of projects in informal STEM education.

http://www.exhibitfiles.org/ : Resource for exhibit developers.

http://www.cpb.org/stations/npsresearch : Resources for media professionals.

www.scienceafterschool.org/index : Resources compiled by The Coalition for Science After School.

http://www.citizenscience.org/ : Information about citizen science and related projects.

http://www.nsdl.org/ : Online digital library for STEM education and research.

References

American Statistical Association (2007). *Using statistics effectively in mathematics education research.* Retrieved March 27, 2009, from http://www.amstat.org/education/pdfs/UsingStatisticsEffectivelyinMathEdResearch.pdf .

Borgman, C.L., Abelson, H., Dirks, L., Koedinger, K., Linn, M., Lynch, C., et al. (2008). *Fostering learning in the networked world: The cyberlearning opportunity and challenge*. Retrieved March 27, 2009, from http://www.nsf.gov/pubs/2008/nsf08204/nsf08204.pdf .

Friedman, A. (Ed.). (2008). *Framework for evaluating informal science education projects*. Retrieved March 27, 2009, from http://caise.insci.org/resources/Eval_Framework.pdf .

National Research Council (2009). *Learning science in informal environments: People, places, and pursuits*. Washington, D. C.: The National Academies Press.

National Science Foundation (2005). *The mathematics education portfolio brief*, (NSF 05-03). Retrieved March 27, 2009, from http://www.nsf.gov/pubs/2005/nsf0503/nsf0503.pdf .

National Science Foundation (2006). *Investing in America's future: Strategic plan FY 2006-2011 (NSF 06-48).* Retrieved March 27, 2009, from http://www.nsf.gov/pubs/2006/nsf0648/NSF-06-48.pdf .

RAND Mathematics Study Panel (2003). *Mathematical proficiency for all students: Toward a strategic research and development program in mathematics education.* Santa Monica, CA: RAND Corporation.

III. AWARD INFORMATION

The ISE program expects to make approximately 40 awards based on anticipated funding of $25 million each in FY 2010 and FY 2011 for new awards. It is anticipated that approximately 6 Research, 6 Pathways, 20 Full-Scale Development, 3 Broad Implementation, and 5 Communicating Research to Public Audiences awards will be made as Standard or Continuing Grants per year, pending availability of funds.

Duration and Funding Levels:

Research: Project duration from one to five years. The maximum award is $1,500,000.

Pathways: Project duration is up to two years. The maximum award is $250,000.

Full-Scale Development: Project duration may be from one to five years. Full-Scale Development proposals will normally be funded in the $1 million to $3 million dollar range.

Broad Implementation: Project duration may be from one to five years. Broad Implementation proposals will normally be funded in the $1 million to $3 million dollar range.

Communicating Research to Public Audiences: Project duration may be up to two years and the maximum award is $150,000.

IV. ELIGIBILITY INFORMATION

Organization Limit:

None Specified

PI Limit:

For Communicating Research to Public Audiences projects ONLY: PI must hold an active NSF-funded research award in any NSF directorate or program.

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Additional Eligibility Info:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required):* Preliminary proposals are required and must be submitted via the NSF FastLane system.

PRELIMINARY PROPOSALS (Required for all proposal types except Communicating Research to Public Audiences):

A preliminary proposal (pre-proposal) is required in order to submit a full proposal for all ISE-specific project types except for Communicating Research to Public Audiences. Preliminary proposals provide an opportunity to assess the responsiveness of the project to the ISE guidelines and the potential to compete successfully in the merit review process.

Preliminary proposals must be submitted in FastLane no later than 5:00 p.m. local time on the due date immediately prior to the full proposal submission date. They are required in all cases, including resubmission of a proposal that has been previously declined. In the case of a resubmission, the proposal must be substantially revised. **A new preliminary proposal is required for each round of competition.**

The response to a preliminary proposal is either to encourage or discourage submission of a full proposal based on assessment by reviewers of the likelihood that a proposal will be competitive. This assessment is advisory, and full proposals may be submitted in either event. Written reviews provide feedback to PIs to strengthen their proposals. It is expected that proposals that are encouraged will continue to be clarified and some modifications may be made leading up to the submission of the full proposal; however, the basic concept and structure of the project must remain essentially the same.

The following instructions apply to preliminary proposals submitted to the ISE program:

Submission of a preliminary proposal requires completion of the following forms in FastLane. No additional NSF forms are required.

1. **Cover Sheet.** Be sure to include the program solicitation number and to check the Preliminary Proposal box.
2. **Project Summary**. The Project Summary is limited to one single-spaced page. **The first sentence must identify the kind of project: Research; Pathways; Full-Scale Development; or Broad Implementation.** The Project Summary is a critical proposal element that must make the essence of the project clear to the reviewer. It must succinctly identify the project's Intellectual Merit and Broader Impacts in separate sections under these two headings. **If Intellectual Merit and Broader Impacts are not explicitly identified, the proposal will be returned without review.**
3. **Project Description.** The narrative is a condensed version of the Project Description for a full proposal. **The first sentence must identify the kind of project: Research; Pathways; Full-Scale Development; or Broad Implementation.** It is limited in length to **six single-spaced pages**. It must identify the essential features of the project using the same category headings as for full proposals.
4. **Budget** (including Justification). The support requested from NSF should be entered in the budget forms generated in FastLane. It is not necessary to enter the budget for each year; an overall cumulative budget for the project is sufficient.
5. **Supplementary Documents.** Additional documents will NOT be accepted for preliminary proposals.

Other Fastlane forms (i.e., References, Biographical Sketches, Current and Pending Support) should NOT be submitted.

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 nsfpubs@nsf.gov.

If a proposal is resubmitted after being previously declined, it must be substantially revised, responding to concerns raised in the written reviews and Panel Summary. If not, the proposal will be returned without review. For full proposals based on previous Pathways Grants, the Final Report must have been submitted by the full proposal deadline date.

All proposals must include: Cover Sheet, Project Summary, Project Description (Narrative), References Cited, Biographical Sketches, Budgets (including Justification), Current and Pending Support, and Supplementary Documents (if applicable). Specific requirements for the ISE program that supplement the GPG Guidelines are described below. See section 7, Supplementary Documents, for allowable information.

1. **Cover Sheet**

   Proposers are reminded to include the number of this solicitation. Failure to do so will delay processing of the proposal. Proposals that require preliminary proposals must have the preliminary proposal number entered into the appropriate box on the Cover Sheet. Proposers should refer to the NSF Grant Proposal Guide, http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0929/gpg_2.jsp#IID7 , for information related to human subjects research.

2. **Project Summary**

   The Project Summary is limited to one page and is a critical proposal element that must make the essence of the project clear to the reviewer. **The first sentence must identify the project type: Research; Pathways; Full-Scale Development; Broad Implementation or Communicating Research to Public Audiences.** It must succinctly identify the project's Intellectual Merit and Broader Impacts in separate sections under these two headings. **If Intellectual Merit and Broader Impacts are not explicitly identified in the project summary, the proposal will be returned without review.**

3. **Project Description (Narrative)**

The first sentence must identify the project type: Research; Pathways; Full-Scale Development; Broad Implementation or Communicating Research to Public Audiences.

For consideration by the ISE program, **the Project Description must explicitly address all of the areas below.** The Project Description is limited to 15 single-spaced pages in length. Pay particular attention to the NSF typeface and font size requirements in the GPG.

a. **Project Rationale**

In this section the proposers should describe the primary project goals, hypotheses, research questions, or issues being addressed; the strategy or approach that will be undertaken; they should clearly identify the STEM focus; and they should make a case for the relevance of the STEM focus and nature and importance of the proposed work. The investigators must identify the public or professional audience, justify their approach as appropriate for that audience, and articulate the intended impacts. *Proposers must explain in what ways the project will advance knowledge, practice, capacity, or other critical aspects of informal STEM learning*. They must also explain how the proposed project builds upon the pertinent literature, prior practice, or research of others and of the team.

Results of Prior NSF Support by the PI or co-PIs within the past five years: The PI and co-PIs must describe relevant prior NSF-funded projects and especially their *outcomes* in sufficient detail for reviewers to assess the quality of prior efforts and how those relate to the proposed work. If a proposal is based on a prior Pathways project, the findings and accomplishments of that project must be clearly specified, *along with the award number and PI name*.

b. **Project Design**

As appropriate to the project type, the proposals should describe the research design, the development, the adaptation, or the implementation plans, or other approaches to be used in accomplishing the project objectives. Anticipated deliverables should be clearly specified. Intended learning outcomes and impacts should be provided. As appropriate, proposals should address how the project serves the needs and interests of diverse audiences and incorporates strategies for dissemination to reach targeted audiences, including outreach and other forms of relationship-building. For research projects, specific methodology and process should be discussed, and a case made that these methods or processes are systematic and suitable; data sources, audiences, methods for piloting and designing, instruments, outcome measures, and analysis plans should be included.

All projects must include an appropriate evaluation plan. See the *Framework for Evaluating Impacts of Informal Science Education Projects (Framework)*, available at http://www.caise.insci.org/ , for categories of impacts and guidance.

Research projects may be evaluated by an advisory board or other expert group that periodically reviews and reports in writing to the Principal Investigator on the progress of the team.

Pathways projects must conduct internal or external evaluation of what was learned over the course of the project that would inform decision making for subsequent proposals by the project team or others in the field. Lessons learned should include outcomes of the work that were particularly promising or particularly unpromising, with reasons.

Full-Scale Development projects should include *front-end evaluation, formative evaluation, and remedial evaluation* where appropriate. They must also include a summative evaluation conducted by an external evaluator.

Broad Implementation projects should include an external evaluation. The evaluation should assess the effectiveness of adaptations to achieve broader dissemination and indicate the quality of the STEM learning experience compared with the original program. The investigator must report some measure of the project output (such as the number of new learners or communities reached). We encourage investigators to create new approaches to conceptualizing magnitude of a project's impact.

The goals of many projects will include distributing the developed exhibitions, TV productions, and other products. Describe the distribution mechanisms and marketing plans to reach intended audiences. *Proposals in all categories must describe the plan for disseminating information about the project as widely as possible to interested professional communities and other groups, including both academic researchers and practitioners.* Projects are encouraged to explore creative ways to achieve broader impacts.

Note with respect to Institutional Review Board (IRB) Processes: Most proposals to this solicitation involve research or evaluation studies that will require review by the submitting organization's IRB. In some cases, the IRB letter will indicate an exemption from IRB review. In other instances, the project timeline may require that study protocols cannot be finalized until some period after the project has been initiated, and the IRB letter should so indicate. Information about human subject research can be found in the NSF Grant Proposal Guide. http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0929 .

c. **Project Management**

Explain how the project team and/or partner organizations will work collaboratively to achieve the deliverables and produce impacts that would not otherwise be possible. Describe the members of team, the collaborators, the senior personnel, advisory committee members, consultants, and contractors. Describe how they provide the relevant experience in STEM content, informal science learning, knowledge of target audiences, media, and research and evaluation. Provide a scheduled plan of work with major milestones for key project tasks. If applicable, present a logic model or flow chart of the project, including inputs, activities, outputs and outcomes.

4. ***References Cited***

Include references to relevant research literature in informal learning and other areas that support the proposed

strategies and approaches and evaluation.

5. **Budgets**

   All budget requests must be consistent with the project scope and duration. All budgets (grantee and subawards) must be accompanied by Budget Justifications that include itemizations corresponding to each FastLane budget line item. Requested equipment must be essential components of project deliverables, such as exhibits.

   Include under Travel (Line E on the FastLane budget) the cost for the PI to attend a two-day meeting annually at NSF. Each subaward on line G.5 requires a complete set of Proposal Budget forms accompanied by a Budget Justification that includes the basis for selecting the subawardee as well as itemization of expenses and explanations.

6. **Other Fastlane Forms**

   Biographical Sketches: Sketches must be provided for the PI, co-PIs, and other senior project personnel. These sketches need not follow a prescribed format, but must be limited to two pages per person. Biographical sketches should be sufficiently detailed to show that the necessary expertise is available to conduct the project.

   Current and Pending Support: Required for the PI, co-PIs, and senior project personnel. The proposal being submitted should be listed first and identified as *pending*.

   Facilities, Equipment & Other Resources: Not required for ISE proposals.

7. **Supplementary Documents**

   The 15-page Project Description must provide sufficient information for reviewers to make reasoned judgments about the proposed work.

   All ISE proposals are allowed to submit as Supplementary Documents:

   - Letters of commitment from consultants, advisors, and organizational partners indicating their roles in the project.

   Supplementary Documents--other than letters of commitment--are not allowed for Research, Pathways, and Communicating Research to Public Audiences projects. Proposals submitted in these three categories with additional Supplementary Documents will be returned without review.

   For Full-Scale Development and Broad Implementation projects only, it may be necessary to provide a *limited* amount of additional supporting information. Because reviewers may be asked to assess a substantial number of competing proposals, PIs must be *extremely judicious* in the number of pages submitted. *In most cases PIs should submit executive summaries and illustrative samples of materials rather than complete reports or publications.*

   For exhibition deliverables:

   - Provide floor plans or essential visual representations of exhibits or physical environments to be designed.
   - For traveling exhibitions, provide letters of interest from possible host institutions.
   - For broadcast media (film, video, radio) deliverables:
   - Provide documentation of interest or commitment from a major national or regional broadcast or cable outlet, or an indication of interest and distribution plan for a non-broadcast film.
   - Provide a treatment or script for one or more programs in any series of any broadcast media.

   For deliverables that involve media that cannot be represented on the printed page:

   - Only media that cannot be submitted in Supplementary Documents may be provided as DVD or CD; 15 copies labeled with proposal number, title, and PI, must be sent to: Informal Science Education Program, EHR/DRL, Room 885, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230 [phone: (703) 292-8616]. These materials, which will not be returned, must be received within 5 business days following electronic submission; clearly mark the package *re*: Supplementary Documents and indicate the proposal number.

   Note: Supplementary Documents are distinct from Appendices, as stipulated in the Grant Proposal Guide: All information necessary for the review of a proposal must be contained in Sections A through I of the proposal. **Appendices may not be included unless a formal deviation has been authorized**. See GPG Chapter II.A for more information about deviations.

Proposers are reminded to identify the program solicitation number (NSF 09-553) 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.

Other Budgetary Limitations:

Funding for the following are **not** supported by this program: capital or operating expenses; purchase of major or office equipment; vehicles; undergraduate tuition; paid advertising; admissions or similar fees; school field trips, camps, science fairs or similar competitions; or projects whose primary focus is health or medicine. Funds cannot be requested for costs recovered through the organization's indirect cost rate.

C. Due Dates

- **Preliminary Proposal Due Date(s)** ***(required)*** (due by 5 p.m. proposer's local time)***:***

  June 25, 2009

  except CRPA proposals

  June 24, 2010

  except CRPA proposals

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

  November 19, 2009

  except CRPA proposals

  November 18, 2010

  except CRPA proposals

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.

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.

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:

Each proposal will be reviewed for the strength of the case it makes for the project rationale, design, and management, i.e., the significance of the problem being addressed and possible impact, the innovative ideas being brought to the problem, and the quality of the overall team and its collaborative processes.

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 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.

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.

PIs are required to submit final evaluation reports of the project for posting to the web site http://www.informalscience.org/ (or other sites designated by ISE) as part of submission of the Final Report and (2) provide project data via the ISE program online project management system. PIs may be requested to provide additional project data for ISE program analysis and evaluation

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Address Questons to the Program, telephone: (703)292-8616, email: DRLISE@nsf.gov

For questions related to the use of FastLane, contact:

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

For administrative questions contact:

- Phyliss Minn, Senior Program Assistant, pminn@nsf.gov or (703) 292-5087.

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 Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

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

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

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding

grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

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

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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