# Advancing Informal STEM Learning (AISL)

## PROGRAM SOLICITATION
## NSF 14-555

## REPLACES DOCUMENT(S):
## NSF 13-608

**National Science Foundation**

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

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

July 10, 2014

   Science Learning+ Planning Proposals

November 14, 2014

   AISL Proposals

## IMPORTANT INFORMATION AND REVISION NOTES

Revision Summary regarding Full Proposals:

- Eliminates preliminary proposals or letters of intent;
- Replaces the Research and Full-Scale Development project types, and introduces two new project types: (1) Research in Service to Practice and (2) Innovations in Development;
- Enhances the descriptions of each project type and emphasizes that all proposals must clearly articulate how they advance evidence-based knowledge of STEM learning in informal learning environments through research and/or evaluation;
- Revises the description of what is required for external review and evaluation of projects; and
- Revises the description of dissemination.

Revision Summary regarding Science Learning+ Proposals:

This revised solicitation adds a new Program Type: Science Learning+ Proposals.

Science Learning+ is a collaborative effort of the NSF, and The Wellcome Trust and Economic and Social Research Council (ESRC) from the United Kingdom. The goal of the collaboration is to make transformational steps toward improving the knowledge bases and practices of informal STEM experiences to better understand, strengthen and coordinate STEM engagement and learning. The three key aims of Science Learning+ are:

1. Strengthening the research and knowledge base

2. Bridging the gap between research and practice

3. Developing venues for sharing knowledge and experiences.

## SUMMARY OF PROGRAM REQUIREMENTS

## General Information

**Program Title:**

   Advancing Informal STEM Learning (AISL)

**Synopsis of Program:**

   The **Advancing Informal STEM Learning** (AISL) program seeks to advance new approaches to and evidence-based understanding of the design and development of STEM learning in informal environments; provide multiple pathways for broadening access to and engagement in STEM learning experiences; advance innovative research on and assessment of STEM learning in informal environments; and develop understandings of deeper learning by participants.

   The AISL program supports six types of projects: (1) Pathways, (2) Research in Service to Practice, (3) Innovations in Development, (4) Broad Implementation, (5) Conferences, Symposia, and Workshops, and (6) Science Learning+ Proposals.

**Cognizant Program Officer(s):**

*Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.*

- Address Questions to the Program, telephone: (703)292-8616, email: DRLAISL@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:** 36 to 51

It is anticipated that about 6-10 Pathways awards, 7-10 Research in Service to Practice awards, 10-13 Innovations in Development awards, 3-6 Broad Implementation awards, 5-7 Conferences, Symposia, and Workshops awards will be made in FY 2015, pending availability of funds. EAGERS, RAPIDS, and CAREER awards are also made from these funds. Five (5) Science Learning+ Planning awards are anticipated in FY 2015, pending availability of funds. Up to three (3) Science Learning+ Partnership awards are anticipated in FY 2016.

**Anticipated Funding Amount:** $25,000,000 to $32,000,000

Normal limits for funding requests of AISL proposals are as follows: (1) Pathways projects: up to $300,000 with duration up to two years; (2) Research in Service to Practice projects: from $300,000 to $2,000,000 with a duration from two to five years; (3) Innovations in Development projects: $500,000 to $3,000,000 with duration up to five years; (4) Broad Implementation projects from $500,000 to $3,000,000 with a duration from two to five years; (5) Conferences, Symposia, and Workshops projects up to $250,000 with a duration of up to two years; and (6) Science Learning+ Planning projects up to $115,000 for a duration of one year in 2015, and Partnership projects up to $2.4 million with a duration of up to five years in 2016.

## Eligibility Information

**Who May Submit Proposals:**

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

**Who May Serve as PI:**

> There are no restrictions or limits.

**Limit on Number of Proposals per Organization:**

> There are no restrictions or limits.

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

> There are no restrictions or limits for Full Proposals. For Science Learning+ proposals, a PI can only submit one proposal as PI, but can be involved in other proposals as a Co-PI or in a staff/consultant/subaward relationship.

## Proposal Preparation and Submission Instructions

**A. Proposal Preparation Instructions**

- **Letters of Intent:** Not required

- **Preliminary Proposal Submission:** Not required

- **Full Proposals:**
    - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
    - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

**B. Budgetary Information**

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

**C. Due Dates**

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

    July 10, 2014

    > Science Learning+ Planning Proposals

## Proposal Review Information Criteria

**Merit Review Criteria:** National Science Board approved criteria apply.

## 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

**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 and engineering research and education enterprises.

The Directorate for Education and Human Resources (EHR) makes investments that support a healthy and robust national science, technology, engineering, and mathematics (STEM) education enterprise. The directorate works toward that vision through its mission, which is to support the preparation of a diverse, globally competent STEM workforce and a STEM-literate citizenry through investment in innovative research and development on STEM education and learning.

Opportunities to learn STEM effectively - for people of all ages, from all corners of the Nation, and in many venues (e.g., classrooms and living rooms; science centers and virtual centers) - are the foundation for a scientifically literate society and strong scientific workforce. These in turn are the basis for keeping our Nation globally competitive, prosperous and secure. EHR provides the focus for NSF's investments to advance STEM learning, scientific literacy, and a globally competitive science and engineering workforce.

The EHR investments are concentrated into three categories that form a strategic framework for the directorate's mission. Within each of these categories, EHR will continue to build and emphasize its research and development activities.

- Learning and learning environments: Investments in this category seek to develop understanding of the cognitive, affective, and non-cognitive foundations of STEM learning; to study emerging contexts and tools for learning STEM concepts and skills; and to build environments that promote new, high-impact learning opportunities for tomorrow's scientists and engineers, as well as citizens and students living in an increasingly technology-oriented society.
- Broadening participation in STEM: Programs in this category capitalize on the Nation's diversity in order to increase the scientific workforce by engaging and building capacity in *all* people in STEM learning and professional training, particularly those from groups that have been traditionally underrepresented in STEM fields.
- STEM workforce: Workforce investments are intended to improve the education and preparation of a STEM workforce that will be ready to capitalize on unprecedented advances in technology and science, and to address future global, social, and economic challenges. This framework positions the directorate to respond more readily to emerging opportunities created by

new technologies, improvements in the STEM education evidence base, administration priorities, and other national or societal needs.

Different programs within EHR emphasize different categories of the research and development activities (http://www.nsf.gov/about/budget/fy2014/pdf/25_fy2014.pdf).

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

### About the Division of Research on Learning in Formal and Informal Settings

The Division of Research on Learning in Formal and Informal Settings (DRL) supports the research and development of innovative resources, models, and tools for K-12 STEM education and teacher learning; research and development within partnerships of K-12 school districts and institutions of higher education; fundamental research on STEM learning; research and development of experiences that enable lifelong STEM learning inside and outside of school; research on national STEM education priorities; and evaluation studies and activities. While DRL-funded research may be situated in institutional and social settings and may involve development of learning resources, tools, and model learning environments, the principal goal is to understand and support STEM learning in all its forms, by the full range of learners, in a full range of settings. This includes development of innovative and effective approaches and instruments for promoting and assessing learning. A particular focus is on understanding how to improve STEM learning and education opportunities for all learners, including those from groups traditionally underrepresented in STEM - especially women, minorities, persons with disabilities, English-language learners, and veterans. DRL encourages the submission of EAGER, RAPID, INSPIRE, and CAREER proposals in its programs.

DRL funds projects through the following programs:

- Advancing Informal STEM Learning (AISL)
- Discovery Research K-12 (DRK-12)
- Innovative Technology Experiences for Students and Teachers (ITEST)
- Math and Science Partnership (MSP)
- Promoting Research and Innovation in Methodologies for Evaluation (PRIME)
- Research on Education and Learning (REAL)

Each program can be accessed from the DRL Web Page.

Solicitations in this Division have been informed by a newly issued publication, which was developed jointly by National Science Foundation and the Institute of Education Sciences in the U.S. Department of Education entitled, *Common Guidelines for Education Research and Development*. The *Guidelines* describe six types of research studies that can generate evidence about how to increase learning among target audiences. Research types include those that generate the most fundamental understandings related to education and learning; examinations of associations between variables; iterative design and testing of strategies or interventions; and assessments of the impact of a fully-developed intervention on an education outcome. For each research type, there is a description of the purpose and the expected empirical and/or theoretical justifications, types of project outcomes, and quality of evidence.

The *Guidelines* publication can be found on the NSF website with the number NSF 13-126 (http://www.nsf.gov/pubs/2013/nsf13126/nsf13126.pdf). A set of FAQs regarding the *Guidelines* are available with the number NSF 13-127(http://www.nsf.gov/pubs/2013/nsf13127/nsf13127.pdf). Grant proposal writers and PIs are encouraged to familiarize themselves with both documents and use the information therein to help in the preparation of proposals to NSF.

## II. PROGRAM DESCRIPTION

The **Advancing Informal STEM Learning (**AISL) program seeks to advance new approaches to and evidence-based understanding of the design and development of STEM learning in informal environments for public and professional audiences; provide multiple pathways for broadening access to and engagement in STEM learning experiences; advance innovative research on and assessment of STEM learning in informal environments; and develop understandings of deeper learning by participants.

Whether for personal satisfaction, professional advancement, or fulfilling learning requirements for pre-K through graduate and professional education, greater possibilities for accessing and understanding informal education are emerging through increased access to STEM learning anywhere and anytime. These personalized learning options and participatory learning environments are also expanding and broadening participation in STEM and blurring many distinctions between formal and informal learning settings. Many of these changes are related directly or indirectly to the pervasiveness and accessibility of digital technologies.

AISL invites proposals that: address immediate challenges and opportunities in informal education; anticipate radically different structures, functions, and purposes of informal STEM education; challenge existing assumptions about learning and learning environments; and envision the future needs of diverse learners, educators, and STEM professionals in this nation.

When trying to decide whether a proposal is appropriate for AISL, please consider the following:

- AISL projects should build on fundamental research in STEM education, including prior development and research efforts. These should provide theoretical and empirical justification for the proposed project.
- As a research and development program, AISL projects should contribute to the development of innovative products that are useable and useful for diverse participants. These products may include, but are in no way limited to, exhibitions and programs in museums, zoos, aquaria, planetariums, nature centers, parks, and other environments; science communication; after-school and summer programs; radio, television, film, or media programs or series; DYI/maker initiatives, research-related experiences such as citizen science, and on-line experiences such as games, simulations, social media, mobile computing, distributed networks, and massive online open courses. Projects may choose to include how content and practices connect with STEM-related frameworks and curricula, or college and career readiness standards in schools, universities, or other educational settings.
- AISL projects should generate knowledge about developing, testing, and implementing innovative research, models, resources, and tools in informal learning environments. Knowledge generating foci may include, for example, "what is happening," "to what extent," "why," "how," "what works for whom," and "under what circumstances."
- Outcomes from AISL projects should produce evidence of impact, utility, feasibility, and/or potential for wide-spread use, as well as evidence of advancing knowledge and the evidence base about STEM learning in informal learning environments.
- The AISL program also recognizes the complexities of measuring STEM learning in informal environments. As such, the

program encourages innovative assessment methods that draw from knowledge and practice of learning across these environments.

- The contributions of AISL projects to advancing knowledge and the evidence base in STEM education differ from the EHR Core Research program (ECR). AISL's research and development investments focus on the *translation* of foundational and early stage research to research, design, development, and implementation of STEM learning in informal environments. As such, the knowledge base to which AISL contributes most is more closely aligned with *theories of practice* and *designed-based research* than with foundational theory building.

**AISL Project Types**

The program supports six types of projects: (1) Pathways, (2) Research in Service to Practice, (3) Innovations in Development, (4) Broad Implementation, (5) Conferences, Symposia, and Workshops, and (6) Science Learning+ Proposals.

**(1) Pathways**

Projects can be funded for up to $300,000 total and up to two years in duration.

Pathways projects allow practitioners and researchers an opportunity to undertake exploratory development work or feasibility studies that have the potential to lead to the submission of innovative, field-advancing proposals of other project types, such as Research in Service to Practice or Innovations in Development. This type of project should produce evidence, findings, and/or deliverables that form the basis of anticipated further innovative, or potentially transformative, research and development work. The proposal needs to explicitly state how the project informs future work and how it contributes to the advancement of STEM learning in informal environments.

**(2) Research in Service to Practice**

Projects can be funded for $300,000 to $2 million and from two to five years in duration.

The Research in Service to Practice project type specifically focuses on research that advances knowledge and the evidence base for practices, assumptions, broadening participation, and emerging educational arrangements in STEM learning in informal environments. Successful research proposals identify a need for knowledge building in order to better understand or improve practice.

While all proposals are required to advance knowledge, Research in Service to Practice proposal have knowledge generating questions, such as "what is happening," "to what extent," "why," "how," "what works for whom," and "under what circumstances" as their primary focus.

Research in Service to Practice proposals may be qualitative and/or quantitative in nature; involve methodological advances; develop or adapt assessment instruments or scales; use large databases; aggregate data across multiple or distributed settings; focus on post-hoc analyses of existing data, or conduct longitudinal studies that shed light on the impact of STEM learning activities on participants, institutions, and/or systems.

The Research in Service to Practice project type may also include proposals for syntheses or meta-analyses, which address important research, development, and/or implementation research findings in STEM learning. The products of syntheses and meta-analyses should be useable by multiple audiences of educators. AISL particularly encourages such projects that provide research findings and recommendations that are useful to STEM education practitioners, researchers, and decision makers.

Proposals need to demonstrate a review of the literature and the underlying theoretical framework that informs the research plan. Proposals should detail research methods, including qualitative, quantitative, and iterative design-based data collection and analysis plans, as appropriate.

Research in Service to Practice proposals should describe how practitioners are integral collaborators in the research endeavor. Proposals are encouraged to include how research capacity among practitioners, new researchers, and/or evaluators is being enhanced through the project.

**(3) Innovations in Development**

Projects can be funded for $500,000 to $3 million and up to five years in duration.

The Innovations in Development project type is specifically expected to result in innovative models, programs, technologies, assessments, resources, and/or systems for any area of STEM learning in informal environments.

Projects should build on evidence from prior development and research efforts in the field. An explicit theoretical framework as well as either a logic model or theory of action should guide projects. (See notes in Supplementary documents).

In addition, proposals must articulate a plan and process for the design, development, implementation, and evidence-building components (based on research and/or evaluation) of the proposed work. Iterative, design-based research approaches are encouraged, if appropriate.

**(4) Broad Implementation**

Projects can be funded for $500,000 to $3 million and from two to five years in duration.

The Broad Implementation project type specifically supports the expansion of models, programs, technologies, assessments, resources, research, and/or systems that have a documented record of success, innovation, and/or evidence-based knowledge building. The documentation may include summative evaluation or research data that indicates readiness for distribution to a broader population or new setting(s).

The focus of expanded reach may include, but is not limited to, geography, age, socio-economic status, cultural/linguistic group, race and ethnicity, gender, disability, or learning setting. Where appropriate, investigators are encouraged to emphasize individuals from underrepresented or underserved groups as a target audience for a component or for the entire focus of the project.

Proposals must articulate a plan and process for the design, development, implementation, and evidence-building components (based on research and/or evaluation) of the proposed work. Project design may address innovative integration, incremental improvements, adaptations, or trials under typical conditions. Iterative, design-based research approaches are encouraged, if appropriate. Proposals should discuss how evidence (based on research and/or evaluation) will be collected to show broad implementation and impact.

**(5) Conferences, Symposia, and Workshops see** (GPG, II.D.8.)

Projects can be funded for up to $250,000 and are usually one to two years in duration

Conferences, Symposia, and Workshops should be well focused, relate to the goals of the AISL program, and generate product(s) usable by practitioners and researchers. The program is particularly interested in proposals that lead to, for example, the development of communities of practice, the formulation of field-advancing practice, assessments, and/or research agendas for the participating professional communities. Proposals should clearly indicate how the study contributes to the advancement of STEM learning in informal environments.

*Note: Proposals for Conferences, Symposia, and Workshops above $50,000 are now due on the solicitation deadline. Proposals under that threshold may continue to be submitted at anytime.*

### (6) Science Learning+ Planning Proposals

Science Learning+ is a partnership program with The Wellcome Trust and Economic and Social Research Council (ESRC) in the United Kingdom (UK) and NSF in the United States. Lead institutions in the UK apply through the Wellcome Trust (subawards to institutions in the US are acceptable) and lead institutions in the US apply through NSF (subawards to institutions in the UK are acceptable).

The vision of the Science Learning+ program is to make a transformational step to improve the knowledge bases and practices of informal STEM experiences to better understand, strengthen and coordinate their vital role in STEM engagement and learning.

***Objectives***

*Strengthen the research and knowledge base*

- research the value and impacts of informal STEM experiences, especially upon young people aged from birth to 19 years;
- develop a theoretical understanding of the processes which lead to these impacts;
- develop better methodologies to measure the impacts of informal STEM experiences especially upon learning and mediation of learning;
- build research capacity in informal STEM learning;

    *Bridge the practice and research gap*

- increase partnerships, understanding and influence between researchers and practitioners; develop collaborations among institutions and individuals engaged in informal STEM experiences;

- translate, communicate and document the outcomes of research into practice;

    *Share knowledge and experience*

- encourage the sharing of knowledge and skills relating to informal STEM learning, between researchers and practitioners, across different countries (particularly the UK and US), and across different areas of research expertise.

***Funding Priorities***

Proposals are sought to support practice-based research which falls into, or across, the following priorities:

*Understanding learning*

- Builds a better theoretical understanding of the extent to which people learn STEM as a result of informal experiences and how this differs qualitatively and quantitatively from more formally acquired knowledge, skills, practices, interest and identity.
- Explores how informal learning fits into the wider learning (and educational) environment, in understanding whether and how methods of teaching in informal settings work and in recognizing whether there are informal learning methods which could benefit formal STEM education.
- Explores how people learn in different informal settings and with different practitioners and how the impact of such learning varies with participant characteristics (e.g. age, gender, prior STEM knowledge and expectations).

(*Engagement in STEM Science, Technology, Engineering and Mathematics*)

- Seeks to understand how informal STEM experiences can spark people's desire to learn STEM in formal settings and beyond, convey information about possible careers in STEM, and improve scientific literacy.
- Engages in research that explores potential negative impacts of informal STEM experiences (e.g. accentuating gender stereotypes or increasing the impact of social disadvantage) and how any such outcomes can be avoided.

*Skills development*

- Identifies how informal STEM learning experiences build learners' confidence, social and communication skills, and other inter- and intra-personal skills and competencies, and how these may vary with different participant characteristics and across different learning environments.
- Explores the skills development of practitioners and researchers in informal learning. We are interested in how to build stronger collaborations between informal STEM educators and STEM education researchers, especially in understanding how best to enhance practitioners' use of research to improve practice and how best to incorporate practitioner needs into research designs.

*Equity, diversity and access to informal learning settings*

- Investigates how informal STEM settings particularly attract and engage under-served groups in STEM learning, including those young people who are not highly engaged in formal learning environments. We are interested in how informal experiences can act as a bridge to engage socially disadvantaged young people in STEM.

*Measurement of outcomes*

- Develops common instruments or ways to measure the outcomes of informal learning. We are interested in developing and researching new tools and frameworks to enable the sector to better understand the impacts they have on learners.
- Explores how proximal outcomes from informal learning (such as observations of participants and results from post-visit surveys) are linked to distal outcomes (such as increased attainment and ambition in STEM). Greater understanding of the links between proximal and distal outcomes might enable providers of informal learning to focus their evaluations on the proximal outcomes which are easier to measure.
- Examines the impact of informal STEM experiences through the exploration of large datasets.

*Funding Process*

Lead institutions in the UK apply through the Wellcome Trust (subawards to institutions in the US are acceptable) and lead institutions in the US apply through NSF (subawards to institutions in the UK are acceptable).

Grants will be funded in two phases:

*Phase 1: Planning Grants in 2015*.

Short-term (1-year) Planning Grants of up to $115,000 to enable groups of people and organizations in the UK and/or US to meet with each other and develop ideas and strategies. The plan is to fund up to five Planning Grants in FY 15.

Phase 1 will fund the proposals which:

- have a strong research hypothesis or design-based strategy informed by current evidence to be developed into a collaborative research proposal for Phase 2;
- identify the steps and actions to further refine and develop the research question and methods;
- involve collaborations between at least one researcher and at least one informal STEM practitioner;
- identify the other partners required to address the research question and the steps to bring them on board;
- demonstrate commitment to the overall aims of the program and agree to advance these through the sharing of plans, initial findings and participation in workshops;
- are unique in terms of contribution from partners, ambition, credibility and potential to impact the informal STEM learning sector

UK/US collaborations are strongly encouraged, but not essential in Phase 1.

*Phase 2: Partnership Grants in 2016*.

Longer-term research grants of up to $2.4 million for up to five years. While these will typically build on relationships established in Phase 1, successful funding in Phase 1 would not guarantee funding in Phase 2. In addition, Phase 2 will be open to new applicants (and any who were unsuccessful in receiving Phase 1 grants). The plan is to fund up to three Partnership Grants in FY16.

The final details and submission date for Phase 2 will be developed once Phase 1 is underway, and released as a Dear Colleague Letter within six months after the award of the Phase 1 grants. The Partnership Grants need to address some of the key research priorities. In addition, the Partnerships projects will require: 1) both UK and US partners, 2) experts from more than one academic area, and 3) exploration of more than one informal learning environment. We expect these grants to act as beacons for further work and development.

## Other Funding Opportunities

The programs listed below may also be of interest; see individual solicitations for due dates:

EHR Core Research (ECR) grants http://www.nsf.gov/pubs/2013/nsf13555/nsf13555.htm

Faculty Early Career Development (CAREER) grants http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503214

## Selected Resources

The Center for Advancement of Informal Science Education (CAISE) works in collaboration with the NSF AISL program to strengthen and advance the field of informal STEM education and its infrastructure by providing resources for NSF principal investigators, ISE professionals, and STEM researchers. *Resources on the CAISE InformalScience.org website may be pertinent to proposal preparation.* See http://informalscience.org/nsf-aisl for more information.

Institute of Education Sciences, U.S. Department of Education, and the National Science Foundation (August, 2013). Common Guidelines for Education Research and Development: A Report from the Institute of Education Sciences, U.S. Department of Education, and the National Science Foundation. NSF 13-126 (http://www.nsf.gov/pubs/2013/nsf13126/nsf13126.pdf). FAQs: NSF 13-127(http://www.nsf.gov/pubs/2013/nsf13127/nsf13127.pdf).

National Research Council (2012). *A Framework for K-12 Science Education: Practices, crosscutting concepts, and core ideas.* Washington, D.C.: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13165

National Research Council (2012). *Education for Life and Work: Developing transferable knowledge and skills in the 21st century*. Washington, D.C.: The National Academies Press. http://www.nap.edu/catalog.php?record_id=12190

National Research Council. (2011). *Expanding Underrepresented Minority Participation: America's science and technology talent at the crossroads.* Washington, D.C.: The National Academies Press. http://www.nap.edu/catalog.php?record_id=12984

National Research Council (2009). *Surrounded by Science*. Washington, D. C.: The National Academies Press. http://www.nap.edu/catalog.php?record_id=12614

National Research Council (2002). *Scientific Research in Education*. Washington, D. C.: The National Academies Press. http://www.nap.edu/catalog.php?record_id=10236

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President's Council of Advisors on Science and Technology (2010). Prepare and Inspire: K-12 Education in Science, Technology,

Engineering, and Math (STEM) for America's Future. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf

U.S. Department of Education, Office of Educational Technology. (2013). *Expanding Evidence Approaches for Learning in a Digital World,* Washington, D.C. http://www.ed.gov/edblogs/technology/files/2013/02/Expanding-Evidence-Approaches.pdf

U.S. Department of Education, Office of Educational Technology (March 5, 2012). *Transforming American Education: Learning powered by technology*. http://www.ed.gov/sites/default/files/netp2010.pdf

## III. AWARD INFORMATION

It is anticipated that about 6-10 Pathways awards, 7-10 Research in Service to Practice awards, 10-13 Innovations in Development awards, 3-6 Broad Implementation awards, 5-7 Conferences, Symposia, and Workshops awards will be made in FY 2015, pending availability of funds. EAGERS, RAPIDS, and CAREER awards are also made from these funds. Up to 5 Science Learning+ Planning awards, are anticipated in FY 2015, pending availability of funds.

$25 - $32M in FY 2015 are anticipated to be available for new awards made under this solicitation, pending availability of funds. Normal limits for funding requests of AISL proposals are as follows: (1) Pathways projects: up to $300,000 with duration up to two years; (2) Research in Service to Practice projects: from $300,000 to $2,000,000 with a duration from two to five years; (3) Innovations in Development projects: $500,000 to $3,000,000 with duration up to five years; (4) Broad Implementation projects from $500,000 to $3,000,000 with a duration from two to five years; (5) Conferences, Symposia, and Workshops projects up to $250,000 with a duration of up to two years; and (6) Science Learning+ Planning projects up to $115,000 for a duration of one year in FY 2015, and Partnership projects up to $2.4 million with a duration of up to five years in FY 2016.

## IV. ELIGIBILITY INFORMATION

**Who May Submit Proposals:**

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

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:**

There are no restrictions or limits.

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

There are no restrictions or limits for Full Proposals. For Science Learning+ proposals, a PI can only submit one proposal as PI, but can be involved in other proposals as a Co-PI or in a staff/consultant/subaward relationship.

## V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

## A. Proposal Preparation Instructions

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

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

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

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

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

*Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. Unless otherwise specified in this solicitation, you can decide where to include this section within the Project Description.*

**1. Cover Sheet.**

Proposers are reminded to include the number of this solicitation on the Cover Sheet. Failure to do so will delay processing of the proposal. (Grants.gov Users: The program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page).

All proposal submitted to AISL are assumed to have the potential for conducting research on human subjects. Therefore, proposers must select the human subjects box on the cover sheet. To avoid delays in processing, it is strongly recommended that PIs begin the process of obtaining appropriate Institutional Review Board (IRB) approvals or exemptions as awards will not be made without such approvals or exemptions. Proposers should refer to the NSF Grant Proposal Guide for information related to human subjects' research.

**2. Project Summary.**

Each proposal must a submit summary of the proposed project not more than one page in length. The Project Summary should be written in the third person, informative to other persons working in the same or related fields, and, insofar as possible, understandable to a scientifically or technically literate lay reader. It should not be an abstract of the proposal.

The Project Summary consists of three sections:

(1) Overview

- The first sentence must identify the AISL project type: Pathways, Research in Service to Practice, Innovations in Development, Broad Implementation, Conferences, Symposia, and Workshops, or Science Learning+.
- The Overview includes a description of the activity that would result if the proposal were funded and a statement of objectives and methods to be employed.

(2) Intellectual Merit: a statement on the intellectual merit of the proposed activity

- The statement on intellectual merit should describe the potential of the proposed activity to advance knowledge, and

(3) Broader Impacts: a statement on the broader impacts of the proposed activity.

- The statement on broader impacts should describe the potential of the proposed activity to benefit society and contribute to the achievement of specific, desired societal outcomes.

Please note that as part of NSF's effort to implement automated compliance checking in FastLane, the project summary section will now include three text boxes (Overview, Intellectual Merit, and Broader Impacts) and information must be entered into all three text boxes or the proposal will not be accepted by FastLane.

**3. Project Description (Narrative)** - for all proposal types except Science Learning+ Proposals (see section 3a for directions for Science Learning+ Proposals)

In addition to the requirements outlined in the GPG and this solicitation, the first sentence of the Project Description, like the Project Summary, must identify the AISL project type: (1) Pathways, (2) Research in Service to Practice, (3) Innovations in Development, and (4) Broad Implementation, (5) Conferences, Symposia, and Workshops, or (6) Science Learning+.

The narrative is limited to 15 single-spaced pages and should include the following information in section headings labeled A through E.

A. Project Rationale

All AISL proposals need to explicitly address each of the numbered items below.

1. Describe primary project goals, hypotheses, model, products, or research questions being proposed. As knowledge generation is a component of all AISL proposals, indicate how project goals, hypotheses, models, products, or research questions may seek to shed light on issues such as "what is happening," "to what extent," "why," "how," "what works for whom," and "under what circumstances."
2. State the foci of the project. Most proposals are likely to have a primary focus on STEM learning in informal environments. AISL also encourages projects to attend to broadening participation, including individuals from underrepresented and underserved groups, or to workforce development, including 21st century skills, and college and career readiness standards, when appropriate.
3. Explain how the proposed project builds on prior research and practice in STEM education. Provide theoretical and empirical justification for proposed project.
4. Explicitly discuss how the project is innovative, and how it will advance the evidence base for knowledge, practice, capacity, or other critical aspects of STEM learning in informal environments.
5. Identify the STEM content area(s). STEM content may focus on any areas of STEM that NSF supports, including interdisciplinary learning and learning that positions STEM within meaningful personal, cultural or societal frameworks. The STEM content area should be discussed in sufficient depth to provide a clear understanding of concepts, topics, processes, and associated skills that are conveyed to the target audience. Topics should be relevant to the age levels of proposed target audience(s). Projects may include STEM and art or the humanities.
6. If applicable, describe results of relevant prior NSF support of senior project personnel within the past five years, such that reviewers can judge the quality and impact of that work. If a proposal is based on a prior AISL award, the findings and

accomplishments of that project should be clearly specified, along with the award number and PI name.

B. Project Design

All AISL proposals need to explicitly address each of the numbered items below.

1. Describe the project's deliverables.
2. Describe measures of learning outcomes for the target audiences, including how the chosen measures are appropriate for the proposed work and of practical interest and utility to practitioners and decision makers. Recent reports encourage measuring learning outcomes in such terms as interest, engagement, motivation, behavior, identity, persistence, understanding, awareness, knowledge, and use of STEM content and practices, and 21$^{st}$ century skills.
3. Identify the target audience(s)-public or professional-for the work and an appropriate approach for reaching that audience. Public audiences may include learners of any age, educational level, geographic, or cultural background, including those from groups underrepresented in STEM or underserved in STEM, including geographic regions and economically challenged communities. Professional audiences may include those involved in any aspect of STEM learning in informal environments research or development, such as STEM educators, evaluators, education/learning researchers, technologists, media professionals, or STEM professionals doing outreach in informal settings. Address the relevance of STEM learning and project design to proposed target audiences and age levels.
4. If applicable, describe how the project encourages the broader participation in STEM experiences by individuals from groups underrepresented in STEM or those from underserved communities.
5. Describe the evidence-based knowledge generation process for the project, including the questions, instruments, methods, and analyses to be employed.
6. Describe the project's intended impacts on the informal STEM education field.

C. Dissemination Plan

All AISL proposals must include a creative communication strategy for reaching a broad audience for the resources and findings of the project including, where appropriate, practitioners, public audiences, scholars, and local, regional and national decision makers. While the potential results of the proposed research are expected to be of sufficient significance to merit peer-reviewed and broader publication, approaches that reach broader audiences are strongly encouraged. Proposals should identify the key elements of a communication plan, e.g., target audiences and identification of the channels/media/technologies appropriate for reaching specific audiences.

D. Evaluation and External Review

All AISL proposals must describe and make a strong case for how a project contributes to the knowledge base of the informal STEM learning field, through research, evaluation, or a combination of research and evaluation processes. External reviews of projects are also required and may take various forms, appropriate to the project.

**For projects that involve research studies**: External review processes might include an external review panel or advisory board proposed by the project or a third-party evaluator. The external critical review should be sufficiently independent and rigorous to (1) influence the project's activities at appropriate junctures in order to improve the quality of its findings and (2) near the completion of the project, determine if the project addressed its intended goals and comment on the quality of the project's work. Proposals should describe the expertise of the external reviewer(s); explain how that expertise relates to the goals and objectives of the proposal; and specify how the PI will report and use results of the project's external, critical review process.

**For projects with development components:** Proposals must include an evaluation plan and demonstrate that the evaluator(s) is involved from the early stage of the project's conception. The evaluation plan must emphasize the coherence between the proposal goals and the evidence of meeting such goals. It must be appropriate to the type, scope, and scale of the proposed project. It is strongly encouraged that the plans include front end, formative, and remedial/iterative evaluation, as appropriate to achieving the project's goals.

If an evaluation, and not a research component, is the project's primary means of advancing evidence-based knowledge of STEM learning in informal environments, the evaluation plan must include a summative evaluation. The summative evaluation should be sufficiently independent and rigorous to generate evidence of the impact of the project with respect to its intended outcomes. If the person(s) with evaluation expertise is internal to the project, then the external review process must incorporate an external review panel or advisory board that provides an objective, external review of the summative evaluation. (See guidelines for Allowable Additional Supplementary Documents).

E. Project Management

All AISL proposals need to explicitly address each of the numbered items below.

1. Describe the composition of the project's Leadership Team, which, as appropriate for the project, may include senior personnel, subawardees, consultants, and others, in addition to the PI and co-PIs . Proposals should construct their teams carefully, such that the leadership team includes expertise both in practice and in knowledge building. The project's management plan should make it clear how these expertise are both integrally involved in the design of project.
2. Describe members of the larger project team, including STEM professionals, collaborators, advisory board members, consultants, and contractors. Delineate the relevant experience and expertise that team members provide in STEM content, learning research, informal learning environments, knowledge of target audiences, media, research and evaluation--and how the project maximizes the use of appropriate collaborative efforts.
3. Explain the project's management plan and how the project team and partners will work collaboratively to achieve project outcomes.
4. Provide information on collaborations with any of the following individuals or groups connected to the proposal; e.g., practitioners, research scientists, learning researchers, evaluators, community groups, industry, graduate and undergraduate students, content or context specialists, co-designers, advisors, or presenters who engage directly with public audiences.
5. Delineate a schedule or work plan with major milestones for key project tasks.

*Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. Proposers may decide where to include this section within the Project Description*(GPG, II C-2 d (i)).

**3a. Project Description (Narrative)** for Science Learning+ Proposals

**Project Description (Narrative).The narrative is limited to 6 single-spaced pages for Phase 1 proposals and 15 single-spaced pages for Phase 2 proposals, and should include the following information in section headings labeled A through E:**

A. Project Rationale.

- Explain how the proposed project builds on fundamental research in STEM learning and prior research and development efforts. Provide theoretical and empirical justification for proposed effort.
- Provide the rationale for researching this particular area. How does it relate to the Funding Objectives and Priorities? Explicitly discuss how the project is innovative, and how it will advance the evidence base for knowledge, practice, capacity, or other critical aspects of informal STEM learning or learning environments.
- Identify the STEM content area(s) covered in the proposed project. STEM content may focus on any areas of STEM that NSF supports, including interdisciplinary learning and learning that positions STEM within meaningful personal, cultural or societal frameworks.
- If applicable, describe results of relevant prior NSF support of senior project personnel within the past five years, such that reviewers can judge the quality and impact of that work.

B. Project Objectives

- Provide a detailed description of the project's objectives and how they relate to the aims of the Science Learning+ program.

C. Project Design

- Provide the steps and actions to be taken to further refine and develop the research question(s) and methods;
- Identify other partners required to address the research question, and the steps which will be taken to bring them on board;
- Provide timescales and key milestones for the project.

D. Project Management

- Explain how the project team and partners will work collaboratively to achieve project outcomes.
- Describe members of the team, including collaborators, senior personnel, advisory committee members, consultants, and contractors. Delineate the relevant experience and expertise that team members provide in STEM content, learning research, informal STEM learning, knowledge of target audiences, media, research and evaluation--and how the project maximizes the use of appropriate collaborative efforts.
- Provide information on collaborations with key individuals or groups connected to the proposal (e.g., practitioners, research scientists, science of learning researchers, evaluators, community groups, industry, graduate and undergraduate students, content or context specialists, co-designers, advisors, or presenters who engage directly with public audiences).

E. Broader Impacts

Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. This section, labeled "Broader Impacts," may be placed anywhere within the project description/narrative.

**4. Budgets**

All budget requests must be consistent with the project scope and duration. All budgets, both grantee and subaward budgets, must be accompanied by budget justifications that include itemizations corresponding to each FastLane or Grants.gov budget line items and provide sufficient detail as to justify the expense and it relevance to achieving the project goals. Requested equipment must be essential components of project deliverables. **If personnel expenses are entered for postdoctoral scholars (section B of the budget), a one-page postdoctoral mentoring plan is required in the supplementary documents or the proposal will be returned without review (see GPG).**

Include under Travel (Line E on the FastLane budget and Field D on the Grants.gov budget) the cost for the PI to attend a two-day meeting every other year at, or near, NSF.

Each subaward on Line G.5 (FastLane) or Field F.5 (Grants.gov) 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.

**5. Other Forms**

Biographical Sketches: Sketches must be provided for the PI, Co-PIs, and other Senior Personnel and may not exceed two pages per person. These sketches may, but are not required to, follow the NSF prescribed format.

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: In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section (See the GPG Chapter II.C.2.i). The description should be narrative in nature and must not include any quantifiable financial information.

**6. Supplementary Documents**

**Note: Supplementary Documents are distinct from Appendices,** as stipulated in the Grant Proposal Guide: *Appendices may not be included* unless a formal deviation has been authorized. See GPG Chapter II.A for more information about deviations.

**Note:** The 15-page (6-page for Science Learning+ Planning proposals) Project Description must provide sufficient information for reviewers to make reasoned judgments about the proposed work.

**The following are required Supplementary documents:**

1. Postdoctoral Researcher Mentoring Plan. All AISL proposals that include funding for Postdoctoral researchers must submit a one page *Postdoctoral Researcher Mentoring Plan in the supplementary documents section otherwise the proposal may not be accepted or may be returned without review* (see GPG Chapter II.C.2.j. for additional instructions for preparation of this section).

2. Data Management Plan**.** FastLane will not permit submission of a proposal that is missing a **Data Management Plan.** Plans for data management and sharing of the products of research, including preservation, documentation, and sharing of data, samples, physical collections, curriculum materials and other related research and education products should be described in no more than two pages labeled "Data Management Plan" (see GPG Chapter II.C.2.j. for additional instructions for preparation of this section). For more information and the instructions for proposals submitted to the Directorate for Education and Human Resources (EHR) see: http://www.nsf.gov/bfa/dias/policy/dmp.jsp

**Allowable Additional Supplementary Documents:**

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

their commitment to participate, if funded.

2. Summaries of formative and summative evaluation findings of prior work (2 pg maximum in total), if applicable. Not allowed for Science Learning+ Proposals.

3. Additional details of logic models, theory of action, and evaluation plans, as appropriate for the proposed work (5 pg maximum in total). Not allowed for Science Learning+ Proposals.

4. PIs may submit an additional 30 pages maximum in the Supplementary Documents section in addition to the items listed above to provide a limited amount of additional supporting information, when applicable. For example, these may include scripts of media productions, exhibit sketches, and floor plans. Not allowed for Science Learning+ Proposals.

5. Deliverables that involve media or technology that cannot solely 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: Advancing Informal STEM Learning, EHR/DRL, Room 885, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230. These materials, which will not be returned, must be received within 5 business days following electronic submission of the proposal; clearly mark the package re: *Supplementary Documents* and indicate the proposal number. Not allowed for Science Learning+ Proposals.

## B. Budgetary Information

**Cost Sharing:** Inclusion of voluntary committed cost sharing is prohibited.

**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; expenses for school field trips, camps, science festivals, science fairs or competitions that are not integral to the conduct of the research and development efforts of the project; or projects whose primary focus is health or medicine.

## C. Due Dates

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

    July 10, 2014

        Science Learning+ Planning Proposals

    November 14, 2014

        AISL Proposals

## D. FastLane/Grants.gov Requirements

**For Proposals Submitted Via FastLane:**

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

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

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

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

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields

represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

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

## A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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

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

1. What is the potential for the proposed activity to

      a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and

      b. Benefit society or advance desired societal outcomes (Broader Impacts)?

2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

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

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

## 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 evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will be completed and submitted by each reviewer. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

For Science Learning+ proposals only, the recommendations of the NSF Program Officer and unattributed reviews will be shared with a committee jointly identified by NSF and the Wellcome Trust. This committee will review all submitted proposals. The committee will provide further advice regarding the quality and relative strength of the proposals. NSF Program Officers participating in the committee deliberations will consider the advice of the committee and will formulate a final recommendation regarding which proposals should be funded by NSF.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

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

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

## VII. AWARD ADMINISTRATION INFORMATION

## A. Notification of the Award

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

## B. Award Conditions

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

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

nsfpubs@nsf.gov.

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

**Special Award Conditions:**

As a result of this competition, NSF and Wellcome Trust will each make their own awards. Any proposals selected for funding by Wellcome Trust will be subject their standard terms and conditions.

## C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

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

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

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

PIs are required to (1) post final evaluation reports or other knowledge-building products of the project to the web site http://www.informalscience.org/ (or other sites designated by AISL) as part of submission of the Final Report and (2) provide project data via the AISL Online Project Monitoring System (OPMS). PIs may be requested to provide additional project data for AISL program analysis and evaluation.

## VIII. AGENCY CONTACTS

*Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.*

General inquiries regarding this program should be made to:

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

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

For administrative questions contact the Program by e-mail at DRLAISL@nsf.gov or phone at (703)292-8616

## IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website at https://public.govdelivery.com/accounts/USNSF/subscriber/new?topic_id=USNSF_179.

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

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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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**                   (703) 292-5111
  (NSF Information Center)**:**

- **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

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## 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
Office of the General Counsel
National Science Foundation
Arlington, VA 22230

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