

# Domestic Nuclear Detection Office/National Science Foundation Academic Research Initiative (ARI)

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## Program Solicitation

NSF 08-534

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*Replaces Document(s):*

NSF 07-545

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### National Science Foundation

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

Directorate for Engineering

Directorate for Mathematical & Physical Sciences

Office of Cyberinfrastructure

Office of International Science and Engineering



### Department of Homeland Security

Domestic Nuclear Detection Office

Transformational and Applied Research Directorate

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

April 11, 2008

April 01, 2009

First Wednesday in April, Annually Thereafter

through 2011

## SUMMARY OF PROGRAM REQUIREMENTS

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### General Information

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**Program Title:**

Joint Domestic Nuclear Detection Office/National Science Foundation: Academic Research Initiative (ARI)

**Synopsis of Program:**

In FY 2008, the Domestic Nuclear Detection Office (DNDO) within the Department of Homeland Security (DHS) will invest, in partnership with the National Science Foundation (NSF), in frontier research at academic institutions. This transformational research effort will be focused on detection systems, individual sensors or other research that is potentially relevant to the detection of nuclear weapons, special nuclear material, radiation dispersal devices and related threats. The joint DNDO/NSF effort, in coordination with the efforts of other agencies, seeks to advance fundamental knowledge in new technologies for the detection of nuclear threats and to develop intellectual capacity in fields relevant to long-term advances in nuclear detection capability. This research and the research community that will be built under the ARI are seen as critical to our nation's ability to deploy effective nuclear detection measures to counter the serious threat of a nuclear terrorist attack.

Proposals outside of the scope described in this solicitation will be returned without review.

**Research proposals on detection of biological, chemical, and conventional weapons are specifically excluded from the scope of this solicitation.**

**Cognizant Program Officer(s):**

- Rajinder Khosla, NSF Lead Program Director, Electronics, Photonics and Device Technologies, ENG/ECCS, telephone: (703) 292-8339, email: [rkhosla@nsf.gov](mailto:rkhosla@nsf.gov)
- Austin Kuhn, DNDO Lead Program Manager, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7619, email: [austin.kuhn@dhs.gov](mailto:austin.kuhn@dhs.gov)
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- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: [bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)
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- Shih Liu, Program Director, Sensor Innovation and Systems, ENG/CMMI, telephone: (703) 292-7017, email: [sliu@nsf.gov](mailto:sliu@nsf.gov)
- Richard Nader, Program Director, East Asia and Pacific Program, OD/OISE, telephone: (703) 292-7221, email: [rnader@nsf.gov](mailto:rnader@nsf.gov)
- Zeev Rosenzweig, Program Director, Analytical and Surface Chemistry MPS/CHE, telephone: (703) 292-7719, email: [zrosenzw@nsf.gov](mailto:zrosenzw@nsf.gov)
- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: [sspengle@nsf.gov](mailto:sspengle@nsf.gov)
- Usha Varshney, Division Director, Electrical, Communications and Cyber Systems, ENG/ECCS, telephone: (703)

- Nicholas Prins, Deputy Assistant Director, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7473, email: [nicholas.prins@dhs.gov](mailto:nicholas.prins@dhs.gov)

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.076 --- Education and Human Resources
- 47.079 --- Office of International Science and Engineering
- 47.080 --- Office of Cyberinfrastructure
- 97.077 --- Homeland Security Testing, Evaluation, and Demonstration of Technologies

**Award Information**

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**Anticipated Type of Award:** Other Grant - Standard grant for the first year from NSF. Award type for follow-up years determined by DNDO.

**Estimated Number of Awards:** 7 to 8 not to exceed \$400,000 annually per award for a maximum duration of five years with a maximum total award size of up to \$2,000,000, inclusive of both direct and indirect costs.

**Anticipated Funding Amount:** \$58,000,000 over a five-year period from 2007 to 2011 for ARI solicitations to be awarded through NSF and DNDO, subject to availability of funds and the quality and appropriateness of proposals received. FY 2008 is the second year of this program. In fiscal year 2008, the total funding available for this solicitation is \$3,000,000 for the first year of these awards. NSF will support the initial year of the projects with funds made available from DHS in accordance with NSF policies and conditions. Future funding beyond year one will be awarded and administered by DNDO, contingent upon awardees' progress and availability of funds, in accordance with the DHS/DNDO policies and procedures. This solicitation is anticipated to reopen annually with the number of additional projects selected based on the availability of funding and the progress of on-going projects.

**Eligibility Information**

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**Organization Limit:**

Proposals may only be submitted by the following:

- Universities and Colleges: Universities and two- and four-year colleges (including community colleges) located and accredited in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

**PI Limit:**

An individual researcher may not be named as a participant on more than one proposal submitted to this solicitation. This limitation includes participation as a PI, co-PI, senior researcher, consultant, or any other role for which financial remuneration is requested. ARI award funds may not provide salary support to industry, government laboratories, or international organizations, but may be used, in limited cases, to support travel in support of collaborative work.

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

None Specified

**Limit on Number of Proposals per PI: 1**

**Proposal Preparation and Submission Instructions**

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**A. Proposal Preparation Instructions**

- **Letters of Intent:** Not Applicable

- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpg](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/bfa/dias/policy/docs/grantsgovguide.pdf>)

## 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

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

April 11, 2008

April 01, 2009

First Wednesday in April, Annually Thereafter

through 2011

## Proposal Review Information Criteria

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**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

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**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

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In FY 2008, DNDO, in partnership with NSF, will invest in leading edge, frontier research on nuclear detection technology and other research that is potentially relevant to the detection of domestic nuclear threats.

Recent advances in nuclear detection technology have yielded innovative instruments and systems that have been of tremendous value to our national security. Additional frontier research in areas critical to our nation will yield similar advances. This is particularly true for the technologies applicable to countering the threat of a nuclear terrorist attack. Through this solicitation, DNDO, in partnership with NSF, will provide funding to establish and maintain strong research efforts at a broad range of academic institutions. These efforts will rebuild intellectual capability in academic disciplines relevant to nuclear detection through the initiation and maintenance of long-term frontier research at academic institutions.

This Academic Research Initiative (ARI) seeks to advance fundamental knowledge for nuclear detection. The DNDO/NSF investment will coordinate with and leverage on research currently underway in other areas of the federal government. The Department of Homeland Security, the Department of Energy, the Department of Defense, and others each fund active research into developing nuclear detection technology and systems. By making a long-term commitment to frontier research in the field, effective technologies and systems to counter such threats can best be developed and eventually implemented. This research and the research community that will be developed under the ARI are seen as critical to our nation's ability to deploy increasingly effective homeland security measures.

### Research Description

The sensitivity, resolution and stand-off capability of sensors and sensor systems determine what nuclear threats can be detected, at what location, and how quickly. This is particularly important for shielded nuclear material where the signatures are faint and difficult to distinguish from normally occurring background.

The key objective for any research into nuclear detection is to distinguish threats from non-threats in a realistic environment, thereby resulting in a detection system that has minimal-to-no false alarms. Topics include sensor and non-intrusive interrogation technologies, stand-off detection, signal processing, and autonomous system technologies.

Specific areas of research may include the development of detectors based on new detection materials that maximize the efficiency of the system while producing the best possible energy resolution. An example is advanced scintillators or semiconductors capable of excellent efficiency and resolution. Additional research may go toward the development of new detectors or systems that exploit non-traditional techniques to detect a photon or particle interaction in a material. These may be based on principles such as optical, microwave, or RF probes of the detector material, acoustic spectroscopy, calorimetry, or thermal methods or spatially resolving the electrons liberated by a photoelectric event. Areas of research in non-intrusive interrogation technologies may include the development of compact, reliable, high-flux neutron and photon generators that provide energy and directionality control.

Additionally, the miniaturization of nuclear detection equipment is needed. Some applications require portable, compact, rugged, and low-power detection systems. However, there are recognized physical limits to miniaturization since a certain

mass of material is needed to interact with radiation. Application-specific integrated circuits and other related devices are especially promising in the miniaturization of both electronics and photonics; research is needed in signal generation, fast readout, and processing and visualization in order to extract the maximum amount of information from small electronic signals produced by gamma or neutron interactions in the detection material. Also, in order to maintain active sensors in the field, small reliable power sources are required.

Complementing this sensor research would be advances in modeling and simulations and analysis of detector response and background, isotope identification, pattern recognition techniques, and prediction of materials properties. In addition, research in the area of nuclear forensics could provide significant benefit to DNDO while training the next generation of researchers.

Additional perspective is provided in the report on the *Workshop on the Role of the Nuclear Physics Research Community in Combating Terrorism*: <http://www.sc.doe.gov/henp/np/homeland/CombatTerrorismFinal110602.pdf>

## II. PROGRAM DESCRIPTION

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Under the broad category of nuclear detection, examples of possible topics that build on previous DNDO/DHS or NSF-supported research include:

### **Science and Engineering of Detector Materials, Concepts and Designs for New Sensors and Sensing Systems.**

Proposed research should have the potential to lead to sensors or sensor systems that are sensitive, selective, and stable with rapid response times. A unifying theme is to stimulate fundamental advances for *in situ* and remote sensing systems with a goal toward observing, modeling, and analyzing a wide range of nuclear threats. Research to significantly improve the yield and performance of sensor materials beyond those presently available is needed. This includes development and improvement of scintillator materials (e.g., faster response, higher light output, better linearity, and improvements in growth and fabrication) as well as semiconductor materials (e.g., reducing impurities, optimizing charge collection, allowing room temperature operation, and innovatively improving blocking contacts) with the goals of excellent efficiency and energy resolution. Proposed research should leverage recent advances in materials, molecular design (e.g., synthetic and theoretical chemistry), nanotechnologies (e.g., particles, molecules, clusters, quantum dots, and ceramics), microelectronics, photonics, telemetry, robotics, wireless communication, geographic information systems, sensor networks, and other methods for highly resolved spatial, spectral and temporal sensing. Research in non-traditional detector concepts including electro-optical, acousto-optical, microwave, or RF technologies that may involve actively probing materials via optical or other means are also of interest. Sensors or systems that are capable of mobility, large standoff distance, or unattended operation are desired. In addition, nation-wide deployment requires an emphasis on reduced cost and size as well as increased portability and reliability.

**Science and Engineering of Non-Intrusive Active Interrogation Systems; Particle Generators and Accelerators, Associated Detectors, and Algorithms for Improved Data Analysis.** This addresses full-system and system components aimed at quickly, reliably, and non-intrusively locating high density, high atomic number, and nuclear materials that may be hidden among a wide variety of non-threat materials. Research in the area of sources includes: 1) Particle accelerators with extremely large gradients, including muon generators and accelerators, 2) Tunable, high-duty, monochromatic photon sources with a selectable set of energies, 3) Directed high-flux neutron sources with neutron energies above 2 MeV. Research in detectors for interrogation systems include: 1) High efficiency detectors designed for radiography and/or tomography applications, and 2) Fast neutron detectors that are insensitive to gamma-rays and can discriminate neutron energies above several MeV. Research in fast, reliable, and automatic data analysis algorithms for imaging systems aimed at improving the determination of high-density, high atomic number, and nuclear materials is also relevant.

**Nuclear Forensics and Attribution.** Proposed research should emphasize advancements in the analytical techniques and instrumentation used in determining the origin and transit route of nuclear materials. These developments need to be applicable in providing assistance to law enforcement, federal, and international agencies responsible for oversight in the proliferation of these materials and in the identification of their origin. An emphasis is being given to identifying ways to improve instrumentation and techniques for the physical, chemical, radiological, or morphological analysis of nuclear or radioactive materials and any associated materials. Applications include determination of the origins, transport and use of these materials as well as prevention of their use. Acceptable studies can emphasize improvements in existing methods and instrumentation for chemical and radiological characterization, as well as the development of novel, advanced approaches. Improvements in the separation or analysis of non-nuclear material associated with nuclear materials, as well as automation, are also considered to be within the scope of this initiative. In addition, research studies which identify ways to improve on current utilization of "signatures" which can be used to identify source materials in the nuclear fuel cycle are encouraged.

In all cases, the DNDO and NSF, which will jointly manage the program, seek significant advances in nuclear detection capabilities. These advances can be based on new technology or by enabling transformational uses of current technology. Evolutionary (*i.e.* spiral) advances in current technology are generally not appropriate topics for ARI proposals.

This DNDO/NSF research program encourages PIs to consider the development of education programs for the training of graduate and undergraduate students in this important area. PIs are encouraged to provide innovative approaches that give

students substantial opportunities to gain deeper knowledge and expertise in this area. This program seeks to integrate research and education, which is a key strategy NSF supports and promotes. Proposals with an international dimension are welcome.

**Research proposals on detection of biological, chemical, and conventional weapons are excluded from the scope of this solicitation.**

#### TYPE OF SUPPORT

Proposals should involve a comprehensive program of innovative and high-risk research in a focused or interdisciplinary area with potential for high impact. The research must include the involvement of multiple undergraduate and graduate students as well as post-doctoral fellows. The requested budget may be for up to an all-inclusive total, including both direct and indirect costs, of \$2,000,000, not to exceed \$400,000 per year and a duration of five years. Collaborations with National Laboratories including, e.g. summer internships and other exchange of personnel, are strongly encouraged but must be performed on a no-exchange-of-funds basis.

All students supported with award funds must be citizens or permanent residents of the U.S., its territories, or its possessions.

### III. AWARD INFORMATION

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**Anticipated Type of Award:** Standard grant for the first year from NSF. Award type for follow-up years determined by DNDO.

**Estimated Number of Awards:** 7 - 8, not to exceed \$400,000 annually per award for a maximum duration of five years with a maximum total award size of up to \$2,000,000, inclusive of both direct and indirect costs.

**Anticipated Funding Amount:** \$58,000,000 over a five-year period from 2007 to 2011 for ARI solicitations to be awarded through NSF and DNDO, subject to availability of funds and the quality and appropriateness of proposals received. FY 2008 is the second year of this program. In fiscal year 2008, the total funding available for this solicitation is \$3,000,000 for the first year of these awards. NSF will support the initial year of the projects with funds made available from DHS in accordance with NSF policies and conditions. Future funding beyond year one will be awarded and administered by DNDO, contingent upon awardees' progress and availability of funds, in accordance with the DHS/DNDO policies and procedures. This solicitation is anticipated to reopen annually with the number of additional projects selected based on the availability of funding and the progress of on-going projects.

Estimated program budget, number of awards and average award size or duration are subject to the availability of funds, and the quality and appropriateness of proposals received.

### IV. ELIGIBILITY INFORMATION

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#### Organization Limit:

Proposals may only be submitted by the following:

- Universities and Colleges: Universities and two- and four-year colleges (including community colleges) located and accredited in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

#### PI Limit:

An individual researcher may not be named as a participant on more than one proposal submitted to this solicitation. This limitation includes participation as a PI, co-PI, senior researcher, consultant, or any other role for which financial remuneration is requested. ARI award funds may not provide salary support to industry, government laboratories, or international organizations, but may be used, in limited cases, to support travel in support of collaborative work.

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



None Specified

**Limit on Number of Proposals per PI: 1**

**Additional Eligibility Info:**

## V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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### A. Proposal Preparation Instructions

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**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](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg). Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov). Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (<http://www.nsf.gov/bfa/dias/policy/docs/grantsgovguide.pdf>). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@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.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

#### 1. Cover Sheet:

**Project Title Block:** The project title for ARI proposals must begin with "ARI-MA" and follow with an informative title.

**Program Selection Block:** This will be populated automatically upon selecting the ARI solicitation (see next program block).

**Program Solicitation Block:**

- **FastLane Users:** Select the ARI program solicitation number from the pull-down list. Entries on the cover sheet are limited to the principal investigator and a maximum of three co-principal investigators. Additional project leaders or senior personnel should be listed on the Project Summary page and entered into FastLane as senior investigators.
- **Grants.gov Users:** The ARI program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page. NSF allows one principal investigator and a maximum of three co-principal investigators to be identified on a proposal. Instructions for entering additional senior project participants are included in Section V.5. of the NSF Grants.gov Application Guide.

#### 2. Project Summary:



The Project Summary is limited to one page.

In addition to addressing the intellectual merit and broader impacts of the proposal, the Project Summary **must include a brief but explicit statement on how the proposed research relates to nuclear threat detection. Omission of this statement will result in the proposal being returned without review.**

### 3. Project Description:

**Descriptor Codes:** To facilitate the proposal review process, at the beginning of the project description, each proposal must specify a primary review code chosen from the following list:

Primary Review Code (specify one and only one)

CISE (for Computer & Information Science & Engineering)

ENG (for Engineering)

MPS (for Mathematical and Physical Sciences)

OCI (for Cyberinfrastructure)

IDP (for Interdisciplinary: optional designation for proposals that are broadly interdisciplinary or for which no single disciplinary area stands out as primary)

Also, to underscore multidisciplinary collaborations, up to two secondary review codes chosen from the list below may be specified below the primary review code:

Secondary Review Codes (specify from none up to two)

CISE (for Computer & Information Science & Engineering)

EHR (for Education and Human Resources)

ENG (for Engineering)

MPS (for Mathematical and Physical Sciences)

OCI (for Cyberinfrastructure)

INT (for International: optional designation for proposals that include a significant international dimension)

IDP (for Interdisciplinary: designation for proposals that are broadly interdisciplinary and/or for which no single disciplinary area stands out)

Project Descriptions must adhere to the 15 page limit, as described in the NSF Grant Proposal Guide (GPG) or NSF Grants.gov Application Guide.

Describe the vision and goals of the proposed research, approaches and methodologies to attain the goals, and the expected outcomes. **The project description must present a clear and compelling explanation of the cutting edge nature of the proposed research and its potential for significantly advancing nuclear detection capabilities. High risk proposals with the potential for high impact are encouraged.**

**Proposed Research:** Narrative consisting of the following items:

- An explanation of the scientific context, intellectual merit, relevance to nuclear threat detection, the transformational potential and timeliness of the proposed project;
- A description of the proposed research;
- A discussion of the broader impacts of the proposed work;
- If appropriate, a justification for why an effort involving at least two investigators is necessary to carry out the proposed project;

- If appropriate, a discussion of the mode of collaboration with description of any use of cyberinfrastructure;
- A description of the contribution to be made by each senior investigator;
- A timeline for the planned work; and
- Plans for disseminating the results.

**Modes of Dissemination and Education:** Narrative describing:

- The mode of training undergraduate students, graduate students, and postdoctoral researchers, including co-mentorship or other collaborative training; and
- Plans for dissemination and education/outreach, including any pilot activities.

**Management Plan:** If appropriate, narrative describing:

- How the group effort will be coordinated, including any use of cyberinfrastructure;
- How decisions will be made regarding the conduct of the project; and
- How collaboration will be evaluated;

**4. References Cited:**

References should include full titles of articles and book chapters cited. This section should include bibliographic citations only and must not be used to provide parenthetical information outside of the project description. Indicate with an asterisk (\*) references co-authored by two or more proposal investigators.

**5. Biographical sketches:**

For PIs, co-PIs and all senior personnel, provide brief biographical sketches using the format described in the Grant Proposal Guide. Note that recent collaborators and other affiliates should also be collected into the combined list given in the Supplementary Documentation (see below).

**6. Budget:**

Include up to five annual budgets, one for each year of the duration of the award; a cumulative budget will be automatically generated by FastLane or Grants.gov. A detailed budget justification (up to three pages) should document proposed expenses. Multi-institutional proposals should use the award-sub award proposal mechanisms or the collaborative mechanism (see GPG guidelines, chapter II.D.3).

Mention if any government furnished equipment (GFE, e.g. specific radioactive sources to calibrate or test detector systems) is required.

An annual grantees workshop will enable the investigators of grants awarded through this solicitation to review progress, exchange information, and promote collaborations. The PI, all co-PIs, and at least one of the students supported from each funded grant will be required to participate. Members of the DNDO global nuclear defense architecture team and appropriate members of the end-user community are also expected to be present at this annual workshop to provide guidance on the rapidly evolving needs in nuclear detection. Funds must be included in each year of the proposal budget for attendance at this annual workshop. For budgetary purposes the workshop may be assumed to be in the Washington, D.C. area and be of three days duration. This workshop will be a primary mechanism for the DNDO/NSF program managers to assess progress and thus to adjust the future funding profiles for individual projects.

**7. Current and Pending Support:**

A full description of the total level of current and pending support from all sources for the key personnel. Any overlap between federally funded projects and the proposed research must be clarified.

**8. Facilities:**

A description of the facilities (including laboratories, computational facilities, and cyber infrastructure) that will be made available to the project. Separate facilities descriptions should be included for multi-institutional projects or those involving non-academic partners.

**9. Suggested Reviewers/Reviewers Not to Include (Optional):**

Include potential reviewers who span the range of disciplines represented by the ARI proposal.

#### 10. Supplementary Documentation:

In addition, proposers must send the following information immediately after submission of their proposal. After receipt of the NSF proposal number follow the instructions found at <http://www.nsf.gov/eng/eccs/ari.jsp> to submit two lists: the first containing the last names, first names and institutional affiliations of all senior personnel (PI and co-PIs) and any named personnel whose salary is requested in the project budget; the second one containing the full names and institutional affiliations of all people having conflicts of interest with any senior personnel (PI and co-PIs) or named personnel whose salary is requested in the project budget. These lists will be used by DHS and NSF to check for conflicts of interest in assembling the review community.

### B. Budgetary Information

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

**Other Budgetary Limitations:** All students supported with award funds must be citizens or permanent residents of the U.S., its territories or its possessions.

### C. Due Dates

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

April 11, 2008

April 01, 2009

First Wednesday in April, Annually Thereafter

through 2011

### D. FastLane/Grants.gov Requirements

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- **For Proposals Submitted Via FastLane:**

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

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

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

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: <http://www.grants.gov/CustomerSupport>. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: [support@grants.gov](mailto:support@grants.gov). The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, will be reviewed. All proposals are carefully reviewed by DNDO/NSF staff, and by three to ten other persons outside NSF and DNDO who are experts in the particular fields represented by the proposal. These reviewers are selected by the DNDO/NSF 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 with the proposer.

### A. DNDO/NSF Merit Review Criteria

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All 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. DNDO and NSF will employ additional criteria as provided elsewhere in this solicitation 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>.

DNDO/NSF staff 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:**

The following additional merit review considerations apply:

- How well does the proposal describe how the project will lead to progress in addressing a "big problem" in detection of the nuclear threat that involves innovation and/or high risk?
- How well does the proposal describe why a project requires a long timeline, multi-disciplinary and/or multi-institutional effort?
- What potential does the project have for a major advance that is relevant to detection of shielded or unshielded nuclear weapons or special nuclear material (plutonium or highly enriched uranium)?
- What is the project's potential to attract broad scientific and public interest and support?
- How effective are the project's educational, dissemination, and, especially for large awards, management plans?

## **B. Review and Selection Process**

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Proposals submitted in response to this program solicitation will be reviewed by 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, a panel consisting of a DNDO Executive and an NSF Executive will recommend whether the proposal should be declined or recommended for award. DNDO/NSF are 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 date of receipt. The interval ends when the NSF/DNDO Executive Panel 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 DNDO/NSF Program Officers. 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/DNDO should be inferred from technical or budgetary discussions with an NSF/DNDO 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**

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### **A. Notification of the Award**

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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 DNDO/NSF Program Managers 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**

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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 Federal Demonstration Partnership (FDP) 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/>

[general\\_conditions.jsp?org=NSF](#). Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from [pubs@nsf.gov](mailto:pubs@nsf.gov).

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

### Special Award Conditions:

NSF will fund the initial year of the projects with funds made available from DHS in accordance with NSF policies and conditions. Future funding beyond year one will be awarded and administered by DNDO, contingent upon awardees' progress and availability of funds, in accordance with DHS/DNDO policies and procedures.

## C. Reporting Requirements

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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. Within 90 days after expiration of a grant, the PI also is required to submit a final project report.

Although NSF will provide funding only for the initial year of each award, all annual and final project reports must be submitted through FastLane.

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.

An annual grantees workshop will enable the investigators of grants awarded through this solicitation to review progress, exchange information, and promote collaborations. The PI, all co-PIs, and at least one of the students supported from each funded grant will be required to participate. Members of the DNDO global nuclear defense architecture team and appropriate members of the end-user community are also expected to be present at this annual workshop to provide guidance on the rapidly evolving needs in nuclear detection. Funds must be included in each year of the proposal budget for attendance at this annual workshop. For budgetary purposes the workshop may be assumed to be in the Washington, D.C. area and be of three days duration. This workshop will be a primary mechanism for the DNDO/NSF program managers to assess progress and thus to adjust the future funding profiles for individual projects. (Include in budget request.)

## VIII. AGENCY CONTACTS

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General inquiries regarding this program should be made to:

- Rajinder Khosla, NSF Lead Program Director, Electronics, Photonics and Device Technologies, ENG/ECCS, telephone: (703) 292-8339, email: [rkhosla@nsf.gov](mailto:rkhosla@nsf.gov)
- Austin Kuhn, DNDO Lead Program Manager, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7619, email: [austin.kuhn@dhs.gov](mailto:austin.kuhn@dhs.gov)
- Yogesh Gianchandani, Program Director, Integrated, Hybrid and Complex Systems, ENG/ECCS, telephone: (703) 292-8339, email: [ygiancha@nsf.gov](mailto:ygiancha@nsf.gov)
- Ani Aprahamian, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-8958, email: [aapraham@nsf.gov](mailto:aapraham@nsf.gov)
- Michael Foster, Division Director, Computing and Communication Foundations, CISE/CCF, telephone: (703) 292-

8910, email: [mfooster@nsf.gov](mailto:mfooster@nsf.gov)

- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: [bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)
- Warren Hein, Program Director, Division of Undergraduate Education EHR/DUE, telephone: (703) 292-4644, email: [whein@nsf.gov](mailto:whein@nsf.gov)
- Leland Jameson, Program Director, Computational Mathematics, MPS/DMS, telephone: (703) 292-4883, email: [lameson@nsf.gov](mailto:lameson@nsf.gov)
- Suhada Jayasuriya, Program Director, Control Systems, ENG/CMMI, telephone: (703) 292-7014, email: [sjayasur@nsf.gov](mailto:sjayasur@nsf.gov)
- Bradley Keister, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-7377, email: [bkeister@nsf.gov](mailto:bkeister@nsf.gov)
- Shih Liu, Program Director, Sensor Innovation and Systems, ENG/CMMI, telephone: (703) 292-7017, email: [sliu@nsf.gov](mailto:sliu@nsf.gov)
- Richard Nader, Program Director, East Asia and Pacific Program, OD/OISE, telephone: (703) 292-7221, email: [rnader@nsf.gov](mailto:rnader@nsf.gov)
- Zeev Rosenzweig, Program Director, Analytical and Surface Chemistry MPS/CHE, telephone: (703) 292-7719, email: [zrosenzw@nsf.gov](mailto:zrosenzw@nsf.gov)
- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: [sspengle@nsf.gov](mailto:sspengle@nsf.gov)
- Usha Varshney, Division Director, Electrical, Communications and Cyber Systems, ENG/ECCS, telephone: (703) 292-8339, email: [uvarshne@nsf.gov](mailto:uvarshne@nsf.gov)
- Nicholas Prins, Deputy Assistant Director, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7473, email: [nicholas.prins@dhs.gov](mailto:nicholas.prins@dhs.gov)

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: [fastlane@nsf.gov](mailto: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](mailto:support@grants.gov).

## IX. OTHER INFORMATION

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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, MyNSF (formerly the Custom News Service) 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 Regional 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. MyNSF also is available on NSF's Website at <http://www.nsf.gov/mynsf/>.

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 DOMESTIC NUCLEAR DETECTION OFFICE

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Recognizing the risks associated with the potential use of a nuclear weapon within the United States, the Department of Homeland Security (DHS) has integrated all nuclear detection research, development, testing, evaluation, acquisition, and operational support into a single office: the Domestic Nuclear Detection Office (DNDO). The DNDO will develop a global nuclear detection architecture; conduct research and development; and acquire and support the deployment of domestic nuclear detection systems.

The DNDO is a jointly staffed office established to improve the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the Nation, and to further enhance this capability over time.

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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

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

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

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

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

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

Send an e-mail to: [pubs@nsf.gov](mailto:pubs@nsf.gov)

or telephone: (703) 292-7827

• **To Locate NSF Employees:** (703) 292-5111

## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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

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