

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

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## Program Solicitation

10-526

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Replaces Document(s):  
NSF 09-532

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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 International Science and Engineering

Office of Cyberinfrastructure



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 15, 2010

## IMPORTANT INFORMATION AND REVISION NOTES

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

## 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 2010, 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):**

- Geoffrey A. Prentice, Lead Program Director, ENG/CBET, telephone: (703) 292-8320, email: [gprentic@nsf.gov](mailto:gprentic@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)
- Radhakishan Baheti, Program Director, ENG/ECCS, telephone: (703) 292-8339, email: [rbaheti@nsf.gov](mailto:rbaheti@nsf.gov)
- Clark Cooper, Materials and Surface Engineering, ENG/CMMI, telephone: (703) 292-7899, email: [ccooper@nsf.gov](mailto:ccooper@nsf.gov)
- Anne Emig, Program Director, OD/OISE, telephone: (703) 292-7241, email: [aemig@nsf.gov](mailto:aemig@nsf.gov)
- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: [bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)
- Leland Jameson, Program Director, Computational Mathematics, MPS/DMS, telephone: (703) 292-4883, email: [lameson@nsf.gov](mailto:lameson@nsf.gov)
- Bradley Keister, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-7377, email: [bkeister@nsf.gov](mailto:bkeister@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)
- John F. Mateja, Program Director, DUE/EHR, telephone: (703) 292-4641, email: [jmateja@nsf.gov](mailto:jmateja@nsf.gov)
- Allena K. Opper, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-8958, email: [aopper@nsf.gov](mailto:aopper@nsf.gov)
- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: [sspengle@nsf.gov](mailto:sspengle@nsf.gov)
- Jon Stoffel, Program Director, Program Director, OD/OCI, telephone: (703) 292-8544, email: [jstoffel@nsf.gov](mailto:jstoffel@nsf.gov)
- Sonya Williams, Science Assistant, ENG/CBET, telephone: (703) 292-7947, email: [sowillia@nsf.gov](mailto:sowillia@nsf.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:** - Standard grant for the first year from NSF. Award type for follow-up years determined by DNDO.

**Estimated Number of Awards:** 7 to 8 new awards in FY 2010, 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 2010 is the fourth year of this program. In fiscal year 2010, 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) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

### PI Limit:

None Specified

### Limit on Number of Proposals per Organization:

None Specified

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

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.

## 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/publications/pub\\_summ.jsp?ods\\_key=grantsgovguide](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide))

### 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 15, 2010

## 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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The Department of Homeland Security has been tasked to ensure that the United States remains safe from the illicit importation, development, procurement or use of a nuclear or radiological device. Recent advances in nuclear and radiological 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 or radiological terrorist attack. In FY 2010, DNDO, in partnership with NSF, will invest in leading edge, frontier research on nuclear detection technology and other research that is relevant to the detection of nuclear and radiological threats. Through this solicitation funding will be provided 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 in areas relevant to nuclear and radiological detection and interdiction. 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.

The sensitivity, resolution, and stand-off capability of sensors and sensor systems determine what nuclear and radiological threats can be detected, at what distances or locations, and how quickly. This is particularly important for shielded nuclear and radiological material where the signatures are faint and difficult to distinguish from naturally occurring background. The key objective for any research into nuclear detection is to distinguish signatures of interest from the background in a realistic environment, thereby resulting in a detection system that has minimal-to-no false alarms.

Analyses conducted by DNDO have highlighted a number of significant, long-term challenges in the deployment and operation of an effective nuclear and radiological detection architecture. Many of these challenges cannot be easily overcome with existing or near-term technology developments. For example, few effective, affordable, near-term technological solutions have been identified for:

- Radiation monitoring along the Nation's unattended air, land and sea borders;
- Mobile or re-locatable radiation detection and monitoring;
- Unattended or ubiquitous radiation detection sensing systems;
- Fusion of large amounts of highly complex and diverse information from multiple sensors and other sources

Solutions to many of these challenges will require sustained, long-term research to develop the fundamental scientific and technological foundation required to make such detection systems effective and affordable.

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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In order to effectively build on previous DNDO and NSF-supported research and fill critical nuclear detection mission areas, proposed research must fit into one or more of the following three general categories:

**Science and Engineering of New Detection System Concepts, Architectures, Networks and/or Associated Advanced Data Processing and Algorithms.** Proposed research should have the potential to lead to sensor or detection systems that are highly sensitive to signatures produced by nuclear and radiological materials and selective in the ability to distinguish and locate these materials from naturally occurring background. In addition, the future ability to deploy a detection system often requires an emphasis on reduced cost and size as well as increased portability and reliability. Research into new detection system concepts, architectures, or networks may include: 1) innovative techniques for detecting nuclear and radiological threats illicitly transported for use against the Nation via general aviation (non-commercial aircraft), small maritime craft (under 300 tons), and/or the expansive land borders between official Ports of Entry; and/or 2) innovative and advance data processing and analysis techniques which lead to significant improvements in the capability of a sensor or sensor system to detect and/or identify radiological materials, the ability of a detection system to image or locate a nuclear or radiological material, and/or the ability to fuse sensor data (both radiation and other sensors) to better overall detection system performance as well as enhancing the way in which detectors are used, operated, deployed, or networked. In all cases the research should include significant simulation and modeling to provide a fundamental basis to support the proposed approach.

**Science and Engineering of Non-Intrusive Active Interrogation Systems; Particle Generators and Accelerators, Associated Detectors, and Algorithms for Improved Data Analysis.** Proposed research should improve the automated material discrimination and/or anomaly detection capability of non-intrusive inspection (NII) systems used for air, land, and sea cargo; vehicle scanning; and human portable scanning scenarios on boats and in buildings. Examples of existing NII systems are radiography, computed tomography, spectral analysis (including NRF), and neutron-based assays. The research may address full-systems or system components including: 1) battery-operated, human-portable, compact neutron generators utilizing D-D fusion that can be pulsed up to 100 Hz (or more) with sharp on-off transitions (under 100 ns - no dark current) and with total yield greater than  $10^7$  n/sec; 2) high efficiency, fast recovery (under 50 ns), spectral detectors with better than 0.7% energy resolution (at 662 KeV) that provide an affordable solution to photon-based NII applications; 3) high-efficiency, threshold neutron detectors that effectively ignore neutrons below 3 MeV and discriminates photons from neutrons (rejecting more than  $10^4$  photons for every false neutron count); 4) small footprint (non-bremsstrahlung) photon source with energies that fall between 8 and 15 MeV (narrow/wide-band) with forward flux greater than  $10^8$  photons/cm<sup>2</sup>/second at one meter from source; and/or 5) automated image analysis algorithms for single and dual energy radiography systems.

**Nuclear Forensics for Attribution.** In the area of nuclear forensics analysis of pre-detonation materials, proposed research

should emphasize advancements in the analytical techniques that could be used to determine the origin and transit route of nuclear materials. Laboratory analysis determines physical, chemical, radiological, or morphological properties of a sample of material (or debris in the case of post-det). This process produces data such as ratios of isotopes or quantitative values of trace elements that feed into the data evaluation and interpretation processes. Research emphasis should include: 1) identifying ways to improve techniques, and methodologies (i.e., speed, accuracy, and precision in both existing and novel methods) for the physical, chemical, radiological, or morphological analysis of nuclear or radioactive materials including determination of the specific processing the material underwent, geographic origins, transport pathways, and intended use; 2) improvements in the separation or analysis of non-nuclear material associated with nuclear materials, as well as associated automation techniques; and/or 3) ways to improve on current utilization of signatures that can be used to identify source materials in the nuclear fuel cycle. Some research examples include radiological chronometric methods for determining the "purification age" of uranium ( $^{235}\text{U}$ - $^{231}\text{Pa}$  or  $^{241}\text{Pu}$ - $^{241}\text{Am}$  as trace in U matrix), physical and metallurgical forensic signature classification hierarchy (particle size distribution and morphology, grain structure, microstructure and inhomogeneities, etc...), computer tomography (CT) imaging as a tool applied to relevant materials on multiple length scales, and nuclear forensics applications of synchrotron light crystallography.

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 strongly encourages PIs to develop education initiatives that train graduate and undergraduate students in this important area. PIs are particularly encouraged to provide experiential opportunities that allow students to develop a deeper knowledge, expertise, and appreciation of this important area (e.g., undergraduate research experiences for individual students or for multiple students through a program like NSF's Research Experiences for Undergraduates Sites). 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 graduate students and is encouraged to include undergraduate 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 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 new awards in FY 2010, 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 2010 is the fourth year of this program. In fiscal year 2010, 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) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.

**PI Limit:**

None Specified

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

None Specified

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

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.

**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 [nsfpubs@nsf.gov](mailto: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](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](mailto: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.

**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 four 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 four 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.

The Project Summary must address the **intellectual merit** and **broader impacts** of the proposal and **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: designation for proposals that include a significant international dimension)

IDP (for Interdisciplinary: designation for proposals that are 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:

Proposers must submit the following information immediately after submission of their proposal to NSF separately from the Fastlane submission. After receipt of the NSF proposal number, follow the instructions found at <http://www.nsf.gov/eng/cmmi/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 during the selection of reviewers.

Additionally, in order to facilitate accurate and effective review of each submitted proposal by a group of experts, proposers are required to submit the following information noting which of the following categories best describe the proposed research. This information will be supplied to NSF following the directions listed at the same web site address listed above for conflicts. Proposers are allowed to select up to **two** per proposal of the following:

- Semiconductor Detector Materials
- Scintillator Detector Materials
- Other Detector Materials
- Neutron Detector Materials
- Neutron Detection Systems
- Integrated Detection Systems/Networks
- Nontraditional Detection Concepts
- Passive Detection Systems
- Non-Intrusive Imaging Systems/Techniques
- Active Interrogation Systems/Techniques
- Accelerators/Particle Generators for Active Interrogation
- Algorithms, Software Tools, or Analysis Techniques
- Nuclear Forensics
- Other (Explain)

If "Other" is being selected, please limit your explanation to a brief paragraph.

Proposals that request funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. The mentoring plan must not exceed one page (see GPG guidelines, chapter II.C.2j).

## 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 US, its territories or its possessions.

ARI award funds may not provide salary support to industry, government laboratories, or international partners, but may be used, in limited cases, to support travel in support of necessary collaborative work, including international research activities for participating U.S. students.

## C. Due Dates

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

## 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>.

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

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?

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**B. Review and Selection Process**

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 DNDO-NSF 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 or DNDO should be inferred from technical or budgetary discussions with an DNDO-NSF Program Officer. A Principal Investigator or

organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

## VII. AWARD ADMINISTRATION INFORMATION

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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 Research Terms and Conditions \* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

\*These documents may be accessed electronically on NSF's Website at [http://www.nsf.gov/awards/managing/award\\_conditions.jsp?org=NSF](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](mailto: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](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:

- Geoffrey A. Prentice, Lead Program Director, ENG/CBET, telephone: (703) 292-8320, email: [gprentic@nsf.gov](mailto:gprentic@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)
- Radhakishan Baheti, Program Director, ENG/ECCS, telephone: (703) 292-8339, email: [rbaheti@nsf.gov](mailto:rbaheti@nsf.gov)
- Clark Cooper, Materials and Surface Engineering, ENG/CMMI, telephone: (703) 292-7899, email: [ccooper@nsf.gov](mailto:ccooper@nsf.gov)
- Anne Emig, Program Director, OD/OISE, telephone: (703) 292-7241, email: [aemig@nsf.gov](mailto:aemig@nsf.gov)
- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: [bhamilto@nsf.gov](mailto:bhamilto@nsf.gov)
- Leland Jameson, Program Director, Computational Mathematics, MPS/DMS, telephone: (703) 292-4883, email: [ljamesson@nsf.gov](mailto:ljamesson@nsf.gov)
- Bradley Keister, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-7377, email: [bkeister@nsf.gov](mailto:bkeister@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)
- John F. Mateja, Program Director, DUE/EHR, telephone: (703) 292-4641, email: [jmateja@nsf.gov](mailto:jmateja@nsf.gov)
- Allena K. Opper, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-8958, email: [aopper@nsf.gov](mailto:aopper@nsf.gov)
- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: [sspengle@nsf.gov](mailto:sspengle@nsf.gov)
- Jon Stoffel, Program Director, Program Director, OD/OCI, telephone: (703) 292-8544, email: [jstoffel@nsf.gov](mailto:jstoffel@nsf.gov)
- Sonya Williams, Science Assistant, ENG/CBET, telephone: (703) 292-7947, email: [sowillia@nsf.gov](mailto:sowillia@nsf.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, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and

other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the [NSF web site](#).

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

## ABOUT THE DOMESTIC NUCLEAR DETECTION OFFICE

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: [nsfpubs@nsf.gov](mailto:nsfpubs@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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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA  
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

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11/07/06  
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