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

PROGRAM SOLICITATION
NSF 11-530

REPLACES DOCUMENT(S):
NSF 10-526

National Science Foundation

Directorate for Engineering

Directorate for Mathematical & Physical Sciences

Directorate for Computer & Information Science & Engineering

Directorate for Education & Human Resources

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):

May 23, 2011

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide (GPG)* Chapter II.C.2.g(xi) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

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

Synopsis of Program:

The ARI is a joint Domestic Nuclear Detection Office (DNDO) and National Science Foundation (NSF) program seeking novel cross-cutting research that will enable the nation's ability to prevent and respond to nuclear or radiological threats. This continuing program intends to expand its scope this year to include research in response and recovery from nuclear or radiological attack, with emphasis on multidisciplinary approaches. This year's solicitation topics will encompass two broad areas. First are investigations in new technologies, concepts or approaches to enhance the Global Nuclear Detection Architecture (GNDA) that in turn will lead to improved capabilities for the detection and interdiction of nuclear or radiological threat materials or devices. Second are investigations to aid in the effective response and recovery from nuclear or radiological events at the local, state and Federal level, to include investigations in nuclear forensics. Primary objectives of ARI include advancing fundamental knowledge in the above areas and developing intellectual capacity in fields relevant to long-term advances in these areas.

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):

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

- Paul J. Werbos, Lead Program Director, ENG/ECCS, telephone: (703) 292-8339, email: pwerbos@nsf.gov
- Joel Rynes, Acting Assistant Director, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7608, email: joel.rynes@dhs.gov
- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: bhamilto@nsf.gov
- Mark Wrobel, DNDO Lead Program Manager, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7629, email: mark.wrobel@dhs.gov
- Dennis Wenger, Program Director, ENG/CMMI, telephone: (703) 292-8606, email: dwenger@nsf.gov
- Bradley Keister, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-7377, email: bkeister@nsf.gov
- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: sspengle@nsf.gov
- Kyungseon Joo, Program Director, MPS/PHY, 1015N, telephone: (703) 292-8958, email: kjoo@nsf.gov
- Kevin Thompson, Program Director, Program Director, OD/OCI, telephone: (703) 292-4220, email: kthompso@nsf.gov
- Shih Chi Liu, Program Director, ENG/CMMI, telephone: (703) 292-7017, email: sliu@nsf.gov
- Richard W. Peterson, Program Director, DUE/EHR, telephone: (703) 292-4629, email: rpeterso@nsf.gov
- Dana Denick, Science Assistant, ENG/ECCS, telephone: (703) 292-8339, email: ddenick@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
- 47.080 --- Office of Cyberinfrastructure
- 97.077 --- Homeland Security Testing, Evaluation, and Demonstration of Technologies

Award Information

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 2011, 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 2011 to 2015 for ARI solicitations to be awarded through NSF and DNDO, subject to availability of funds and the quality and appropriateness of proposals received. FY 2011 is the fifth year of this program. In fiscal year 2011, 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

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

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.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

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

  May 23, 2011

Proposal Review Information Criteria

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

Award Administration Information

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

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

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I. INTRODUCTION

This Joint NSF/DNDO solicitation is seeking proposals for new ideas and technologies that will greatly improve the Nation's capability to prevent and respond to nuclear or radiological attacks. The Department of Homeland Security (DHS) 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. Critical to supporting this objective is cutting-edge research supporting the development of new capabilities for law enforcement and DHS components to aid detecting and interdicting these devices or component materials. Research is also required to improve capabilities to effectively respond and recover from nuclear or radiological events, and support U.S. capabilities for effective and timely attribution. In FY 2011 the Domestic Nuclear Detection Office (DNDO), a component of DHS, in partnership with the NSF will invest in leading edge, fundamental research in science and technology that will support the successful detection and interdiction nuclear and radiological threats. It is also considering expanding the scope of this research to enable the Nation's effective response and recovery from events that could result from these threats. Through this Academic Research Initiative (ARI), 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 the above objectives through the initiation and maintenance of long-term frontier research at academic institutions.

By making a long-term commitment to frontier research in this 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 capabilities. This DNDO-NSF program will coordinate with and leverage research currently underway in other areas of the federal government, to include research sponsored by DHS, the Department of Energy, and the Department of Defense.

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 or masked nuclear and radiological materials where detectable signatures are difficult to distinguish from naturally occurring background or intentional interference. A key research objective in threat detection is maximizing sensitivity and specificity for those threats, resulting in high confidence detection and interdiction with minimal false alarms and minimal impact to the flow of commerce.

Previous studies conducted by DNDO have highlighted a number of significant, long-term challenges in the deployment and operation of an effective Global Nuclear Detection Architecture (GNDA). The GNDA is a worldwide network of sensors, telecommunications, and personnel, with the supporting information exchanges, programs, and protocols that serve to deter, detect, identify, and report on nuclear and radiological devices and materials out of regulatory control. Many of these challenges cannot be easily overcome with existing or near-term technology developments. For example, few effective, affordable, near-term technological solutions or approaches have been identified for:

- Radiation monitoring along the Nation's unattended land and sea borders;
- Agile, mobile and re-locatable radiation detection and monitoring;
- Unattended or ubiquitous radiation detection sensing systems;
- High capacity, low dose scanning/screening technologies for cargo.

Solutions to these challenges will require sustained, long-term, interdisciplinary research to develop the fundamental scientific and technological foundation required to make such capabilities 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

Should our nation suffer from a nuclear or radiological attack, novel and effective strategies, technologies and approaches will be required to effectively respond to and recover from such an event. Research in a broad range of areas to improve resiliency, support prompt and effective response, and enable successful recovery and restoration efforts across multiple domains is required. Multidisciplinary approaches will be required to address many of these challenging research areas.

II. PROGRAM DESCRIPTION

In order to effectively build on previous DNDO and NSF-supported research and address the program objectives discussed above, proposed research must fit into one or more of the following three general categories:

1. Science and Engineering of Novel Detection System Concepts, Architectures and Networks for Challenging Pathways.

Proposals in this category should emphasize a study plan to investigate one or more pathways that may be used to illicitly transport nuclear and radiological materials or devices. Specifically, this study plan will detail a step-wise approach to investigating, assessing and recommending novel but practical and cost-effective concepts to detect and interdict threat materials being transported by means of one or more of the following pathways: general aviation (non-commercial aircraft), small maritime craft (under 300 tons), across expansive land border regions between official Ports/Points of Entry, and/or within the interior of the United States via intra and inter-state highways or waterways. Study plans should emphasize interdisciplinary approaches, and include proposed analyses, modeling and experimentation to support and defend the recommended concepts. These studies may include innovative or advanced

data processing and analysis techniques, operational modeling, adversary modeling, novel sensor design and applications, and novel systems or integrated approaches to threat detection. Successful approaches should dramatically enhance or support law enforcement and other front-line personnel's ability to detect, adjudicate and interdict nuclear and radiological threats.

Proposals are also encouraged that can address a grand challenge in radiation detection: development of a gamma-ray sensitive detection material that can achieve ≤ 1% energy resolution at 662 keV at room temperature and can be produced in large volume at low to moderate cost. For the purpose of this solicitation, large volume is taken to be 1 cubic inch but could in principle be grown to much larger volumes.

2. Science and Engineering of Non-Intrusive Inspection (NII) and Active Interrogation Systems for Detection of Nuclear / Radiological Threats.

Proposals under this topic should emphasize either a study plan or directed research to address one or more cargo modalities that require efficient and effective means of high volume, low-dose scanning for nuclear or radiological threats with minimal impact on the flow of commerce. Two modalities of particular interest are air cargo and rail cargo. A study plan will detail a step-wise approach to investigating, assessing and recommending novel but practical and cost-effective concepts to detect and interdict threat materials being transported by means of one or more modality. Study plans should emphasize interdisciplinary approaches, and include proposed analyses, modeling and experimentation to support and defend the recommended concepts. Successful approaches should dramatically enhance or support law enforcement and other front-line personnel's ability to detect, adjudicate and interdict nuclear and radiological threats when implemented in either primary or secondary scanning roles.

3. Nuclear/Radiological Response, Recovery and Forensics.

Proposals under this topic should focus on research specific to the unique challenges posed by populations and environments directly impacted by nuclear and radiological events, and specifically events related to the detonation of nuclear or radiological devices in urban environments. A broad range of potential research areas can be encompassed by this topic, but should emphasize approaches that can dramatically improve local, state and/or federal capabilities to respond and recover from such events. Studies in response may include comparative analyses of findings from previous experience in response to a nuclear or radiological event, or an assessment of current local/state response planning and preparedness. It may also include applied mathematical approaches to predicting complex system response and effects (psychological, social, economic, infrastructure) from these events, and investigation of education and communication strategies for first responders and the general public to support preparedness and response to these events. Studies in recovery may include comparative analyses of recovery from natural or technological disasters relative to nuclear or radiological attacks, or development of a theory for nuclear/radiological event recovery. It may also include research that can dramatically improve the resiliency and recovery of short- and/or long-term effects, to include social and psychological effects, particularly with emphasis on high risk populations and of critical infrastructure. Multidisciplinary approaches are highly encouraged, to include engineering, science, social, behavioral and economic sciences and planning. Research involving the development of medical diagnostics, treatments or prophylaxis for radiation exposure or medical decontamination is excluded from this topic.

Proposals for nuclear or radiological forensics should be specific to pre-detonation materials, and emphasize advancements in the analytical techniques that could be used to determine the origin and transit route of nuclear materials. Laboratory analyses include assessing the physical, chemical, radiological, or morphological properties of a sample of material (or debris in the case of post-detonation) that can have forensics value. Forensics value includes determination of the specific processing the material underwent, geographic origins, transport pathways, and intended use.

All proposals should emphasize fundamental and early applied research that can potentially support dramatically new or improved capabilities to detect and interdict nuclear and radiological threats, and respond to or recover from nuclear or radiological events.

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.

Research proposals specific to the detection of biological, chemical, and conventional weapons or materials are excluded from the scope of this solicitation, as are proposals not specific to the unique issues of nuclear and radiological response, recovery and forensics.

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 duration of five years. Duration of studies will typically be one year, with the potential for follow-on support dependent on the findings and recommendations of the study. 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

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 2011, 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 2011 to 2015 for ARI solicitations to be awarded through NSF and DNDO, subject to availability of funds and the quality and appropriateness of proposals received. FY 2011 is the fifth year of this program. In fiscal year 2011, 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 DHS, 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

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.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

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

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

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

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

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

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 a one page narrative and a quad chart that summarizes the effort.

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 enabling the global nuclear detection architecture and/or research objectives outlines in Section II. Program Description. Omission of this statement will result in the proposal being returned without review.**

The quad chart provides a single page summary of the effort and should include a picture, graphic or artist's conception of the effort in the top left, a summary of intellectual merit in the bottom left, a summary of broader impact on the top right, and a summary of schedule and proposed budget in the bottom right.

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 impact. 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 the solicitation topics in Section II, its potential long-term impact and timeliness of the proposed project;
- A detailed 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 multidisciplinary approach taken and its proposed benefits;
- A description of the contribution to be made by each senior investigator; and
- A timeline for the planned work.

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. Representatives of DNDO, DHS Science and Technology, other Federal agencies, and various National Laboratories and industry are also expected to be present at this annual workshop to provide an expanded opportunity for collaboration and information sharing. 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, but highly recommended):**

   Include potential reviewers who span the range of disciplines represented by the ARI proposal. Suggestions are also accepted for reviewers that may have interest and expertise on other topics described in the Program Description section.

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.goveng/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
    - Response and Recovery
    - 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. See Chapter II.C.2.j of the GPG for further information about this requirement.

    Proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. See Chapter II.C.2.j of the GPG for further information about this requirement.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

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

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

  May 23, 2011

D. FastLane / Grants.gov Requirements

- **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. 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. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www07.grants.gov/applicants/app_help_reso.jsp. 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. 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

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

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?
- What potential does the project have to improve local, state or Federal ability to respond or recover from, a nuclear or radiological attack, with significant reduction in likely damage?

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 a 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

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements.

Organizations whose proposals are declined will be advised as promptly as possible by the 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

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

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

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

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 DHS, contingent upon awardees' progress and availability of funds, in accordance with DHS/DNDO policies and procedures.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. 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. Representatives of DNDO, DHS Science and Technology, other Federal agencies and various National Laboratories and industry are also expected to be present at this annual workshop to provide an expanded opportunity for collaboration and information sharing. . 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

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

General inquiries regarding this program should be made to:

- Paul J. Werbos, Lead Program Director, ENG/ECCS, telephone: (703) 292-8339, email: pwerbos@nsf.gov
- Joel Rynes, Acting Assistant Director, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7608, email: joel.rynes@dhs.gov
- Bruce Hamilton, Program Director, Environmental Sustainability, ENG/CBET, telephone: (703) 292-8320, email: bhamilto@nsf.gov
- Mark Wrobel, DNDO Lead Program Manager, Transformational and Applied Research Directorate, DNDO, telephone: (202)254-7629, email: mark.wrobel@dhs.gov
- Dennis Wenger, Program Director, ENG/CMMI, telephone: (703) 292-8606, email: dwenger@nsf.gov
- Bradley Keister, Program Director, Nuclear Physics, MPS/PHY, telephone: (703) 292-7377, email: bkeister@nsf.gov

- Sylvia Spengler, Program Director, Information Integration and Informatics, CISE/IIS, telephone: (703) 292-8930, email: sspengle@nsf.gov
- Kyungseon Joo, Program Director, MPS/PHY, 1015N, telephone: (703) 292-8958, email: kjoo@nsf.gov
- Kevin Thompson, Program Director, Program Director, OD/OCI, telephone: (703) 292-4220, email: kthompso@nsf.gov
- Shih Chi Liu, Program Director, ENG/CMMI, telephone: (703) 292-7017, email: sliu@nsf.gov
- Richard W. Peterson, Program Director, DUE/EHR, telephone: (703) 292-4629, email: rpeterso@nsf.gov
- Dana Denick, Science Assistant, ENG/ECCS, telephone: (703) 292-8339, email: ddenick@nsf.gov

For questions related to the use of FastLane, contact:

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

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

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

ABOUT THE 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). DNDO will develop a global nuclear detection architecture; conduct research and development; and acquire and support the deployment of domestic nuclear detection systems.

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

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

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

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

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

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

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

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

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

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

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

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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