

# Secure and Trustworthy Cyberspace (SaTC)

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## PROGRAM SOLICITATION NSF 12-503

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### REPLACES DOCUMENT(S): NSF 10-575

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National Science Foundation

Directorate for Computer & Information Science & Engineering  
Division of Computer and Network Systems  
Division of Computing and Communication Foundations  
Division of Information & Intelligent Systems

Directorate for Social, Behavioral & Economic Sciences  
Division of Social and Economic Sciences

Directorate for Mathematical & Physical Sciences  
Division of Mathematical Sciences

Office of Cyberinfrastructure

Submission Window Date(s) (due by 5 p.m. proposer's local time):

January 04, 2012 - January 11, 2012

Small Projects

January 12, 2012 - January 25, 2012

Medium Projects

February 08, 2012 - February 22, 2012

Frontier Projects

## IMPORTANT INFORMATION AND REVISION NOTES

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This program originated with the Trustworthy Computing program in CISE (CISE Cross-Cutting Programs, [NSF 10-575](#)) and has been extended to include SBE, OCI and MPS.

This solicitation will not fund "large" projects; instead, it seeks to fund at least two Frontiers in Cybersecurity projects. These are large, multi-institution projects that will provide high-level visibility to grand challenge research areas. These projects may have total budgets up to \$10,000,000 with durations of up to five years.

### Important Reminders

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

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### General Information

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Program Title:

Secure and Trustworthy Cyberspace (SaTC)

Synopsis of Program:

Cybersecurity is an important challenge in today's world. Corporations, agencies, national infrastructure and individuals have been victims of cyber-attacks. Addressing this problem requires multi-disciplinary expertise in human, statistical, mathematical, computational, and computer sciences and ultimately the transition of new concepts and technologies to practice.

The SaTC program seeks proposals that address cybersecurity from one or more of three perspectives: *Trustworthy Computing Systems*, *Social, Behavioral and Economics*, and *Transition to Practice*, as well as proposals that combine multiple perspectives. Proposers are invited to submit proposals in three project classes, which are defined below:

- Small projects - up to \$500,000 in total budget, with durations of up to three years
- Medium projects - \$500,001 to \$1,200,000 in total budget, with durations of up to four years
- Frontier projects - \$1,200,001 to \$10,000,000 in total budget, with durations of up to five years

Projects with Trustworthy Computing Systems and/or Social, Behavioral and Economic perspectives can include an optional *Transitions* phase, described in a supplemental document of no more than five pages. This phase should describe how successful research results are to be further developed, matured and experimentally deployed in organizations or industries, including in networks and end systems used by members of the NSF science and engineering communities. Proposals for small or medium projects with a Transitions phase can exceed the above-stated maximums up to \$167,000 in the small category and as much as \$400,000 in the medium category.

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.*

- Jeremy Epstein, Program Director, 1175, telephone: (703) 292-8950, email: [jepstein@nsf.gov](mailto:jepstein@nsf.gov)
- Samuel Weber, Program Director, CISE/CNS, 1175, telephone: (703) 292-7096, email: [sweber@nsf.gov](mailto:sweber@nsf.gov)
- Kevin Thompson, Program Director, OCI, 1145, telephone: (703) 292-4220, email: [kthompso@nsf.gov](mailto:kthompso@nsf.gov)
- Peter Muhlberger, 995, telephone: (703) 292-7848, email: [pmuhlber@nsf.gov](mailto:pmuhlber@nsf.gov)
- Andrew D. Pollington, Program Director, MPS/DMS, 1025, telephone: (703) 292-4878, email: [adpollin@nsf.gov](mailto:adpollin@nsf.gov)
- Nina Amla, 1115, telephone: (703) 292-8910, email: [namla@nsf.gov](mailto:namla@nsf.gov)
- Sol Greenspan, 1115, telephone: (703) 292-8910, email: [sgreensp@nsf.gov](mailto:sgreensp@nsf.gov)
- Vijayalakshmi (Vijay) Atluri, 1125, telephone: (703) 292-8930, email: [vatluri@nsf.gov](mailto:vatluri@nsf.gov)

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

- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.075 --- Social Behavioral and Economic Sciences
- 47.080 --- Office of Cyberinfrastructure

### Award Information

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Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 64

NSF anticipates up to 50 Small awards, up to 12 Medium awards and up to 2 Frontier awards in FY12.

Anticipated Funding Amount: \$50,000,000

Up to \$50,000,000 dependent upon the availability of funds in FY12.

### Eligibility Information

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Organization Limit:

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

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

An individual can participate as a PI, co-PI or Senior Personnel on no more than two proposals, regardless of the perspective or category to which the proposals are submitted.

## 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: Inclusion of voluntary committed cost sharing is prohibited.
- Indirect Cost (F&A) Limitations: Not Applicable
- Other Budgetary Limitations: Not Applicable

### C. Due Dates

- Submission Window Date(s) (due by 5 p.m. proposer's local time):

January 04, 2012 - January 11, 2012

Small Projects

January 12, 2012 - January 25, 2012

Medium Projects

February 08, 2012 - February 22, 2012

Frontier Projects

## 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: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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## I. INTRODUCTION

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The Nation's critical infrastructure, including the Internet, creates significant social value, and plays a vital role in tightly integrating the economic, political and social fabric of society. However, our infrastructure remains vulnerable to a wide range of threats that challenge its security. Overcoming this present and growing vulnerability is a major challenge. It calls for long-term investments in a wide area of scientific fields, and a focus on ensuring the adoption and implementation of new technologies that emerge from research.

## II. PROGRAM DESCRIPTION

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Cybersecurity is an important challenge in today's world. Corporations, agencies, national infrastructure and individuals have been victims of cyber-attacks. Attacks exploit weaknesses in technical infrastructures and human behavior. Understanding the motivation and incentives of individuals and institutions, both as attackers and defenders, can aid in creating a more secure and trustworthy cyberspace. Addressing this problem requires multi-disciplinary expertise in human, statistical, mathematical, computational, and computer sciences and ultimately the transition of new concepts and technologies to practice.

This program welcomes proposals that address Cybersecurity from a Trustworthy Computing Systems perspective, a Social, Behavioral and Economic perspective, and a Transition to Practice perspective. In addition, we welcome proposals that integrate research addressing two or more of these perspectives. Proposals may be submitted in one of the following three categories:

- Small projects: up to \$500,000 in total budget, with durations of up to three years
- Medium projects: \$500,001 to \$1,200,000 in total budget, with durations of up to four years
- Frontier projects: \$1,200,001 to \$10,000,000 in total budget, with durations of up to five years

Small and medium projects with Trustworthy Computing Systems and/or Social, Behavioral and Economic perspectives can include an optional *Transitions* phase, described in a supplemental document of no more than five pages. This phase should describe how successful research results are to be further developed, matured, and experimentally deployed in organizations or industries, including in networks and end systems used by members of the NSF science and engineering communities. Proposals with a Transitions phase can exceed the above-stated maximums up to \$167,000 for small projects and as much as \$400,000 for medium projects.

Frontier Projects, with total budgets ranging from \$1,200,001 to \$10,000,000 for durations of up to five years, are well suited to two or more investigators (PI, co-PI(s), or other Senior Personnel), and a team of students and/or postdocs. NSF seeks to fund at least two Frontiers in Cybersecurity projects this year. They should be large, multi-institution projects that provide high-level visibility to grand challenge research areas. Project descriptions must be comprehensive and well-integrated, and should make a convincing case that the collaborative contributions of the project team will be greater than the sum of each of their individual contributions. Rationale must be provided to explain why a budget of this size is required to carry out the proposed work. Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, a Collaboration Plan is required for all Frontier proposals. The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Frontier projects may be submitted to the Trustworthy Computing Systems Perspective and/or the Transition to Practice Perspective. Frontier projects may also include the Social Behavioral, and Economic Perspective if it is integrated into one or both of the other perspectives.

### Trustworthy Computing Systems Perspective

Proposals addressing Cybersecurity with a Trustworthy Computing Systems perspective aim to provide the basis for designing, building, and operating a cyberinfrastructure with improved resistance and improved resilience to attack that can be tailored to meet a wide range of technical and policy requirements, including both privacy and accountability. Within its scope, the program supports all research approaches from theoretical to experimental, including participation by human subjects. Theories, models, cryptography, algorithms, methods, architectures, languages, software, tools, systems and evaluation frameworks are all of interest.

Of particular interest is research addressing how better to design into components and systems desired security and privacy properties. Methods for raising attacker costs by incorporating diversity and change into systems, while preserving system manageability, are also relevant.

Research that studies the tradeoffs among trustworthy computing properties, e.g., security and usability, or accountability and privacy, as well as work that examines the tension between security and human values such as openness and transparency is also welcomed. Also, methods to assess, reason about, and predict system trustworthiness, including observable metrics, analytical methods, simulation, experimental deployment and, where possible, deployment on live testbeds for experimentation at scale are considered. Statistical, mathematical and computational methods in the area of cryptographic methods, new algorithms, risk assessments and statistical methods in cybersecurity are also welcome.

### Social, Behavioral and Economic Perspective

Proposals addressing the Social, Behavioral and Economic perspective of Cybersecurity may include research at the individual, group, organizational, market, and societal levels, identifying cybersecurity risks and exploring the feasibility of potential solutions. All research approaches, including (but not limited to) theoretical, experimental, observational, statistical, survey, and simulation-based are of interest.

Strong proposals will demonstrate the capabilities of the research team to bring to bear state-of-the-art research in the human sciences to the question. Strong proposals will seek to understand, predict and explain prevention, attack and/or defense behaviors and contribute to developing strategies for remediation. Proposals that contribute to the design of incentives, markets or institutions to reduce either the likelihood of cyber attack or the negative consequences of cyber attack are especially welcome, as are proposals that examine incentives and motivations of individuals.

Proposals submitted with a Social, Behavioral and Economic perspective will be evaluated with careful attention to the following:

- The mutual application of, and contribution to, basic Social, Behavioral and Economic science research.
- The generalizability of the research to multiple cyber security settings.
- The ultimate contribution to the construction of institutions that induce optimal behavior.

Proposals submitted with a SBE perspective may be submitted to the Small and Medium categories. In FY 12, SBE perspective proposals may also be submitted to an SBE standing program in response to their Spring solicitation due dates.

#### Transition to Practice Perspective

Proposals from this perspective address the challenge of moving from research to capability. Proposals leverage successful results from previous and current basic research and focus on later stage activities in the research and development lifecycle - applied research, development, prototyping, testing, and experimental deployment. Strong preference will be given to projects whose outcomes result in fielded capabilities and innovations of direct benefit to networks, systems and environments supporting NSF science and engineering research and education. Preference will be given to proposals addressing one of the following topic areas: malware detection and prevention, situational understanding, data assurance, risk analysis, and software assurance. Any software developed in this program area is required to be released under an open source license listed by the Open Source Initiative (<http://www.opensource.org/>). Additional review criteria also apply to this program area, as described below.

Proposals submitted with a Transition to Practice perspective will be evaluated with careful attention to the following:

- The expected impact on the deployed environment described in the proposal.
- The extent to which the value of the proposed cybersecurity research and development is described in the context of a needed capability required by science and engineering, and potential impact across a broader segment of the NSF community.
- The feasibility, utility, and interoperability of the capability in its proposed operational role.
- A project plan that addresses in its goals and milestones the demonstration and evaluation of a working system in the target environment.
- Tangible metrics described to evaluate the success of the capabilities developed, and the steps necessary to take the system from prototype status to production use.

#### Transitions Phase

Proposals for small or medium projects that are submitted without a Transition to Practice perspective may include an optional Transitions phase, described in a supplemental document of no more than five pages. This phase should describe how successful research results are to be further developed, matured and experimentally deployed in organizations or industries, including in networks and end systems used by members of the NSF science and engineering communities. Proposals with a Transitions phase can exceed the above-stated maximums of up to \$167,000 for small projects and \$400,00 for medium projects.

Proposals submitted with a Transitions phase will be evaluated with careful attention to the following:

- The expected impact on the deployed environment described in the supplemental document.
- The extent to which the value of the proposed cybersecurity research and development is described in the context of a needed capability required by science and engineering, and potential impact across a broader segment of the NSF community.
- The feasibility, utility, and interoperability of the capability in its proposed operational role.
- A phase plan that addresses in its goals and milestones the demonstration and evaluation of a working system in the target environment.
- Tangible metrics described to evaluate the success of the capabilities developed, and the steps necessary to take the system from prototype status to production use.
- The appropriateness of the phase budget for the phase plan. The supplemental document should explain how the additional budget will be used to execute the phase plan.

### III. AWARD INFORMATION

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NSF anticipates up to 50 Small awards, up to 12 Medium awards and up to 2 Frontier awards in FY12 and up to \$50,000,000 dependent upon the availability of funds.

### IV. ELIGIBILITY INFORMATION

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#### Organization Limit:

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

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 2

An individual can participate as a PI, co-PI or Senior Personnel on no more than two proposals, regardless of the perspective or category to which the proposals are submitted.

## 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.

Additional Proposal Preparation and Submission Instructions

When submitting a proposal, indicate which NSF division you would like to consider your proposal. Proposals focused on the Trustworthy Computing Systems Perspective should be submitted to CNS; proposals focused on the Social, Behavioral and Economic Perspective should be submitted to SES; and proposals focused on the Transition to Practice Perspective should be submitted to OCI. Proposals that address multiple perspectives can select multiple divisions. In this case, the unit of consideration that is listed first should represent the perspective that is most relevant for the proposal.

Proposal Titles: Proposal titles must begin with an acronym that indicates the most relevant perspective. Select an acronym from the following list:

- Trustworthy Computing Systems Perspective: TWC
- Social, Behavioral and Economic Science Perspective: SBES
- Transition to Practice Perspective: TTP
- Transition Phase: Phase

The acronym should be followed with a colon, then the project class (Small, Medium or Frontier) followed by a colon, then the title of your project. For example, if you are submitting a Small proposal to the Trustworthy Computing Systems Perspective, then your title would be TWC: Small: Title. If you are submitting to multiple perspectives, put the most relevant first, followed by the second perspective, followed by a colon, then the project class, followed by a colon, then the title. For example, if you are submitting a Small proposal to the Trustworthy Computing Systems Perspective and the Social Behavioral and Economic Science Perspective, then your title would be TWC SBES: Small: Title. If you submit a Transition Phase, the title should begin with the acronym that indicates the most relevant perspective followed by a colon, then "Phase" followed by a colon, then the project class followed by a colon, and then title. For example, if you are submitting a Social, Behavioral and Economic Science Perspective with a Transition Phase, then the title would be: SBES: Phase: Medium: Title. If you submit a proposal as part of a set of collaborative proposals, the title of the proposal should begin with the acronym that indicates the most relevant perspective followed by a colon, then the project class followed by a colon, then "Collaborative" followed by a colon, and the title. For example, if you are submitting a collaborative set of proposals for a Medium project to the Transition to Practice Perspective, the title of each would be TTP: Medium:Collaborative: Title.

Transition Phase proposals: Small and medium projects with Trustworthy Computing Systems and/or Social, Behavioral and Economic perspectives (i.e., without a Transition to Practice perspective) can include an optional Transitions phase. Proposals submitted with a Transitions phase should include a supplemental document of up to five pages. This document should describe how successful proposed research results are to be further developed, matured, and experimentally deployed in organizations or industries, including in networks and end systems used by members of the NSF science and engineering communities. It should also include a phase budget that indicates what additional funds would be needed to carry out the Transitions phase. The budget can be no larger than \$167,000 for small projects and \$400,000 for medium projects, and can include any expenses allowable.

Note that the proposal budget sheets should not include the additional items to be funded should the Transitions phase be funded. Should a decision be made to fund the phase, the PI or PIs will be asked to submit a revised budget.

Collaboration Plan: Since the success of collaborative research efforts are known to depend on thoughtful coordination mechanisms that regularly bring together the various participants of the project, all Frontier proposals must include a Collaboration Plan. Frontier proposals can add up to 3 additional pages for Collaboration Plans. Collaboration Plans should be included at the end of the Project Description in a section entitled "Collaboration Plan". The length of and degree of detail provided in the Collaboration Plan should be commensurate with the complexity of the proposed project. Where appropriate, the Collaboration Plan might include: 1) the specific roles of the project participants in all organizations involved; 2) information on how the project will be managed across all the investigators, institutions, and/or disciplines; 3) identification of the specific coordination mechanisms that will enable cross-investigator, cross-institution, and/or cross-discipline scientific integration (e.g., yearly workshops, graduate student exchange, project meetings at conferences, use of the grid for videoconferences, software repositories, etc.), and 4) specific references to the budget line items that support collaboration and coordination mechanisms. **If a Frontier proposal does not include a Collaboration Plan, that proposal will be returned without review.**

NOTE: Proposals submitted for the SBE perspective (only) may be submitted to the Small and Medium categories. Proposals including a Trustworthy Computing or Transition to Practice perspective, or from a combination of perspectives, may be submitted to any category. Also, in FY12, SBE perspective proposals may be submitted to SBE standing programs in response to their Spring due dates.

## B. Budgetary Information

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Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

## C. Due Dates

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- Submission Window Date(s) (due by 5 p.m. proposer's local time):

January 04, 2012 - January 11, 2012

Small Projects

January 12, 2012 - January 25, 2012

Medium Projects

February 08, 2012 - February 22, 2012

Frontier Projects

## 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. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: [http://www07.grants.gov/applicants/app\\_help\\_reso.jsp](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](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 where they will be reviewed if they meet NSF proposal preparation requirements. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal.

## A. NSF Merit Review Criteria

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All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgments.

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.

### Additional Solicitation Specific Review Criteria

Proposals may be submitted with one or more of the following perspectives: Trustworthy Computing and Systems; Social, Behavioral and Economics; Transition to Practice. Proposals for small or medium projects that do not have a Transition to Practice perspective can include an optional Transitions phase.

Proposals submitted with a Social, Behavioral and Economic perspective will be evaluated with careful attention to the following:

- The mutual application of, and contribution to, basic Social, Behavioral and Economic science research.
- The generalizability of the research to multiple cyber security settings.
- The ultimate contribution to the construction of institutions that induce optimal behavior.

Proposals submitted with a Transition to Practice perspective will be evaluated with careful attention to the following:

- The expected impact on the deployed environment described in the proposal.
- The extent to which the value of the proposed cybersecurity research and development is described in the context of a needed capability required by science and engineering, and potential impact across a broader segment of the NSF community.
- The feasibility, utility, and interoperability of the capability in its proposed operational role.
- A project plan that addresses in its goals and milestones the demonstration and evaluation of a working system in the target environment.
- Tangible metrics described to evaluate the success of the capabilities developed, and the steps necessary to take the system from prototype status to production use.

Proposals submitted with a Transitions phase will be evaluated with careful attention to the following:

- The expected impact on the deployed environment described in the supplemental document.
- The extent to which the value of the proposed cybersecurity research and development is described in the context of a needed capability required by science and engineering, and potential impact across a broader segment of the NSF community.
- The feasibility, utility, and interoperability of the capability in its proposed operational role.
- A phase plan that addresses in its goals and milestones the demonstration and evaluation of a working system in the target environment.
- Tangible metrics described to evaluate the success of the capabilities developed, and the steps necessary to take the system from prototype status to production use.
- The appropriateness of the phase budget for the phase plan. The supplemental document should explain how the additional budget will be used to execute the phase plan.

NSF staff also will give careful consideration to the following in making funding decisions:

### ***Integration of Research and Education***

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich



research through the diversity of learning perspectives.

### ***Integrating Diversity into NSF Programs, Projects, and Activities***

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

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

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Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

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

## **VII. AWARD ADMINISTRATION INFORMATION**

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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 cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

### **B. Award Conditions**

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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).

### **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. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report will delay NSF review and processing of any future funding increments as well as any pending proposals for 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. The project outcomes report must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

## VIII. AGENCY CONTACTS

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*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:

- Jeremy Epstein, Program Director, 1175, telephone: (703) 292-8950, email: [jepstein@nsf.gov](mailto:jepstein@nsf.gov)
- Samuel Weber, Program Director, CISE/CNS, 1175, telephone: (703) 292-7096, email: [sweber@nsf.gov](mailto:sweber@nsf.gov)
- Kevin Thompson, Program Director, OCI, 1145, telephone: (703) 292-4220, email: [kthompso@nsf.gov](mailto:kthompso@nsf.gov)
- Peter Muhlberger, 995, telephone: (703) 292-7848, email: [pmuhlber@nsf.gov](mailto:pmuhlber@nsf.gov)
- Andrew D. Pollington, Program Director, MPS/DMS, 1025, telephone: (703) 292-4878, email: [adpollin@nsf.gov](mailto:adpollin@nsf.gov)
- Nina Amla, 1115, telephone: (703) 292-8910, email: [namla@nsf.gov](mailto:namla@nsf.gov)
- Sol Greenspan, 1115, telephone: (703) 292-8910, email: [sgreensp@nsf.gov](mailto:sgreensp@nsf.gov)
- Vijayalakshmi (Vijay) Atluri, 1125, telephone: (703) 292-8930, email: [vatluri@nsf.gov](mailto:vatluri@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).

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

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

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

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

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

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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