Small Business Innovation Research Program Phase I (SBIR)

December 2016 Submission

PROGRAM SOLICITATION
NSF 16-599

REPLACES DOCUMENT(S):
NSF 16-554

National Science Foundation

Directorate for Engineering
Industrial Innovation and Partnerships

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

December 06, 2016

FastLane will not permit submission after 5:00 p.m. "proposer's time" on the deadline date. Proposer's time is determined by the time zone of the company's address as registered with NSF.

IMPORTANT INFORMATION AND REVISION NOTES

The National Science Foundation's Small Business Innovation Research (SBIR) program provides non-dilutive funds for small businesses to conduct research and development (R&D) on technology innovations that have the potential to be commercially successful and benefit society. **The NSF SBIR program accepts innovative proposals that show promise of commercial and societal impact in almost all areas of technology.**

This solicitation calls for SBIR Phase I proposals to undertake R&D with the aim of establishing technical feasibility of an innovation. Successful applicants will receive a grant of up to $225,000 to undertake a Phase I project over a period of 6 to 12 months (the period to be nominated by the company).

Successful SBIR proposers will receive funding about 6 months after the solicitation deadline date. Companies that receive a Phase I award are eligible to apply for a Phase II award (award amount up to $750,000; duration 2 years). SBIR Program Directors host webinars in the weeks leading to the proposal deadline. Further information about the program, including the webinar schedule, short videos and Q&A, is also available at www.nsf.gov/SBIR.

Registrations. *Start Now - These registrations take time and are required to receive funding.* You must register the same information in the same way in each of these systems to avoid problems later. (See the Additional Eligibility section for more details). *We recommend that you register in the following order:*

1. Dun and Bradstreet Data Universal Numbering System (DUNS)
2. System for Award Management (SAM)
3. Small Business Administration (SBA) Company Registry
4. NSF FastLane - register company and Principal Investigator (PI)

An organization may submit no more than ONE Phase I proposal to this SBIR/STTR cycle (where SBIR/STTR cycle is defined to include the SBIR Phase I solicitation and the STTR Phase I solicitation with a December 6, 2016 deadline). This eligibility constraint will be strictly enforced. In the event that an organization exceeds this limit, the first proposal received will be accepted based on earliest date and time of proposal, and the remainder will be returned without review. No exceptions will be made.

Important Information

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

Please note however, that this solicitation contains information that deviates from the standard NSF Proposal & Award Policies & Procedures Guide (PAPPG) (NSF 16-1), including Part I: Grant Proposal Guide (GPG) proposal preparation guidelines.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Small Business Innovation Research Program (SBIR)
December 2016

Synopsis of Program:

The SBIR program is congressionally mandated and intended to support scientific excellence and technological innovation through the investment of Federal research funds to build a strong national economy by: stimulating technological innovation in the private sector; strengthening the role of small business concerns in meeting federal research and development needs; increasing the commercial application of federally supported research results; and fostering and encouraging participation by socially and economically disadvantaged and women-owned small businesses.

The SBIR program solicits proposals from the small business sector consistent with NSF's mission to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense.

The program is governed by Public Law 112-81 (SBIR/STTR Reauthorization Act of 2011). SBIR/STTR policy is provided by the Small Business Administration (SBA) through the SBA Policy Directive. A main purpose of the legislation is to stimulate technological innovation and increase private sector commercialization. The NSF SBIR/STTR program is therefore in a unique position to meet both the goals of NSF and the purpose of the SBIR/STTR legislation by transforming scientific discovery and innovation into both social and economic benefit, and by emphasizing private sector commercialization.

The NSF SBIR/STTR program places a strong emphasis on private-sector commercialization. Because the program has no topical focus, the NSF offers very broad solicitation topics that are intended to permit as many eligible science- and technology-based small businesses as possible to compete for these funds. The topics are detailed on the SBIR/STTR website.

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.

- Henry Ahn, Smart Health (SH) and Biomedical (BM) Technologies, telephone: 703-292-7069, email: hahn@nsf.gov
- Peter Atherton, Information Technologies (IT), telephone: (703) 292-8772, email: patherto@nsf.gov
- Prakash Balan, Chemical Technologies (CT), telephone: (703) 292-5341, email: pbalan@nsf.gov
- Anna Brady-Estevez, Environmental Technologies, telephone: (703) 292-7077, email: abrady@nsf.gov
- Glenn H. Larsen, Educational Technologies and Applications (EA), telephone: (703) 292-4607, email: glarsen@nsf.gov
- Debasis Majumdar, Advanced Materials and Instrumentation (MI), telephone: (703) 292-4709, email: dmajumda@nsf.gov
- Rajesh Mehta, Advanced Manufacturing and Nanotechnology (MN), telephone: (703) 292-2174, email: rmehta@nsf.gov
- Muralidharan S. Nair, Electronic Hardware, Robotics and Wireless Technologies (EW), telephone: (703) 292-7059, email: mnair@nsf.gov
- Ben Schrag, Other Topics (OT), telephone: 703-292-8323, email: bschrag@nsf.gov
- Rick Schwerdtferger, Internet of Things (IoT), Semiconductors (S) and Photonic (PH) Devices, telephone: 703-292-8353, email: rschwerd@nsf.gov
- Ruth M. Shuman, Biological Technologies (BT), telephone: (703) 292-2160, email: rshuman@nsf.gov
- Jesus V. Soriano, Smart Health (SH) and Biomedical (BM) Technologies, telephone: (703) 292-7795, email: jsoriano@nsf.gov

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

- 47.041 --- Engineering

Award Information

Anticipated Type of Award: Fixed Award Amount

Estimated Number of Awards: 150

(pending the availability of funds)

Anticipated Funding Amount: $33,750,000

For SBIR Phase I pending the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Only firms qualifying as a small business concern are eligible to participate in the SBIR/STTR program (see Eligibility Guide for more information). Please note that the size limit of 500 employees ***includes affiliates***. The firm must be in compliance with the SBIR/STTR Policy Directive(s) and 13 CFR 121.

Who May Serve as PI:

The primary employment of the Principal Investigator (PI) must be with the small business concern at the time of

award and for the duration of the award, unless a new PI is named. Primary employment is defined as at least 51% employed by the small business. NSF normally considers a full-time work week to be 40 hours and considers employment elsewhere of greater than 19.6 hours per week to be in conflict with this requirement. As such, the PI must have a legal right to work for the proposing company in the US, as evidenced by citizenship, permanent residency or an appropriate visa. The PI does not need to be associated with an academic institution. There are no PI degree requirements (i.e., the PI is not required to hold a Ph.D. or any other degree). A PI may be primarily employed at another organization at the time of *submission* , as long as he or she is primarily employed at the proposing small business at the time of award. A PI must devote a minimum of one calendar month per six months of performance to an SBIR or STTR Phase I project.

Limit on Number of Proposals per Organization: 1

An organization may submit no more than ONE Phase I proposal to this SBIR/STTR cycle (where SBIR/STTR cycle is defined to include the SBIR Phase I solicitation and the STTR Phase I solicitation with a December 6, 2016 deadline). This eligibility constraint will be strictly enforced. In the event that an organization exceeds this limit, the first proposal received will be accepted based on earliest date and time of proposal, and the remainder will be returned without review. No exceptions will be made.

Limit on Number of Proposals per PI or Co-PI: 1

No person may be listed as the principal investigator for more than one proposal submitted to this solicitation.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  Indirect costs plus fringe benefits are limited to a maximum rate of 150% of direct salaries and wages. This limitation may entail mandatory committed cost sharing by the organization. In such cases, it constitutes an exception to NSF's cost sharing policy.

- **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. submitter's local time):

  December 06, 2016

  FastLane will not permit submission after 5:00 p.m. "proposer's time" on the deadline date. Proposer's time is determined by the time zone of the company's address as registered with NSF.

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

The National Science Foundation (NSF), an independent agency of the Federal Government, invites eligible small business concerns to submit Phase I proposals for its Small Business Innovation Research (SBIR) program. The NSF will support high-quality projects on important scientific, engineering, or science and engineering education problems and opportunities that could lead to significant commercial and/or societal impacts if the research is successful.

II. PROGRAM DESCRIPTION

The NSF SBIR Program encourages the submission of proposals across all areas of science and engineering (except drug development). The NSF recognizes that innovation often can't be categorized. Therefore, **proposals are accepted in any areas of technology that show promise of high commercial and societal impact.**

The aim of a Phase I project should be to demonstrate technical feasibility of the proposed innovation and thereby bring the innovation closer to commercialization. Proposals should describe the development of an innovation that demonstrates the following characteristics:

- **Involves a high degree of technical risk** – for example: Has never been attempted and/or successfully done before; Is still facing technical hurdles (that the NSF-funded R&D work is intended to overcome).
- **Has the potential for significant commercial impact and/or societal benefit, as evidenced by**: Having the potential to disrupt the targeted market segment; Having good product-market fit (as validated by customers); Presenting barriers to entry for competition; Offering potential for societal benefit (through commercialization under a sustainable business model).

For more in-depth program information please reference the SBIR/STTR website.

III. AWARD INFORMATION

SBIR Phase I proposals may be submitted for funding up to $225,000. SBIR Phase I projects run for six to twelve months. Award notification is typically four to six months from the proposal submission deadline date.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Only firms qualifying as a small business concern are eligible to participate in the SBIR/STTR program (see Eligibility Guide for more information). Please note that the size limit of 500 employees ***includes affiliates***. The firm must be in compliance with the SBIR/STTR Policy Directive(s) and 13 CFR 121.

Who May Serve as PI:

The primary employment of the Principal Investigator (PI) must be with the small business concern at the time of award and for the duration of the award, unless a new PI is named. Primary employment is defined as at least 51% employed by the small business. NSF normally considers a full-time work week to be 40 hours and considers employment elsewhere of greater than 19.6 hours per week to be in conflict with this requirement. As such, the PI must have a legal right to work for the proposing company in the US, as evidenced by citizenship, permanent residency or an appropriate visa. The PI does not need to be associated with an academic institution. There are no PI degree requirements (i.e., the PI is not required to hold a Ph.D. or any other degree). A PI may be primarily employed at another organization at the time of *submission* , as long as he or she is primarily employed at the proposing small business at the time of award. A PI must devote a minimum of one calendar month per six months of performance to an SBIR or STTR Phase I project.

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Limit on Number of Proposals per PI or Co-PI: 1

No person may be listed as the principal investigator for more than one proposal submitted to this solicitation.

Additional Eligibility Info:

Additional Eligibility Info:

Broad Participation. Socially and economically disadvantaged small business concerns and women-owned small business concerns are encouraged to participate.

Partnering. Proposing firms are also encouraged to take advantage of research expertise and facilities that may be available to them at colleges, universities, national laboratories, and from other research providers. Such collaborations may include research subcontracts or consulting agreements. The employment of faculty and students by the small business may also occur. However, note that for an SBIR Phase I Proposal, a minimum of two-thirds of the research, as measured by the budget, must be performed by the small business concern, and the balance may be outsourced to consultants or subcontractors or a combination thereof. Please note that although partnering is encouraged, proposals submitted should NOT mark the proposal as "Collaborative" during submission.

Ownership and Venture Capital, Joint Ventures. Please note that NSF has elected not to use the authority given under 15 U.S.C. § 638(dd)(1) (also §5107 of the SBIR/STTR Reauthorization Act). Hence, small businesses that are majority -owned by one or more venture capital operating companies (VCOCs), hedge funds or private equity firms are NOT eligible to submit proposals or receive awards from the NSF SBIR/STTR program. Proposals from joint ventures and partnerships are permitted, provided the proposing entity qualifies as a small business concern (see the Eligibility Guide for more information).

REGISTRATIONS: *Start Now - These registrations take time and are required to receive funding.* You must register the same information in the same way in each of these systems to avoid problems later. *We recommend that you register in the following order:*

1. Dun and Bradstreet Data Universal Numbering System (DUNS). In accordance with the Office of Management and Budget policy directive 75 FR 22706, each proposer must have a DUNS number prior to submission of a proposal to NSF. Any subawardees named in the proposal must be registered in FastLane, which requires that they also obtain a DUNS number (https://iupdate.dnb.com/iUpdate/viewiUpdateHome.htm).

2. System for Award Management (SAM) Registration. Each proposer (excluding subawardees) must initiate their company's registration in the SAM database prior to submission of the proposal. The SAM is the primary registrant database for the U.S. Government. This SAM registration must be maintained with current information at all times during which the organization has an active award or a proposal under consideration by NSF. Failure to comply with the SAM registration requirement prior to proposal submission may impact the processing of the proposal. To register in the SAM, go to https://www.sam.gov/ . NSF is able to determine whether or not a firm has registered in SAM upon submission; no special documentation is required.

During proposal submission in FastLane, you may receive a warning that your firm is either 1) not registered in SAM; or 2) the record in FastLane does not match the data in SAM. ***If you have indeed initiated the SAM registration process, or have registered, but with data which do not match those in FastLane, you can still successfully submit a proposal.*** However, please work to resolve this mismatch after proposal submission because the mismatch must be resolved before a proposal can be awarded.

3. Small Business Administration (SBA) Company Registration. Receipt of an SBC ID is required prior to submission of the proposal. SBA maintains and manages a Company Registry for proposing SBIR/STTR companies at http://www.sbir.gov/registration/ to track ownership and affiliation requirements. The SBIR/STTR policy directive requires each small business concern (SBC) applying for a Phase I or Phase II award to register in the Company Registry prior to submitting an application. All SBCs must report and/or update ownership information to SBA prior to each SBIR/STTR application submission or if any information changes prior to award. Please see the SBA registration documentation section of the Proposal Submission Instructions.

4. FastLane (NSF's electronic proposal submission system): https://www.fastlane.nsf.gov/n1/N1AddInst.html.

BENCHMARKS (APPLIES TO PREVIOUS SBIR/STTR AWARD WINNERS ONLY)

Phase I to Phase II Transition Rate Benchmark. The Phase I to Phase II Transition Rate benchmark required by the SBIR/STTR Reauthorization Act of 2011 is implemented. For Phase I applicants that have received more than 20 Phase I federal SBIR/STTR awards over the past 5 fiscal years, the minimum Phase I to Phase II Transition Rate is 0.25 over those 5 fiscal years. Small businesses who fail to meet this transition requirement will be notified by SBA and will not be eligible for an NSF Phase I award in this submission cycle. Further information: Transition

Rate Benchmark.

Commercialization Benchmark. The commercialization benchmark required by the SBIR/STTR Reauthorization Act of 2011 only applies to Phase I applicants that have received more than 15 Phase II federal SBIR/STTR awards over the past 10 fiscal years, excluding the last two years. These companies must have achieved the minimum required commercialization activity in order to be eligible to receive a Phase I award, as determined by the information entered in the company registry at SBIR.gov. Firms for which the commercialization benchmark applies should consult SBIR.gov for more information: Commercialization Benchmark.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified 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-PUBS (7827) or by e-mail from nsfpubs@nsf.gov.

See Chapter II.C.2 of the GPG for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions.

This solicitation DOES contain many instructions that DEVIATE FROM THE STANDARD NSF Grant Proposal Guide (GPG) proposal preparation instructions. **This solicitation contains the information needed to prepare a proposal and refers to specific sections of the GPG only when necessary. The instructions in this solicitation take precedence over instructions in the GPG in the event of a conflict.**

Please note that proposals must be submitted in FastLane, NSF's electronic proposal submission system. Applications are NOT accepted through Grants.gov.

Soliciting Pre -Submission Feedback. Potential proposers may (but are NOT required to) email a 1-2 page executive summary to the cognizant SBIR/STTR Program Director to help gauge whether a project meets the program's intellectual merit and broader/commercial impact criteria. The summary should discuss: the company and team; the market opportunity, value proposition, and customers; the technology/innovation; and the competition. Program Director contact information can be found on the technology area page on the SBIR/STTR website. Potential proposers are discouraged from submitting an executive summary to multiple Program Directors in parallel. Please note that responsiveness of Program Directors will be limited in the 2 weeks leading up to the solicitation deadline.

Phase I Proposal and Program Objectives. An SBIR Phase I proposal must describe the research effort needed to establish the feasibility of the proposed scientific or technical innovation. The primary objectives of the Phase I effort are to (i) determine whether the innovation has sufficient technical and broader/commercial impact merit for proceeding into a Phase II project and (ii) to assess commercial feasibility of the proposed innovation. The deliverable of an SBIR Phase I grant is a report describing technical accomplishments that will be included as part of the Phase II proposal package in FastLane.

Marking Proprietary Information. To the extent permitted by law, the Government will not release properly identified and marked technical and commercially sensitive data. If the proposal contains proprietary information, check the box at the bottom of the proposal cover page and identify proprietary technical data in the proposal by clearly marking the information and also providing a legend. Typically, proprietary information is marked in the text either with an asterisk at the beginning and end of the proprietary paragraph, underlining the proprietary sections, or choosing a different font type. An entire proposal should not be marked proprietary.

Debriefing on Unsuccessful Proposals. When a proposal is declined, verbatim copies of reviews (excluding the names of the reviewers) summaries of review panel deliberations, if any, and a description of the process by which the proposal was reviewed will be available electronically. Phase I proposals that have been declined or returned without review by NSF are NOT eligible for resubmission under the same program solicitation; however, proposals may be resubmitted under a subsequent solicitation after substantial revisions have been made.

Proposal Format and Sample Limitations. Samples, videotapes, slides, appendices, or other ancillary items will not be accepted. Websites containing demonstrations, etc., may be cited in the proposal, but reviewers are not required to access them. Multiple column formats are not accepted. Arial, Courier New, or Palatino Linotype at a font size of 10 points or larger or Times New Roman or Computer Modern fonts at a font size of 12 points or larger, should be used.

PROPOSAL CONTENT

For more detailed help in preparing and submitting a proposal via the NSF FastLane system, please see the SBIR/STTR FastLane Submission Guide on the SBIR/STTR website.

Proposal Returned without Review. The following list shows the DO's and DON'Ts of proposal submission. Failure to comply with this list means that a proposal may be returned without review.

DO's of NSF SBIR Phase I Proposal Submission:

INCLUDE ALL REQUIRED ELEMENTS. Submit a proposal that is complete. Even if the FastLane system allows a proposal to be submitted without these items, ALL proposals must have each of the items listed below, WITHOUT EXCEPTION.

- Project Summary
- Project Description
- References Cited
- Biographical Sketches
- Preliminary Budget and Budget Justification
- Current and Pending Support
- Collaborators and Other Affiliations

Facilities, Equipment and Other Resources
- Supplementary Documents (all that are applicable)

PROVIDE COMPANY COMMERCIALIZATION HISTORY (if applicable). Submit a Company Commercialization History form (on the NSF template) if your company has received an SBIR/STTR Phase II proposal previously (from any agency). DO NOT modify the NSF Company Commercialization template to include additional narrative or information beyond what is required on the form.

DON'Ts of NSF SBIR Phase I Proposal Submission:

DO NOT SUBMIT LATE. FastLane will not permit submission after 5:00 p.m. "proposer's time" on the deadline date. **Proposer's time is determined by the time zone of the company's address as registered with NSF.** Late proposals may not be accepted or will be returned without review.

DO NOT VIOLATE THE FOLLOWING PROPOSAL CONTENT RULES:

- Do not submit a Project Description that is more than 15 pages long.
- Do not submit a Budget exceeding $225,000.
- Do not submit a "Collaborative Proposal" (a special proposal type in FastLane). Collaboration with research institutions is encouraged; however, only one proposal, submitted by the company and with subawards to the research institution(s), should result.
- Do not submit a proposal that lacks sufficient technical/commercial potential substance to justify review; does not contain research proposed in science, engineering, or education; or contains unacceptable objectives.

DO NOT INCLUDE EXTRAS.

- Do not upload additional information, beyond what is specifically required and permitted, into the proposal (marketing materials, research results/academic papers, patent applications, etc.)
- Do not upload any documents to the "ADDITIONAL Single Copy Documents" subsection under the "Single Copy Documents' section in FastLane except "Collaborators and Other Affiliations." However, please note that you may complete the "List of Suggested Reviewers" section, if you wish.
- Do not upload documents to the Supplementary Documents except those described in Supplementary Documents.

Each NSF SBIR Phase I proposal shall have the following components:

Cover Sheet and Certification. Complete topic and subtopic fields should be included on the cover sheet. Designate one, and only one, topic and subtopic. All proposals must be electronically signed. If a proposer fails to disclose on the proposal cover page whether another Federal Agency has received this proposal (or an equivalent or overlapping proposal), the proposer could be liable for administrative, civil or criminal sanctions. NSF will not make awards that duplicate research funded or expected to be funded by other agencies, although in some cases NSF may fund portions of work described in an overlapping proposal provided that the budgets appropriately reduce costs and allocate costs among the various sponsors.

Project Summary [One (1) page MAXIMUM]. The Project Summary should be written in the third person, informative to other persons working in the same or related fields, and, insofar as possible, understandable to a scientifically or technically literate lay reader. It should not be an abstract of the proposal. Do not include proprietary information in the summary.

Proposals that do not contain a complete Project Summary will not be accepted by FastLane or will be returned without review. The Project Summary is completed in FastLane by entering information into 3 text boxes.

- **Box 1: Overview, Key Words, and Subtopic Name:** Describe the potential outcome(s) of the proposed activity in terms of a product, process, or service. Provide a list of key words or phrases that identify the areas of technical expertise to be invoked in reviewing the proposal; and the areas of application that are the initial target of the technology. Provide the subtopic name.
- **Box 2: Intellectual Merit:** This section MUST begin with "This Small Business Innovation Research Phase I project". Address the intellectual merits of the proposed activity. Do not include proprietary information in the summary. Briefly describe the technical hurdle(s) that will addressed by the proposed R&D (which should be crucial to successful commercialization of the innovation), the goals of the proposed R&D, and a high-level summary of the plan to reach those goals.
- **Box 3: Broader/Commercial Impact:** In the short term, the proposed R&D activity is expected to bring the innovation closer to commercialization under a sustainable business model. In this box, describe the potential impacts the commercialization of this innovation will have on society. Examples include generating larger economic impacts, meeting societal needs, and enabling further scientific / technological understanding.

Project Description. [Fifteen (15) pages MAXIMUM]. The project description is the core of the proposal document, where you convince the SBIR Program Director and the expert reviewers that your proposed R&D project meets the NSF's criteria for intellectual merit and broader/commercial impact. Present evidence that the proposed technology is innovative, that development of it entails high technical risk, and that you have a credible plan to establish technical feasibility during Phase I. Convince the reviewers that the company and the project team have the necessary expertise, resources, and support to carry out the project, and that they are committed to building a viable business around the product/service being developed. Finally, present a compelling case that the project objectives will significantly advance the readiness of the technology and strengthen and validate its commercial position.

Elevator Pitch (no more than one page)

- The Customer. Describe the expected customer for the innovation. What customer needs or market pain points are you addressing?
- The Value Proposition. What are the benefits to the customer of your proposed innovation? What is the key differentiator of your company or technology? What is the potential societal value of your innovation?
- The Innovation: Succinctly describe your innovation. This section can contain proprietary information that could not be discussed in the Project Summary. What aspects are original, unusual, novel, disruptive, or transformative compared to the current state of the art?

The Commercial Opportunity (recommended length: 2 to 4 pages)

- Is there a broader societal need you are trying to address with this commercial opportunity? Please describe.
- Describe the market and addressable market for the innovation. Discuss the business economics and market drivers in the target industry.
- How has the market opportunity been validated? Describe your customers and your basic business model.

Describe the competition. How do you expect the competitive landscape may change by the time your product/service enters the market?
- What are the key risks in bringing your innovation to market?
- Describe your commercialization approach. Discuss the potential economic benefits associated with your innovation, and provide estimates of the revenue potential, detailing your underlying assumptions.
- Describe the resources you expect will be needed to implement your commercialization approach.
- Describe your plan and expected timeline to secure these resources.

The Innovation (recommended length: 1-3 pages)

- Briefly describe the innovation. At what stage of technical development is the innovation? (A more detailed description can be provided in the Technical Discussion and R&D Plan, as described below).
- Describe the key technical challenges and risks in bringing the innovation to market. Which of these will be your focus in the proposed Phase I project?
- Describe the status of the intellectual property associated with this project and how you plan to protect it.
- NSF Lineage: Does your project have roots in non-SBIR NSF funding, either to the company or other organizations/institutions? If possible, please list the NSF award number(s) and division(s).

The Company/Team (recommended length: 1-3 pages)

- Describe the company founders or key participants in this proposed project. What level of effort will these persons devote to the proposed Phase I activities? How does the background and experience of the team enhance the credibility of the effort; have they previously taken similar products/services to market?
- Describe your vision for the company and the company's expected impact over the next five years.
- If the company has existing operations, describe how the proposed effort would fit into these activities. Describe the revenue history, if any, for the past three years. Include government funding and private investment in this discussion.
- Will you have consultants or subawardees working on this project? If so, what is their expertise, affiliation, and contribution to the project?

Technical Discussion and R&D Plan (minimum length: 5 pages, recommended length: 5 to 7 pages)

- Describe the innovation in sufficient technical depth for a knowledgeable reviewer to understand why it is innovative and how it can provide benefits in the target applications. Supplement this description with any necessary background information.
- Describe the key objectives to be accomplished during the Phase I research, including the questions that must be answered to determine the technical AND commercial feasibility of the proposed concept.
- Describe the critical technical milestones that must be met to get the product or service to market.
- Present an R&D plan, with timeline. What are the objectives, and what experiments, computations, etc. are planned to reach those objectives?

References Cited. Provide a comprehensive listing of relevant references, including patent numbers and other relevant intellectual property citations. A list of References Cited must be uploaded into the system. If there are no references cited in the proposal, please indicate this by putting the statement "No References Cited" into this module.

Biographical Sketches. Provide a resume for the Principal Investigator (PI) and senior personnel (individuals with critical expertise who will be working on the project and are employed at the proposing company or at a subaward institution). Information regarding consultants should also be provided in this format but instead uploaded as part of the preliminary Budget Justification. Biographical sketches should not exceed two pages per person. Do not include personal information such as home address in biographical sketches. Provide information in the following sections: **(I) Education:** Institution, Location, Major/Concentration, Degree, and Year. **(II) Relevant Experience:** Include technical and/or commercial experience. List in reverse chronological order beginning with the current position. **(III) Products:** Includes patents, publications, etc. Up to 5 may be listed that are related to the proposed work and up to 5 that are significant but not related to the proposed work.

Budget, Subaward Budgets, and Budget Justification. Detailed documentation of all budget line items is required and MUST be documented on the Budget Justification page. The proposed budget should reflect the needs of the proposed R&D project. Line numbers below refer to the required budget format in FastLane, NSF's proposal submission system. The total budget shall not exceed $225,000 for the Phase I proposal. Budget line items must be shown in detail in the Budget Justification.

Line A - Senior Personnel. List the Principal Investigator and Senior Personnel by name, their time commitments (in calendar months), and the dollar amount requested. Senior Personnel are individuals with critical expertise who are employed at the proposing company. The PI must be budgeted for a minimum of one month to the proposed project. Please note that a PI may be budgeted for more than two months (deviates from GPG- Chapter II.C.2g.(i)(a)). The best source in determining an appropriate salary request is the Bureau of Labor Statistics: http://www.bls.gov/bls/blswage.htm. In the Budget Justification provide the title; annual, monthly, or hourly salary rate; time commitment; a calculation of the total requested salary; and a description of responsibilities for the PI and each of the Senior Personnel.

Line B - Other Personnel. List the number of additional general personnel (technicians, programmers, etc.) and the total monetary and time commitment for these personnel. These personnel must be employed at the proposing company. The details of the individual commitments, roles, and requested funds should be provided in the Budget Justification. Do NOT list company employees under B.1, B.3, or B.4 in the main budget. Post-doctoral scholars and students (undergraduate and graduate) should be listed on a subaward budget to a research institution, unless they are employees of the company, in which case they may be listed under Lines A, B.2, or B.6, as appropriate.

Line C - Fringe Benefits. It is recommended that proposers allot funds for fringe benefits here ONLY if the proposer's usual (established) accounting practices provide that fringe benefits be treated as direct costs. Otherwise, fringe benefits should be included in Line I, Indirect costs. (Line I+ Line C) should not be more than 150% of (Line A + Line B).

Line D - Equipment. Equipment may NOT be purchased on an NSF SBIR Phase I grant. Equipment is defined as an item of property that has an acquisition cost of $5,000 or more (unless the organization has established lower levels) and an expected service life of more than one year.

Line E.1 - Travel. One domestic travel trip for up to two persons (normally the PI and an individual associated with business operations) is required to attend a two-day Grantee Conference in the DC area. The intent of this workshop is to discuss the research program with a program director, learn about preparing a Phase II proposal, and learn what steps and skills will be needed to succeed in Phase I, II, and beyond. Therefore, this trip must be included in the Phase I budget. An explicit statement acknowledging attendance at the grantee workshop is required on the Budget Justification page. A good budget estimate is $2,000 per person to cover the conference registration fees and travel expenses. All other budgeted travel must be necessary for the successful execution of the Phase I R&D. Travel for purposes other than the project R&D (e.g. marketing, customer engagements) is

not permitted in the Phase I budget.

Line E.2 - Foreign travel expenses (Line E.2) are NOT permitted.

Line F - Participant Support Costs. Participant support costs are NOT permitted on a Phase I grant.

Line G.1 - Materials and Supplies. Materials and supplies are defined as tangible personal property, other than equipment, costing less than $5,000, or other lower threshold consistent with the policy established by the proposing organization. The proposal Budget Justification should indicate the specifics of the materials and supplies required, including an estimated cost for each item. Items with a total cost exceeding $5,000 should be accompanied by pricing documentation (e.g. quote, link to online price list, prior purchase order or invoice), to be included in the budget justification.

Line G.2 - Publication Costs/Documentation Costs. Publication Costs/Documentation costs are NOT permitted on a Phase I proposal.

Line G.3 - Consultant Services. Consultant services include specialized work that will be performed by professionals that are not employees of the proposing small business. Purchases of analytical services, other services, or fabricated components from commercial sources should not be listed under consultant services and should instead be reported in the budget under Other Direct Costs/Other (Line G.6). No person who is an equity holder, employee, or officer of the proposing small business may be paid as a consultant unless an exception is recommended by the Program Director and approved by the Division Director for the Division of Industrial Innovation and Partnerships. All research on an SBIR project, including that conducted by consultants, must be carried out in the U.S. (See definition of Place of Performance.)

Letters of Collaboration. Each consultant, whether paid or unpaid, must provide a signed statement that confirms availability, time commitment, role in the project, and the agreed consulting rate (not to exceed $600 per day; see below). Provide this letter as part of the Budget Justification and NOT as a Supplementary Document.

Consultant Rate. The consulting rate under this solicitation can be a maximum of $600 per day (NSF defines a day as 8 hours). Consultant travel should be shown under the domestic travel category, E-1, but counts as an outsourcing expense for the purpose of determining whether the small business concern meets the minimum level of effort for an SBIR proposal.

Biographical Sketch. Provide a biographical sketch for each consultant. Maximum of two pages per person. Please follow the format described in the GPG. Provide this in the Budget Justification section, NOT in the Biographical Sketches section.

Line G.4 - Computer Services. Funds may be allocated for computer services. Requested items with a total cost exceeding $5,000 should be accompanied by pricing documentation (e.g. quote, link to online price list, prior purchase order or invoice), to be included in the budget justification.

Line G.5 - Subawards. Subawards may be utilized when a significant portion of the work will be performed by another organization and is generally not commercially available, such as work performed by a university or research laboratory. Purchases of analytical services, other services, or fabricated components from commercial sources should not be listed under subawards and should instead be reported in the budget under Other Direct Costs/Other (Line G.6).

Subawards require a separate sub-budget and Sub-budget Justification in FastLane. The format for the sub-budget and Sub-budget Justification are the same as for the main budget. Subawardees (the institution, not the individual PI or researcher) should also provide a letter of collaboration that confirms the role of the subaward organization in the project and explicitly states the subaward amount. Provide this letter as part of the Budget Justification and NOT as a Supplementary Document.

Line G.6 - Other. This line includes the purchase of analytical services, other services, or fabricated components from commercial sources. Requested items with a total cost exceeding $5,000 should be accompanied by pricing documentation (e.g. quote, link to online price list, prior purchase order or invoice), to be included in the budget justification.

Line I - Indirect Costs. Indirect costs are defined as costs that are necessary and appropriate for the operation of the business, but which are not specifically allocated to the NSF SBIR project. Specify the base and rate. Indirect costs plus fringe benefits is limited to an effective rate of 150% of salaries and wages. That is, (Line I+ Line C) should not be more than 150% of (Line A + Line B). Common indirect cost expenses include legal and accounting expenses, employee health insurance, fringe benefits, rent, and utilities. The following expenses will NOT be funded as part of the indirect cost pools, so any established indirect costs rates and calculations for a company should be reduced for the purposes of this proposal to exclude:

- Independent research and development
- Patent and patent related expenses will not be funded as either a direct or indirect cost
- Sales and marketing expenses
- Business development
- Manufacturing and production expenses

Line K – Small Business Fee. Up to seven percent (7%) of the total indirect and direct project costs may be requested as a fee. The fee is intended to be consistent with normal profit margins provided to profit-making firms for R&D work. The fee applies solely to the small business concern receiving the award and not to any other participant in the project. The fee is not a direct or indirect "cost" item and may be used by the small business concern for any purpose, including additional effort under the SBIR award (i.e., the “Prohibited Expenditures” list does not apply).

Prohibited Expenditures (including but not limited to Lines D, E.2, F, and G.2). Equipment, patent expenses, tuition costs, and foreign travel are not allowable expenditures. However, these expenses may be permitted if budgeted under Line K – Small Business Fee. (maximum 7% of the budget).

Budget Justification

The Budget Justification is uploaded in the Budget Module of FastLane. Provide details for each non-zero line item of the budget, including a description and cost estimates. Identify each line item by its letter and number (e.g., G.5 - Subawards). Each non-zero line item should be described in the Budget Justification, but several sections also require more specific information and are listed below:

Lines A and B - Personnel. Provide the names and titles of all personnel and a concise description of their responsibilities on the project, including their budgeted time commitment. Provide the actual annual salary information and calculation that justifies the amounts requested.

Line C - Fringe Benefits. Describe what is included in fringe benefits and the calculations that were used to arrive at the amount requested.

Line E.1 - Domestic Travel. Describe the purpose for domestic travel and acknowledge attendance at the grantee workshop. For trips other than the grantees conference, include the expected number of trips, number of persons travelling, length of each trip, purpose and destination of each trip, and a rough breakdown of the expected cost of each trip.

Line G.1 - Materials and Supplies. Provide an itemized list of the materials and supplies, with the quantity, unit cost, and total cost for each item. Items with a total line item cost over $5,000 should have quotes or pricing documentation included as separate pages in the Budget Justification.

Line G.3 - Consultant Services. Include a copy of the signed Letter of Collaboration. Include a biographical sketch for each consultant.

Line G.5 - Subawards. Include a few sentences describing the scope and objective of the subaward.

Line G.6 - Other. Any single cost of more than $5,000 should be documented by inclusion of pricing info (e.g. a quote, past purchase order, link to online price list).

Line I - Indirect Costs. Provide the calculations that were used to arrive at the amount requested. Please briefly indicate the major cost categories that are included as indirect costs.

Line K – Small Business Fee. Provide the calculation that was used to arrive at the amount requested.

Please note that there is no page limit for the Budget and Sub-budget Justification. That is, the GPG restriction on page limits is not enforced for this solicitation, but all content in the Budget Justification must be related to the Budget.

You can find a sample Budget, Sub-budget, Budget Justification, and Sub-budget Justification here: http://www.nsf.gov/eng/iip/sbir/documents/PhaseI_Budget_Guide.pdf

Current and Pending Support of Principal Investigator and Senior Personnel. Information in this module is collected so that reviewers have visibility into the potential availability of company personnel during the period of performance, if awarded.

Types of Support / Activities. For the PI and each of the senior personnel (individuals with critical expertise who will be working on the project and are employed at the proposing company or at a subaward institution), provide information regarding each of the following that could require effort during the proposed NSF SBIR Phase I performance period, regardless of whether the person will receive a salary from the activity:

- All current and pending support for ongoing projects and proposals (from any source), including continuing grants funding.
- Proposals submitted. Note that concurrent submission of a proposal to other organizations will not influence its review by NSF.
- Upcoming submissions.
- The Phase I proposal being submitted – note that this is considered "pending" and therefore MUST appear in the Current and Pending Support module.

Information Needed

- Name of sponsoring organization.
- Total award amount (if already awarded) or expected award amount (if pending) for the entire award period covered (including indirect costs).
- Title and performance period of the proposal.
- Annual person-months (calendar months) devoted to the project by the PI or senior personnel.

Collaborators & Other Affiliations Information: In lieu of the guidance in the GPG, for the PI and each of the senior personnel, list all partners on any significant collaborations / projects that have occurred in the last two years as a single PDF file. This **single - copy document** will be used to help identify potential conflicts or bias in the selection of reviewers.

Facilities, Equipment and Other Resources. Specify the availability and location of significant equipment, instrumentation, computers, and physical facilities necessary to complete the portion of the research that is to be carried out by the proposing firm in Phase I. **Purchase of equipment is NOT permitted in a Phase I project**. If the equipment, instrumentation, computers, and facilities for this research are not the property (owned or leased) of the proposing firm, include a statement signed by the owner or lessor which affirms the availability of these facilities for use in the proposed research, reasonable lease or rental costs for their use, and any other associated costs. Upload images of the scanned statements into this section.

Supplementary Documents. The supplementary documents permitted in a Phase I proposal are limited to the following (if applicable):

S1. Data Management Plan. Proposals MUST contain a supplementary document labeled "Data Management Plan (DMP)", which should include the statement, "All data generated in this SBIR Phase I project is considered proprietary." This single sentence is sufficient to fulfill the DMP requirement, but applicants may add more detail about how the resulting data will be managed if they desire. See exceptions: https://www.nsf.gov/eng/general/ENG_DMP_Policy.pdf

S2. Mentoring Plan (for Postdoctoral participants). If a proposal requests funding to support post-doctoral scholars at a research institution, a Postdoctoral Mentoring Plan MUST be uploaded to the system. Describe only the mentoring activities that will be provided to all postdoctoral researchers supported by the project. A template can be obtained here: https://www.nsf.gov/eng/iip/sbir/documents/Sample_Postdoc_Mentoring_Plan.doc.

S3. Letter(s) of Support (strongly recommended; no more than three letters). Letters of support act as an indication of market validation for the proposed innovation and add significant credibility to the proposed effort. Letters of support should demonstrate that the company has initiated dialogue with relevant stakeholders (potential customers, strategic partners or investors) for the proposed innovation and that a legitimate business opportunity may exist should the technology prove feasible. The letter(s) must contain affiliation and contact information for the signatory stakeholder. Letters and supporting documents from consultants and subcontractors (or any personnel identified in the preliminary Budget Justification) are NOT considered letters of support and instead should be included in the preliminary Budget Justification section.

S4. Company Commercialization History (if applicable). A Company Commercialization History is required for all proposers certifying receipt of previous Phase II awards from any Federal agency on the third page of the Cover Page in question # 11. The NSF Commercialization History Template MUST be used. All items must be addressed in the format outlined in this template. Changes to the NSF template, additional narratives and/or commercialization history documents from other agencies are not permitted.

S5. Human Subjects and Vertebrate Animals (if applicable). If human subjects Institutional Review Board (IRB) approval is

indicated, it must be in-hand at the time of submission or there must be a plan for such approval. A supporting letter regarding IRB approval should be provided under supplementary documents. The approval must be readily attainable within six weeks of informal notification of recommendation for award to ensure continued processing for funding. The small business has three basic options with regard to human subjects review: 1) Establish your own IRB (see Office for Human Research Protections (OHRP) at Health and Human Services (HHS) http://www.hhs.gov/ohrp/assurances/index.html#registernew; 2) Use the review board of a (usually local) university or research institution, either via consultants to the project, a project subcontract, or directly through its own contacts; 3) Use a commercial company. Please refer to the instructions here on the necessary supplementary documents. Note that in some cases, product testing involves human subjects. Look for federal-wide assurances under the Office for Human Research Protections website (http://www.hhs.gov/ohrp/index.html). Animal use in funded projects requires approval of the company or collaborating institutions' Institutional Animal Care and Use Committee (IACUC). Please refer to http://www.aphis.usda.gov/ for additional information.

S6. Resubmission Change Description (if applicable; no more than one page). A declined proposal may be resubmitted, but only after it has undergone substantial revision. A resubmitted proposal that has not clearly taken into account the major comments or concerns resulting from the prior NSF review may be returned without review. The Foundation will treat the revised proposal as a new proposal, subject to the standard review procedures. If a Phase I proposing company indicates on the cover page that the proposal is a resubmission, the company must include a document detailing the substantial revisions that have been made in this Supplementary Document.

Unacceptable Objectives. Proposed efforts directed toward systems studies; market research; commercial development of existing products or proven concepts; straightforward engineering design for packaging; laboratory evaluations not associated with the research and development process; incremental product or process improvements; evolutionary optimization of existing products; and evolutionary modifications to broaden the scope of an existing product or application are examples of project objectives that are not acceptable for SBIR. Projects determined unacceptable will be returned without review to the proposer. Phase I proposals returned without review by NSF are NOT eligible for reconsideration under the same program solicitation; however, proposals may be resubmitted under a subsequent solicitation after substantial revisions have been made.

Proposers are reminded to identify the NSF publication number (located on the first page of this document) 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.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations:

Indirect costs plus fringe benefits are limited to a maximum rate of 150% of direct salaries and wages. This limitation may entail mandatory committed cost sharing by the organization. In such cases, it constitutes an exception to NSF's cost sharing policy.

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. submitter's local time):

  December 06, 2016

  FastLane will not permit submission after 5:00 p.m. "proposer's time" on the deadline date. Proposer's time is determined by the time zone of the company's address as registered with NSF.

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: http://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.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal

and award process (and associated timeline) is included in the GPG as Exhibit III-1.

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

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

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

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

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

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

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

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?

5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

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

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

Additional Solicitation Specific Review Criteria

THE SBIR PROGRAM HAS ADDITIONAL CRITERIA THAT REFLECT THE LEGISLATIVE EMPHASIS OF THE PROGRAM AND COMPLEMENT THE STANDARD NSF REVIEW CRITERIA LISTED ABOVE.

- **"What is the intellectual merit of the proposed activity?"**
  - Is the proposed plan a sound approach for establishing technical and commercial feasibility?
  - To what extent does the proposal suggest and develop unique or ingenious concepts or applications?
  - How well qualified is the technical team (Principal Investigator, key staff, consultants, and subawardees) to conduct the proposed activity?
    Is there sufficient access to resources (materials and supplies, analytical services, equipment, facilities, etc.)?
  - Does the proposal reflect state-of-the-art in the major research activities proposed? (Are advancements in state-of-the-art likely?)
- **"What are the broader impacts of the proposed activity?"**
  - What may be the commercial and societal benefits of the proposed activity?
  - Does the outcome of the proposed activity lead to a marketable product or process that warrants significant NSF support?
  - Given the stage of the proposed effort, is the team well-balanced between technical and business skills?
  - Has the proposing firm successfully commercialized SBIR/STTR-supported technology where prior awards have been made? (Or, has the firm been successful at commercializing technology that has not received SBIR/STTR support?)
  - Has the proposer evaluated the competitive advantage of this technology vs. alternate technologies that can meet the same market needs?
  - Does the proposal lead to enabling technologies (instrumentation, software, etc.) for further innovation?
  - How well is the proposed activity positioned to attract further funding from non-SBIR/STTR sources once the project ends?

B. Review and Selection Process

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

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. 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 strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal

Investigator. (See Section VI.B. for additional information on the review process).

B. Award Conditions

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

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

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

Special Award Conditions:

SBIR/STTR Funding Agreement Certification:
SBIR/STTR prospective grantees will be notified by NSF to provide a signed SBIR/STTR Funding Agreement Certification. The federal government relies on the information provided by grantees to determine whether the business is eligible for a Small Technology Transfer (STTR) Program award. Certification will be used to ensure continued compliance during the life of the funding agreement. (http://www.nsf.gov/eng/iip/sbir/Forms/SBIR_STTR_Funding_Agreement.pdf)

Fraud, Waste, and Abuse (FWA) Notification:
If at any time you become aware of fraud or any kind of wrongdoing under any award, please contact the NSF Office of Inspector General: Internet: http://www.nsf.gov/oig/hotline_form.jsp; E-mail: oig@nsf.gov Phone: 703-292-7100 (during business hours) or 703-244-4443 (to speak to the duty officer); Anonymous Hotline: 800-428-2189; Fax: 703-292-9158; Mail: 4201 Wilson Boulevard, Suite 1135 Arlington, VA 22230 ATTN: OIG HOTLINE

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 no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

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

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

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

The Phase I final report will be due to NSF **within 15 days of the expiration of the grant** and is limited to 15 pages in length. A Phase II proposal requires a Phase I technical report to be uploaded as part of the Phase II proposal package in FastLane. If the Phase II proposal is submitted prior to the completion of the Phase I award, an interim Phase I technical report may be uploaded as part of the Phase II proposal package in FastLane.

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:

- Henry Ahn, Smart Health (SH) and Biomedical (BM) Technologies, telephone: 703-292-7069, email: hahn@nsf.gov
- Peter Atherton, Information Technologies (IT), telephone: (703) 292-8772, email: patherto@nsf.gov
- Prakash Balan, Chemical Technologies (CT), telephone: (703) 292-5341, email: pbalan@nsf.gov
- Anna Brady-Estevez, Environmental Technologies, telephone: (703) 292-7077, email: abrady@nsf.gov
- Glenn H. Larsen, Educational Technologies and Applications (EA), telephone: (703) 292-4607, email: glarsen@nsf.gov

- Debasis Majumdar, Advanced Materials and Instrumentation (MI), telephone: (703) 292-4709, email: dmajumda@nsf.gov
- Rajesh Mehta, Advanced Manufacturing and Nanotechnology (MN), telephone: (703) 292-2174, email: rmehta@nsf.gov
- Muralidharan S. Nair, Electronic Hardware, Robotics and Wireless Technologies (EW), telephone: (703) 292-7059, email: mnair@nsf.gov
- Ben Schrag, Other Topics (OT), telephone: 703-292-8323, email: bschrag@nsf.gov
- Rick Schwerdtferger, Internet of Things (IoT), Semiconductors (S) and Photonic (PH) Devices, telephone: 703-292-8353, email: rschwerd@nsf.gov
- Ruth M. Shuman, Biological Technologies (BT), telephone: (703) 292-2160, email: rshuman@nsf.gov
- Jesus V. Soriano, Smart Health (SH) and Biomedical (BM) Technologies, telephone: (703) 292-7795, email: jsoriano@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.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, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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