AIR FORCE 15.3 Small Business Innovation Research (SBIR)
Direct to Phase II Proposal Instructions

All Phase II proposals must be prepared and submitted through the Department of Defense (DoD) SBIR/STTR electronic submission site: https://sbir.defensebusiness.org

I. DIRECT TO PHASE II

15 U.S.C. §638 (cc), as amended by NDAA FY2012, Sec. 5106, PILOT TO ALLOW PHASE FLEXIBILITY, allows the Department of Defense to make an award to a small business concern under Phase II of the SBIR program with respect to a project, without regard to whether the small business concern was provided an award under Phase I of an SBIR program with respect to such project. **Air Force is conducting a "Direct to Phase II" pilot implementation of this authority for this 15.3 SBIR solicitation only and does not guarantee the pilot will be offered in future solicitations. Each eligible topic requires documentation to determine that Phase I feasibility has been met and the technical requirements for a Direct to Phase II proposal.**

II. INTRODUCTION

Please review the U.S. Department of Defense Small Business Innovation Research (SBIR) Program Solicitation 15.3. The Air Force (AF) 15.3 Direct to Phase II proposal submission instructions are intended to clarify the Department of Defense (DoD) instructions as they apply to AF requirements. The Air Force Research Laboratory (AFRL), Wright-Patterson Air Force Base, Ohio, is responsible for the implementation and management of the AF Small Business Innovation Research (SBIR) Program.

For general inquiries or problems with the electronic submission, contact the DoD SBIR/STTR Help Desk at [1-800-348-0787] or Help Desk email at [sbirhelp@bytecubed.com] (9:00 a.m. to 6:00 p.m. ET Monday through Friday). For technical questions about the topics during the pre-solicitation period (27 August 2015 through 27 September 2015), contact the Topic Authors listed for each topic on the Web site. For information on obtaining answers to your technical questions during the formal solicitation period (28 September through 28 October 2015), go to https://sbir.defensebusiness.org/sitis.

General information related to the AF Small Business Program can be found at the AF Small Business website, http://www.airforcesmallbiz.org. The site contains information related to contracting opportunities within the AF, as well as business information, and upcoming outreach/conference events. Other informative sites include those for the Small Business Administration (SBA), www.sba.gov, and the Procurement Technical Assistance Centers, http://www.aptac-us.org/. These centers provide Government contracting assistance and guidance to small businesses, generally at no cost.

The AF SBIR Program is a mission-oriented program that integrates the needs and requirements of the AF through R&D topics that have military and/or commercial potential. Efforts under the SBIR program fall within the scope of fundamental research. The Under Secretary of Defense (Acquisition, Technology, & Logistics) defines fundamental research as "basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community," which is distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons. See DFARS 252.227-7018 for a description of your SBIR/STTR rights.

Firms must qualify as a small business concern as defined in the DoD SBIR solicitation at the time of Phase II award. Firms are highly encouraged to review the DoD SBIR/STTR Solicitations requirements.

NOTE: Air Force reserves the right to not make any awards under the Direct to Phase II pilot. The Government is not responsible for expenditures by the offeror prior to award of a contract. All awards are subject to availability of funds and successful negotiations.

III. PROPOSAL REQUIREMENTS:

Direct to Phase II proposals must follow the steps outlined below:

STEP 1:

1. Offerors must create a Proposal Cover Sheet using the DoD Proposal submission site: https://sbir.defensebusiness.org (follow the DoD Instructions for the Cover Sheet located in section 5.4.a).
2. Offerors must submit documentation that satisfies the Phase I feasibility requirement as the last pages of the Direct to Phase II Technical Volume submission*
    a. Maximum page length for feasibility documentation is 25 pages. If you have references, include a reference list or works cited list as the last page of the feasibility documentation. This will count towards the page limit.
    b. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI). If technology in the feasibility documentation is subject to intellectual property (IP), the offeror must provide IP rights assertions. Provide a good faith representation that you either own or possess appropriate licensing rights to all other IP that will be utilized under your proposal. Additionally, proposers shall provide a short summary for each item asserted with less than unlimited rights that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research. Please see section 11.5 of the DoD instructions for information regarding technical data rights.
    c. Include a one page summary on Commercialization Potential addressing the following:
        1. Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
        2. Describe the potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.
    d. DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated and WILL be redacted.

STEP 2:

1. Offerors must prepare a Direct to Phase II proposal using the AF Phase II proposal instructions below.
2. **The Phase II proposal must be submitted by 6:00 a.m. (ET), 28 Oct 2015.**

* NOTE: Offerors are required to provide information demonstrating that the scientific and technical merit and feasibility has been established. **Air Force will not evaluate the offeror's related Phase II proposal if it determines that the offeror has failed to demonstrate that technical merit and feasibility has been established or the offeror has failed to demonstrate that work submitted in the feasibility documentation was substantially performed by the offeror and/or the principal investigator (PI)**. Refer to the Phase I description (within the topic) to review the minimum requirements that need to be demonstrated in the feasibility documentation. **Proposals MUST NOT be related to or logically extend from any prior or ongoing federally funded SBIR or STTR work. If you have received a SBIR award for similar work at any time, you are ineligible to participate in this pilot program.**

NOTE: All Phase II awardees should have a Defense Contract Audit Agency (DCAA) approved accounting system. It is strongly urged that an approved accounting system be in place prior to the AF Phase II award timeframe. If you do not have a DCAA approved accounting system in place in time, it will delay / prevent Phase II contract award. If you have questions regarding this matter, please contact the SBIR Contracting Officer, Gail Nyikon, gail.nyikon@us.af.mil or (937) 255-0263.

IV. PROPOSAL SUBMISSION

The complete proposal, i.e., DoD Cover Sheet, technical proposal, cost proposal, and Company Commercialization Report, must be submitted electronically at https://sbir.defensebusiness.org. The technical proposal is limited to 50 pages. The commercialization report, advocacy letters (if any) the Feasibility Study documentation, "SBIR/STTR Environment, Safety and Occupational Health (ESOH) Questionnaire", (Attachment 1) and the additional cost proposal itemized listing (a through i) should be included as the last pages of the uploaded technical volume. This documentation will not count toward the 50 page limitation. Only one file per submission can be uploaded to the DoD Submission Site. Ensure your complete technical volume and additional cost volume information is included in this sole submission. The preferred submission format is Portable Document Format (.pdf). Graphics must be distinguishable in black and white. **VIRUS-CHECK ALL SUBMISSIONS.**

Phase II proposals require a comprehensive, detailed submission of the proposed effort. AF Direct to Phase II efforts are 15 months; 12 months for technical performance and three (3) months for completion of the final report. AF Direct to Phase II efforts are awarded at values between $900K and $1.5M. **Please refer to individual topic write-ups for specific award amounts**. Commercial and military potential of the technology under development is extremely important. Proposals emphasizing dual-use applications and commercial exploitation of resulting technologies are sought.

All Phase II Research or Research and Development (R/R&D) must be performed by the small business and its team members in the United States, as defined in the DoD 15.3 Solicitation Instructions. The primary employment of the Phase II principal investigator must be with the small business concern at the time of award and during conduct of the entire proposed effort. Primary employment is defined as more than one-half of the principal investigator's time being spent working for the small business. This precludes full-time employment with another organization.

Knowingly and willfully making false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal Statement Act, 18 U.S.C. Section 1001, punishable by a fine up to $10,000, up to five years in prison, or both.

V. PHASE II PROPOSAL PREPARATION INSTRUCTIONS AND PROPOSAL REQUIREMENTS

A. Proposal Requirements. A Phase II proposal should provide sufficient information to persuade the AF the proposed advancement of the technology represents an innovative solution to the scientific or engineering problem and is worthy of support under the stated criteria. All sections below count toward the page limitation, unless otherwise specified.

B. Proprietary Information. Information constituting a trade secret, commercial or financial information, confidential personal information, or data affecting national security must be clearly marked. It shall be treated in confidence to the extent permitted by law. Be advised, in the event of proposal selection it is likely the Work Plan or Statement of Work (SOW) will be incorporated into the resulting contract, in whole or part, by reference or as an attachment. Therefore, segregate any information to be excluded from public release pursuant to the Freedom of Information Act (FOIA). See Section 3.7 of the DoD Solicitation regarding marking of proprietary information.

C. General Content. Proposals should be direct, concise, and informative. Type shall be no smaller than 11-point on standard 8 ½ X 11 paper, with one-inch margins and pages consecutively numbered. Offerors are discouraged from including promotional and non-programmatic items.

D. Proposal Format. The technical proposal includes all items listed below in the order provided.

(1) **Proposal Cover Sheet:** Complete and submit the SBIR Proposal Cover Sheet in accordance with the instructions provided at https://sbir.defensebusiness.org/. The technical abstract should include a brief description of the program objective(s), a description of the effort, anticipated benefits and commercial applications of the proposed research, and a list of key words/terms. The technical abstract of each successful proposal will be submitted to the Office of the Secretary of Defense (OSD) for publication and, therefore, must not contain proprietary or classified information. The term "Component" on the Cover Sheet refers to the AF organization requesting the Phase II proposal.

(2) **Table of Contents:** A table of contents should be located immediately after the Cover Sheet.

(3) **Glossary:** Include a glossary of acronyms and abbreviations used in the proposal.

(4) **Milestone Identification:** Include a program schedule with all key milestones identified. If options are proposed, the schedule should provide notional option start date and period of performance.

(5) **Identification and Significance of the Problem or Opportunity:** Briefly reference the specific technical problem/opportunity that will be pursued under this effort.

(6) **Phase II Technical Objectives:** The proposal should include an assessment of the potential commercial application for each objective.

(7) **Proposer-Prepared Statement of Work (SOW):** The SOW shall be a separate and distinct part of the proposal package, using a page break to divide it from the technical proposal. The proposed SOW must contain a summary description of the technical methodology and task description in broad enough detail to provide contractual flexibility. The following is the recommended format for the SOW; begin this section on a new page. **DO NOT include proprietary information in the SOW.**

a) 1.0 – Objective: This section is intended to provide a brief overview of the specialty area. It should explain why it is being pursued and the expected outcome.
b) 2.0 – Scope: This section should provide a concise description of the work to be accomplished, including the technology area to be investigated, goals, and major milestones. However, the key elements of this section are task development and deliverables, i.e., the anticipated end result and/or product of the effort. This section must also be consistent with the information in 4.0 (below).
c) 3.0 – Background: The proposer shall identify appropriate specifications, standards, and other documents applicable to the effort. This section includes any information, explanation, or constraints to understanding the requirements. It may include relationships to previous, current, and/or future operations. It may also include techniques previously found to be ineffective.
d) 4.0 – Task/Technical Requirements: The detailed description of the individual tasks

to accomplish the work to be performed is considered to be legally binding on the proposer. Therefore, it must be developed in an orderly progression with sufficient detail to establish overall program requirements and goals. The work effort must be segregated into major tasks and identified in separately numbered paragraphs.

Each numbered major task should delineate by subtask the work to be performed. The SOW MUST contain every task to be accomplished; they must be definite, realistic, and clearly stated. Use "shall" whenever the SOW expresses a binding provision. Use "should" or "may" to express a declaration or purpose. Use "will" when no contractor requirement is involved, i.e., ". . . power will be supplied by the Government."

(8) **Deliverables:** Include a section clearly describing the specific sample/prototype hardware/ software to be delivered, as well as data deliverables, schedules, and quantities. Be aware of the possible requirement for unique item identification IAW DFARS 252.211-7003, Item Identification and Valuation, for hardware. If hardware/software will be developed but not delivered, provide an explanation. At a minimum, the following reports will be required under ALL Phase II contracts.

a) Scientific and Technical Reports: Rights in technical data, including software, developed under the terms of any contract resulting from a SBIR solicitation generally remain with the contractor. The Government obtains a royalty-free license to use such technical data for Government purposes during the period commencing with contract award and ending five (5) years after submission of the last contract deliverable. Upon expiration of the five year restrictive license, the Government has unlimited rights to the SBIR data, unless the firm receives another contract under which the SBIR data rights may be asserted.

i. Final Report: The draft is due 30 days after completion of the Phase II technical effort. The first page of the final report will be a single-page project summary, identifying the purpose of the work, providing a brief description of the effort accomplished, and listing potential applications of the results. The summary may be published by DoD; therefore, it must not contain any proprietary or classified information. The remainder of the report should contain details of the project objectives met, work completed, results obtained, and estimates of technical feasibility.

ii. Status Reports: Status reports are due quarterly at a minimum.

iii. Phase II Summary Report: The Phase II summary report is due at the end of the technical effort and must be submitted via electronic form to the AF SBIR/STTR site. Each report should not exceed 700 words and should include a description of the technology and anticipated applications/benefits for Government and/or private sector use. The electronic form/instructions are found on the AF SBIR/STTR site, http://www.afsbirsttr.com. The site is open to the public; therefore, the summary reports should not contain any proprietary or sensitive information.

iv. Small Business Online Success Stories: Success Story submissions are due at the end of the technical effort via the http://launchstories.org/ website. Refer to the Contract Data Requirements List (CDRL) in your contract for submission instructions.

b) Cost Reports: Required if a cost-type contract is awarded; Phase IIs are generally awarded as cost-type.

c) Additional Reporting: AF may require additional reporting or documentation including:

i. Software documentation and users' manuals;
ii. Engineering drawings;
iii. Operation and maintenance documentation;
iv. Safety hazard analysis when the project will result in partial or total development and delivery of hardware; and
v. Updates to the commercialization results.

(9) **Related Work:** Describe significant activities directly related to the proposed effort, including any previous programs conducted by the principal investigator, proposing firm, consultants, or others, and their application to the proposed project. Also list any reviewers providing comments regarding the offeror's knowledge of the state-of-the-art in the specific approach proposed.

(10) **Commercialization Potential:**

a) The DoD requires a commercialization plan be submitted with the Phase II proposal, specifically addressing the following questions:

i. What is the first planned product to incorporate the proposed technology?
ii. Who are the probable customers, and what is the estimated market size?
iii. How much money is needed to bring this technology to market and how will it be raised?
iv. Does your firm have the necessary marketing expertise and, if not, how will your firm compensate?
v. Who are the probable competitors, and what price/quality advantage is anticipated by your firm?

b) The commercialization strategy plan should briefly describe the commercialization potential for the anticipated results of the proposed project, as well as plans to exploit it. Commercial potential is evidenced by:

i. The small business' record of commercializing SBIR/STTR or other research, particularly as reflected in its Company Commercialization Report. The Company Commercialization Report of prior SBIR/STTR awards may be included to satisfy this requirement.
ii. The existence of private sector or non-SBIR/STTR funding sources demonstrating commitment to Phase II efforts/results.
iii. The existence of Phase III follow-on commitments for the research subject.
iv. The presence of other indicators of commercial technology potential, including the firm's commercialization strategy.

c) If awarded a Phase II contract, the contractor is required to periodically update the commercialization results of the Phase II project at https://sbir.defensebusiness.org/. These updates will be required, at completion of the Phase II effort, and subsequently when the contractor submits a new SBIR/STTR proposal to DoD. Firms not submitting a new proposal to DoD will be requested to provide updates annually after completion of the Phase II.

(11) **Military Applications:** Briefly describe the existing/potential military requirement and the military potential of the SBIR/STTR Phase II results. Identify the DoD agency/organization most likely to benefit from the project. State if any DoD agency has expressed interest in, or commitment to, a non-SBIR, Federally-funded Phase III effort. This section should involve not more than one to two (1-2) paragraphs. Include agency point of contact names and telephone numbers.

(12) **Relationship with Future Research or Research and Development (R/R&D) Efforts:**

a) State the anticipated results of the proposed approach, specifically addressing plans for Phase III, if any.
b) Discuss the significance of the Phase II effort in providing a basis for the Phase III R/R&D effort, if planned.

(13) **Key Personnel:** In the technical volume, identify all key personnel involved in the project. Include information directly related to education, experience, and citizenship. A technical resume for the principal investigator, including publications, if any, must also be included. Concise technical resumes for subcontractors and consultants, if any, are also useful. You must identify all non-U.S. citizens expected to be involved in the project as direct employees, subcontractors, or consultants. For these individuals, in addition to technical resumes, please provide countries of origin, type of visas or work permits under which they are performing, and explanation of their anticipated level of involvement in the project.

When the topic area is subject to export control, these individuals, if permitted to participate, are limited to work in the public domain. Further, tasks assigned must not be capable of assimilation into an understanding of the project's overall objectives. This prevents foreign citizens from acting in key positions, such as Principal Investigator, Senior Engineer, etc. Additional information may be requested during negotiations in order to verify foreign citizens' eligibility to perform on a contract awarded under this solicitation.

(14) **Facilities/Equipment:** Describe instrumentation and physical facilities necessary and available to carry out the Phase II effort. Justify equipment to be purchased (detail in cost proposal). State whether proposed performance locations meet environmental laws and regulations of Federal, state, and local Governments for, but not limited to, airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

(15) **Consultants/Subcontractors**: Private companies, consultants, or universities may be involved in the project. All should be described in detail and included in the cost proposal. **In accordance with the Small Business Administration (SBA) SBIR Policy Directive, a minimum of 50% of the R/R&D must be performed by the proposing firm, unless otherwise approved in writing by the Contracting Officer.** Signed copies of all consultant or subcontractor letters of intent must be attached to the proposal. These letters should briefly state the contribution or expertise being provided. Include a SOW and detailed cost proposal. Include information regarding consultant or subcontractor unique qualifications. Subcontract copies and supporting documents do not count against the Phase II page limit. Identify any subcontract/consultant foreign citizens per (13) above.

(16) **Prior, Current, or Pending Support of Similar Proposals or Awards:** WARNING: While it is permissible, with proper notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous Federal program solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. Any potential for this situation must be disclosed to the solicitation agency(ies) before award. If a proposal submitted in response to this solicitation is substantially the same as another proposal previously, currently, or in process of being funded by another Federal agency/DoD Component or the same DoD Component, the company must so indicate on the Cover Sheet and provide the following:

a) The name and address of the Federal agency(ies) or DoD Component(s) to which proposals were or will be submitted, or from which an awarded is expected or has been received;
b) The date of proposal submission or date of award;
c) The title of the proposal;
d) Name and title of the principal investigator for each proposal submitted or award received; and
e) Title, number, and date of solicitation(s) under which the proposal was or will be submitted, or under which an award is expected or has been received.
f) If award was received, provide the contract number.
g) Specify the applicable topics for each SBIR proposal submitted or award received.

NOTE: If this does not apply, state in the proposal, "No prior, current, or pending support for proposed work." Complete the attached SBIR/STTR Environment, Safety, and Occupational Health (ESOH) Questionnaire and include it with the proposal. This form does not count toward the 50-page limitation.

(17) **Cost Proposal:** A detailed cost proposal must be submitted. Cost proposal information will be treated as proprietary. Proposed costs must be provided by both individual cost element and contractor fiscal year (FY) in sufficient detail to determine the basis for estimates, as well as the purpose, necessity, and reasonableness of each. This information will expedite award of the resulting contract if the proposal is selected for award. Generally, cost plus fixed fee (CPFF) contracts are appropriate for Phase II awards. Phase II contracts may include profit (fixed price) or fee (cost type).

To receive a cost-type contract, a determination by the Government of a firm's accounting system adequacy is required. This determination considers the acceptability of a firm's accounting system for accumulating and billing costs under a cost-type contract. The outcome is based on a review performed by the Defense Contract Audit Agency (DCAA), with final approval provided by the Defense Contract Management Agency (DCMA). Please refer to DCAA's website, http://www.dcaa.mil, where specific information may be found under the "Guidance" drop down menu. Select "Information for Contractors," which will open DCAA Manual No. 7641.90. This manual is designed to assist contractors in understanding requirements applicable to the contract audit process. Enclosure 2, "Pre-award Surveys of Prospective Contractor Accounting Systems" contains information regarding DCAA's activity to determine accounting system adequacy. While only a warranted Government Contracting Officer may request a pre-award accounting system survey, this information assists firms in preparing for this activity. All Phase II proposals should indicate whether an accounting system review was previously performed by DCAA and, if so, the contact information for the auditor. Without a Government-approved accounting system, award may be delayed or prevented. Any questions regarding this matter should be discussed with the AF Phase II Contracting Officer.

Cost proposal attachments do not count toward Phase II proposal page limitations. The cost proposal includes:

a) Direct Labor: Identify key personnel by labor category. Number of hours, actual hourly rates, labor overhead, and/or fringe benefits per contractor FY is also required.

b) Direct Materials: Costs for materials, parts, and supplies must be justified and supported. Provide an itemized list of types, quantities, prices, and, where appropriate, purpose. If computer or software purchases are planned, detailed information such as manufacturer, price quotes, proposed use, and support for the need will be required.

c) Other Direct Costs: This includes specialized services such as machining or milling, special test/analysis, and costs for temporary use/lease of specialized facilities/ equipment. Provide usage (hours) expected, rates, and sources, as well as brief discussion concerning the purpose and justification. Proposals including leased hardware must include an adequate lease versus purchase rationale. Special tooling/test equipment/material costs are acceptable but will be carefully reviewed to determine the need/appropriateness of the work proposed. The Contracting Officer must decide whether these purchases are advantageous to the Government and are directly related to the proposed effort. Title to property furnished by the Government will be vested with the AF unless determined to be more cost-effective for transfer to the contractor. The Government's intention is not to directly fund purchase of general purpose equipment.

d) Subcontracts: Subcontract costs must be supported with copies of the subcontract agreements. Agreement documents must adequately describe the work to be performed and basis for cost. The agreement document should include a SOW, assigned personnel, hours and rates, materials (if any), and proposed travel (if any). A letter from the subcontractor agreeing to perform a task or tasks at a fixed price is not considered sufficient. The proposed total of all consultant fees, facility leases or usage fees, and other subcontract or purchase agreements may not exceed one-half of the total contract price or cost, unless otherwise approved in writing by the Contracting Officer.

   IAW FAR 15.404-1, price analysis, including reasonableness, realism, and completeness, of the proposed subcontractor costs by the prime is required. If based on comparison with prior efforts, identify the basis upon which the prior prices were determined to be reasonable. If price analysis techniques are inadequate or the FAR requires submission of subcontractor cost or pricing data, provide a cost analysis IAW FAR 15.404-1(c). Cost analysis includes, but is not limited to, consideration of materials, labor, travel, other direct costs, and proposed profit rates.

e) Consultants: For each consultant, provide a separate agreement letter briefly stating the service to be provided, hours required, and hourly rate and include a short, concise resume.

f) Travel: Each Phase II effort, at a minimum, should include a kickoff or interim meeting. Travel costs must be justified as related to the needs of the effort. Include destinations, the number of trips, number of travelers per trip, airfare, per diem, lodging, ground transportation, etc. Information regarding per diem and lodging rates may be found in the Joint Travel Regulation (JTR), Volume 2, www.defensetravel.dod.mil.

g) Indirect Costs: Indicate the basis of the proposed rates, e.g., budgeted/actual rates

per FY, etc. The proposal should identify the specific rates used and allocation bases to which they are applied. Do not propose composite rates; proposed rates and applications per FY throughout the anticipated performance period should be provided.

h) Cost Share: While permitted, cost sharing is not required and will not be used as an evaluation factor. The cost share portion of contracts may not provide for fee.

i) DD Form 2345: For proposals submitted under export-controlled topics (either International Traffic in Arms (ITAR) and Export Administration Regulations (EAR)), a copy of the certified DD Form 2345, Militarily Critical Technical Data Agreement, or evidence of application submission must be included. The form, instructions, and FAQs may be found at the United States/Canada Joint Certification Program website, http://www.dlis.dla.mil/jcp/. Approval of the DD Form 2345 will be verified if proposal is chosen for award.

E. Company Commercialization Report: All Phase II proposals must contain a "Commercialization Report of Prior SBIR Awards". This report should be submitted as an attachment or enclosure and will not be counted against the 50-page limitation. The online Company Commercialization Report may be used to fulfill this requirement. As instructed in paragraph 11.2 of the DoD Solicitation, prepare the report using the password-protected DoD SBIR electronic submission site, https://sbir.defensebusiness.org/.

VI. METHOD OF SELECTION AND EVALUATION CRITERIA

A. Introduction: Phase II proposals are evaluated on a competitive basis by subject matter expert (SME) scientists, engineers, or other technical personnel. Throughout evaluation, selection, and award, confidential proposal and evaluation information will be protected to the greatest extent possible.

B. Evaluation Criteria: Phase II proposals will be reviewed for overall merit based on following criteria published in the DoD SBIR Solicitation in descending order of importance:

(1) Technical Merit – The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.

(2) Potential for Commercial Application – The potential for commercial (Government or private sector) application and the benefits expected to accrue from it.

(3) Qualifications of the Principal Investigator (and Team) – Qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the R/R&D but also to commercialize the results.

Other factors considered during the selection process include appropriate demonstration of feasibility of the technology, equivalent to that resulting from Phase I type efforts; commitment for Phase III funding; possible duplication with other R/R&D; program balance; budget limitations; and potential, if successful, of leading to a product of continuing interest to DoD. Where technical evaluations are essentially equal in merit, and as cost and/or price is a substantial factor, cost to the Government will be considered in determining the successful offeror. AF anticipates pricing will be based on adequate price competition. The next tie-breaker on essentially equivalent proposals is the inclusion of manufacturing considerations. Phase II evaluations may include on-site assessment of the offeror's research results to date, or of the Contractor's facility, by Government personnel. The reasonableness of proposed costs for the Phase II effort will be examined to determine proposals offering the best value to the Government.

Once the effort is determined to have potential to meet DoD objectives, as well as meeting market needs, the firm is encouraged to pursue private sector or non-SBIR Government funding for a follow-on Phase III effort. Phase III can cover a broad range of activities from commercial application of SBIR- funded R/R&D by non-Federal sources of capital (within Federal Government, would be a subcontract to a Federal contract); SBIR-derived products/services intended for use by the Federal Government, funded by non- SBIR sources of Federal funding; or continuation of R/R&D, previously competitively selected using peer review or merit-based selection procedures, funded by non-SBIR Federal funding sources.

NOTE: Only Government employees and technical personnel from Federally Funded Research and Development Centers (FFRDCs) MITRE and Aerospace Corporations, working under contract to provide technical support to Department of Defense and the AF Space and Missile Systems Center respectively, may evaluate proposals. All FFRDC employees have executed non-disclosure agreement (NDAs) as a requirement of their contracts. Additionally, AF support contractors may be used to administratively or technically support the Government's SBIR Program execution. DFARS 252.227-7025, Limitations on the Use or Disclosure of Government- Furnished Information Marked with Restrictive Legends (Mar 2011), allows Government support contractors to do so without company-to-company NDAs only AFTER the support contractor notifies the SBIR firm of its access to the SBIR data AND the SBIR firm agrees in writing no NDA is necessary. If the SBIR firm does not agree, a company-to-company NDA is required. The attached "NDA Requirements form" (Attachment 2) must be completed, signed, and included in Phase II proposal, indicating your firm's determination regarding company-to-company NDAs for administrative access to SBIR data by AF support contractors. This form will not count against the 50-page limitation.

VII. CERTIFICATIONS

In addition to the standard Federal and DoD procurement certifications, the SBA SBIR/STTR Policy Directives require the collection of certain information from firms at the time of award and during the award life cycle. Each firm must provide this additional information at the time of the Phase II award, prior to receiving 50% of the total award amount for a Phase II award, and prior to final payment on the Phase II award.

VIII. DEBRIEFINGS

In accordance with FAR 15.505, a debriefing may be received by written request. Consistent with the DoD SBIR/STTR Solicitations, the request must be received within 30 days after receipt of notification of non-selection. Written requests for debrief should be uploaded to the Small Business area of the AF SBIR/STTR Site, http://www.afsbirsttr.com. Requests should include the company name and telephone number/email address for a company point of contact, as well as an alternate. Also include the topic number under which the proposal was submitted and the proposal number. Further instructions regarding debrief request preparation/submission is available within the Small Business area of the AF SBIR/STTR Site. Requests received more than 30 days after receipt of notification of non-selection will be fulfilled at the Contracting Officers' discretion. Unsuccessful offerors are entitled to no more than one debriefing per proposal. NOTE: FAR 15.505(a)(2) states, at the offeror's request, debriefs may be delayed until after award. Under the AF SBIR/STTR Programs, debriefs are automated and standardized. Therefore, pre- and post-award debriefs are identical.

SBIR/STTR Environment, Safety and Occupational Health (ESOH) Questionnaire

Company Name:
Title:

a. Will hazardous materials (as defined by Federal Standard 313D, Material Safety Data, Transportation Data and Disposal Data for Hazardous Material Furnished to Government Activities and 40 CFR Part 260 – 279) be used in the contract?

Yes ☐ **No** ☐

If the answer is "yes," list materials:

_____

b. Will explosives or ammunition be used in research? (See definitions listed below before answering.)

Yes ☐ **No** ☐

Explosives and ammunition mean:
(a.) Liquid and solid propellants and explosives, pyrotechnics, incendiaries and smokes in the following:

1. Bulk:
2. Ammunition;
3. Rockets;
4. Missiles;
5. Warheads;
6. Devices; and
7. Components of (1) through (6), except for wholly inert items.

(b.) This definition does not include the following, unless the contractor is using or incorporating these materials for initiation, propulsion, or detonation as an integral or component part of an explosive, an ammunition or explosive end item, or of a weapon system.

1. Inert components containing no explosives, propellants, or pyrotechnics;
2. Flammable liquids;
3. Acids;
4. Oxidizers;
5. Powdered metals; or
6. Other materials having fire or explosive

characteristics.

If the answer is "yes," list items:

_____

c. Will any hazardous processes be performed under the contract? Examples include operation of heavy equipment or power tools, operation of lasers or radio frequency radiation emitters, use of high voltage (greater than 600 volts) equipment, or use of equipment operating at high pressure (greater than 60 psig) or high temperature (greater than 50°C).

Yes ☐ **No** ☐

If the answer is "yes," list processes:

_____

Will this research be completed on a U.S. Air Force installation?

Yes ☐ **No** ☐

If the answer is "yes," list facilities:

_____

d. Will the contract require the purchase, storage use or delivery of any chemicals or hazardous material to USAF facilities?

Yes ☐ **No** ☐

If the answer is "yes," list chemicals or hazardous materials:

_____

e. Will any hazardous chemical or waste be generated during the course of this research?

Yes ☐ **No** ☐

If the answer is "yes," specify the hazardous chemical or waste to be generated:

_____

f. Will any Class I ozone depleting substances (ODSs) be required in this research?
A list of Class I ODSs is located at the following website: http://www.epa.gov/ozone/ods.html

Yes ☐ **No** ☐

If the answer is "yes," list substances:

_____

g. Does this effort involve the purchase or use of any radioactive materials?

Yes ☐ **No** ☐

If the answer is "yes," specify the radioactive materials:

_____

h. Will this effort involve any asbestos, radiation, or chemical generating/using components that will be delivered to USAF facilities?

Yes ☐ **No** ☐

If the answer is "yes," specify the components:

_____

10. Are there any special atmospheric or water resource requirements?

Yes ☐ **No** ☐

If "yes" specify the requirements:

_____

Revised: 10 July, 2015

AIR FORCE
15.3 Small Business Innovation Research (SBIR)
Non-Disclosure Agreement (NDA) Requirements

DFARS 252.227-7018(b)(8), Rights in Noncommercial Technical Data and Computer Software – Small Business Innovation Research (SBIR) Program (May 2013), allows Government support contractors access to SBIR data without company-to-company NDAs only AFTER the support contractor notifies the SBIR firm of its access to the SBIR data AND the SBIR firm agrees in writing no NDA is necessary. If the SBIR firm does not agree, a company-to-company NDA is required.

"Covered Government support contractor" is defined in 252.227-7018(a)(6) as "a contractor under a contract, the primary purpose of which is *to furnish independent and impartial advice or technical assistance directly to the Government in support of the Government's management and oversight of a program or effort* (rather than to directly furnish an end item or service to accomplish a program or effort), provided that the contractor—

> (i) Is not affiliated with the prime contractor or a first-tier subcontractor on the program or effort, or with any direct competitor of such prime contractor or any such first-tier subcontractor in furnishing end items or services of the type developed or produced on the program or effort; and
>
> (ii) Receives access to the technical data or computer software for performance of a Government contract that contains the clause at 252.227-7025, Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends."

USE OF SUPPORT CONTRACTORS:

Support contractors may be used to administratively process SBIR documentation or provide technical support related to SBIR contractual efforts to Government Program Offices.

Below, please provide your firm's determination regarding the requirement for company-to-company NDAs to enable access to SBIR documentation by Air Force support contractors. This agreement must be signed and included in your Phase I/II proposal package

☐ YES ☐ NO Non-Disclosure Agreement Required
(If Yes, include your firm's NDA requirements in your proposal)

Company: _____ Proposal Number: _____

Address: _____ City/State/Zip: _____

Proposal Title: _____

Name _____ Date: _____

Title/Position _____

Revised: 10 July, 2015

AIR FORCE SBIR 15.3 Topic Index

AF153-001	Global Surveillance Augmentation Using Commercial Satellite Imaging Systems
AF153-002	Handheld Dismount Kit for Persistent, Precision Navigation in GPS-challenged Environments for Military Operations
AF153-003	Additive Manufacturing to Support 100% Parts Availability
AF153-004	Additive Manufacturing of Masking to Support Turbine Engine Sustainment

AIR FORCE SBIR 15.3 Topic Descriptions

AF153-001 TITLE: Global Surveillance Augmentation Using Commercial Satellite Imaging Systems

TECHNOLOGY AREA(S):

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the AF SBIR/STTR Contracting Officer, Ms. Gail Nyikon, gail.nyikon@us.af.mil.

OBJECTIVE: Develop an end to end system to exploit current and future commercial satellite imaging systems by utilizing novel techniques and algorithms to fuse the different data packages together to detect changes and provide warning/cueing to other systems.

DESCRIPTION: The commercial industry is paving the way for new end to end low earth orbit satellite systems capable of providing near-continuous (revisit times of minutes to hours) imaging of the Earth. Some exemplars of these developments are Google's SkyBox, PlanetLabs, BlackSky, Spire and Satellogic. Within the next few years, these companies are expected to field their own proprietary constellations, each with their own set of capabilities and products, which will be made available to the average consumer, commercial resellers, corporate and government users. These constellations hold a significant interest for the USAF as they are capable of high revisit rates at pertinent resolutions, between 1-5m. The USAF would like to capitalize on these future systems by building an infrastructure capable of exploiting the products and capabilities of these systems by integrating them into strategic analysis for areas of interest on a global scale. Many of these companies will host their images on their databases anywhere from hours to days after the photos are taken. In addition some systems will allow for consumers to 'task' satellites to take pictures of certain areas for a minimal cost.

As many of the companies will be collecting images with differing resolutions and wavebands, from different angles, times of day and over slightly different regions, the data will have to be collected and fused in order to correlate changes in a given area. An important element of this fusion is the registration of images, and in some cases ortho-rectification and geo-registration across these data sets. Next, the USAF needs to determine, autonomously, when significant changes occur in any given region. This poses significant challenges, as angles, shadows, and potentially a lack of geolocation may inhibit systems from properly alerting personnel of new areas of interest or changes in specific regions being monitored. The criteria for a useful tip/cue includes the time from data collection to receipt of the imagery, geolocation accuracy, probability of false alarm, and characterization of the activity or target of interest (i.e. troop buildup, missile launch preparations, etc). The system needs to provide proper warnings and indicators to the Air Force if an area becomes significant enough to require more persistent monitoring. The ability of the USAF to task these constellations must also be considered if it can provide additional value, in which case the processes for allocating these resources and efficiently tasking the constellations must be developed. This effort will receive no more than $1.5M for this award.

PHASE I: Proposal must show:
A) Demonstrated understanding of space imaging systems and products
B) Demonstrated expertise and capability in processing and fusing satellite imagery while performing useful extraction of intelligence value from such imagery(e.g.,crop monitoring)
C) Demonstrated feasibility of automated processing for data mining space based imagery for applications of military interest

FEASIBILITY DOCUMENTATION: Offerors interested in submitting a Direct to Phase II proposal in response to this topic must provide documentation to substantiate that the scientific and technical merit and feasibility described has been met and describes the potential commercial applications. The documentation provided must substantiate that the proposer has developed a preliminary understanding of global surveillance augmentation using commercial satellite systems. Documentation must include A) demonstrated understanding of space imaging systems and products, B) demonstrated expertise and capability in processing and fusing satellite imagery while performing useful extraction of intelligence value from such imagery (e.g., crop monitoring), C) demonstrated feasibility of automated processing for data mining space based imagery for applications of military interest. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Read and follow all of Step 1 of the Air Force 15.3 Instructions. The Air Force will not evaluate the offeror's related DP2 proposal where it determines that the offeror has failed to demonstrate the scientific and technical merit and feasibility of the Phase I project.

PHASE II: The contractor will study capabilities of future commercial satellite imagery constellations to provide useful military surveillance, indications, warning and threat detection, or other novel applications. The contractor will develop software capable of fusing multiple types of images taken from satellites and determine if a significant change has occurred which could result in further USAF action, and/or to implement image processing algorithms that support novel commercial/military uses.

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for potential government applications. There are potential commercial applications in a wide range of diverse fields that include agricultural crop monitoring, disaster monitoring, and terrain mapping.

REFERENCES:
1. Cudzilo, B., Foley, K.C., Smith, C. "The Ability of a Small Satellite Constellation to Tip and Cue Other Commercial Assets", 26th Annual AIAA/USU Conference on Small Satellites, Aug 2012

2. London, J.R., Marley, A.B., Weeks, D.J., "Army Nanosatellite Technology Demonstrations for the Tactical Land Warfighter", 27 Army Science Conference, Orlando, Florida, November 29 - December 2, 2010

3. Boriah, S., "Time Series Change Detection: Algorithms for Land Cover Change", Doctoral Dissertation University of Minnesota, April 2010 (http://www-users.cs.umn.edu/~sboriah/PDFs/BoriahB2010.pdf)

4. Laneve, G., Cadau, E.G, De Rosa, D. "Change Detection Analysis on Time Series of Satellite Images with Variable Illumination Conditions and Spatial Resolution", Proceedings of the International Workshop on the Analysis of Multi-temporal Remote Sensing Images, 18-20 July 2007

5. Edward Scharff, E., Moratto, Z., Beyer, R., Nefian, A., Lundy, M., Kim, T.K., Husmann, K. and Fong, T., "Neo-Geography Toolkit (NGT) v2", NASA Tech Briefs, 1 June 2015, (https://github.com/neogeographytoolkit/stereopipeline)

KEYWORDS: Satellite imagery, change detection, event monitoring, image data fusion, image processing, image exploitation, geo-rectification, geo-registration, satellite task scheduling.

AF153-002 TITLE: Handheld Dismount Kit for Persistent, Precision Navigation in GPS-challenged Environments for Military Operations

TECHNOLOGY AREA(S):

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual

use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the AF SBIR/STTR Contracting Officer, Ms. Gail Nyikon, gail.nyikon@us.af.mil.

OBJECTIVE: Build and demonstrate a handheld navigation system that is less than 5 lbs, capable of constraining position error growth, and reports estimated position accuracy in GPS-challenged environments.

DESCRIPTION: Accuracy, reliability, persistence, and integrity of Position Navigation and Timing (PNT) information from GPS and other Global Navigation Satellite Systems (GNSS) is under constant threat from asymmetrical jamming and spoofing attacks, rendering operations in anti-access/area-denial (A2AD) or "contested" environments increasingly difficult. A surge of R&D initiatives has given scientists and engineers a variety of tools and techniques that can be used to increase the resiliency of our navigation systems. These include, but are not limited to: GPS anti-Jam/anti-Spoof mechanisms; augmentations with GNSS, exploitation of signals of opportunity (SoOP) such as telecommunication towers or eLoran; vision aided navigation; advancements in MEMS-based navigation sensors; and many more. Navigation system concepts which are designed for GPS-"challenged" environments often have to compromise between performance, robustness, and SWaP-C (Size, Weight, Power and Cost). This topic seeks to leverage the aforementioned innovations as well as other novel ideas to design, build, and field a man-portable navigation system to be used by ground-based forces to navigate to a target in a GPS-contested environment.

The following vignette depicts the robustness and performance required. A tactical vehicle navigates to a drop-off point. Military forces dismount and approach a target of interest on foot, traversing several kilometers over many (up to 12) hours on batteries. The operation occurs in day or darkness, in inclement weather, and in environments with little or no infrastructure such as remote deserts and forests. When GPS and other GNSS are available they can be used. When GPS is degraded or denied, other RF SoOP and landmark-based navigation updates (e.g. vision, magnetic, etc.) should be used to constrain position error growth. Initialization will be at a known location or with GPS.

Throughout the mission, it is desired that the accuracy performance of the navigation solution should be as good as possible with the objective of constraining position errors to less than 100 m. Currently, this level of performance is unfeasible with unaided MEMS-based inertial navigation systems, and while it is anticipated the accuracy will vary throughout the mission depending on the aiding source used, it is critical that valid position accuracy estimates are provided throughout the mission.

Use of aiding to constrain the navigation system error growth is anticipated, and this aiding can include, but is not limited to: vision, radar, RF SoOPs, magnetometer-based landmarks, ranging radios, etc. As the forces will be traveling in a group, a collaborative, a multi-user networked architecture could be considered.

The navigation system can integrate with existing radios and battlespace awareness applications currently used by US military forces. It must be a handheld unit similar in size to a smartphone or tablet with any extra hardware, such as antennas or complimentary sensors, being as few and miniaturized/non-cumbersome as possible. The total weight (including batteries) must not exceed 5 lbs, and ideally is 1 lb or less. The troops must have location, location accuracy, and navigation information constantly updated on their handheld devices (or provided to existing display devices in the appropriate format) after they have dismounted from the vehicle.

This effort will receive no more than $1.5M for this award.

PHASE I: Contractor will have developed a navigation system design, software architecture, and provided test reports showing system performance using real data (with simulated GPS outages/jamming), and a plan for miniaturizing the system to a handheld form factor/providing a real-time navigation solution.

FEASIBILITY DOCUMENTATION: Offerors interested in submitting a Direct to Phase II proposal in response to

this topic must provide documentation to substantiate that the scientific and technical merit and feasibility described has been met and describes the potential commercial applications. The documentation provided must substantiate that the proposer has developed a preliminary understanding to build a handheld dismount kit for persistent, precision navigation in GPS-challenged environments for military operations. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Read and follow all of Step 1 of the Air Force 15.3 Instructions. The Air Force will not evaluate the offeror's related DP2 proposal where it determines that the offeror has failed to demonstrate the scientific and technical merit and feasibility of the Phase I project.

PHASE II: Build and demonstrate a handheld navigation system that operates for 8 hrs on batteries, weighs less than 5 lbs, outputs standard NMEA, and displays position and position accuracy when used by dismounted military forces operating in a GPS-challenged environment. Accuracy of the system will be dependent on environment, the estimate of the accuracy must be provided to the user. The system must include additional methods to constrain position error growth when GPS is not available.

PHASE III DUAL USE APPLICATIONS: Further miniaturize the device, add 12 hr battery life, and enhance its performance in terms of ruggedness (IP64 threshold with IP67 objective, transportation at 25,000 ft, and operation at 0 to 85C threshold with -40C to 125C objective), accuracy, and other capabilities, such as time distribution.

REFERENCES:
1. Groves, Paul D., et al. "The four key challenges of advanced multisensor navigation and positioning." Position, Location and Navigation Symposium-PLANS 2014, 2014 IEEE/ION. IEEE, 2014.

2. Yang, Chun, Soloviev, Andrey, "Covariance Analysis of Spatial and Temporal Effects of Collaborative Navigation", NAVIGATION, Journal of The Institute of Navigation, Vol. 61, No. 3, Fall 2014, pp. 213-225.

3. Grejner-Brzezinska, D.A., C.K. Toth, L. Li, J. Park, X. Wang, H. Sun, I.J. Gupta, K. Huggins, Y.F. Zheng, "Positioning in GPS-challenged Environments: Dynamic Sensor Network with Distributed GPS Aperture and Inter-nodal Ranging Signals," Proceedings of the 22nd International Technical Meeting of the

KEYWORDS: GPS denied, alternative navigation, MEMS, A2AD, jamming, handheld, networked GPS, eLoran, feature-based navigation, multisensor navigation, Special Forces

AF153-003 TITLE: Additive Manufacturing to Support 100% Parts Availability

TECHNOLOGY AREA(S): Materials/Processes

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the AF SBIR/STTR Contracting Officer, Ms. Gail Nyikon, gail.nyikon@us.af.mil.

OBJECTIVE: Develop and demonstrate a capability to manufacture and qualify non-flight critical aircraft parts

DESCRIPTION: Additive manufacturing and new rapid manufacturing methods may have the capability to reduce the cost and the lead time required to produce and maintain many kinds of parts for the aerospace industry. One hurdle in implementing these new manufacturing methods for replacement parts is the stringent, time consuming

and costly qualification processes that must be followed because of the change in manufacturing process, especially for flight-critical parts. There are likely legacy parts within the Air Force supply chain that are excellent candidates for production by these new manufacturing methods, and that also have less stringent qualification requirements because they are non-flight critical.

Lead time sometimes restricts the supply chain for servicing Air Force aircraft. Oftentimes, parts that need to be manufactured have long-lead times for procurement or the supplier is no longer in the business of making the parts. The ability to organically produce non-critical parts has the potential to transform Air Force sustainment practices.

This effort is primarily geared towards replacing non-critical parts with additive manufacturing methods. These parts include but are not limited to such items as brackets, ducting, housings, shrouds (such as the KC-135 refueling shroud), covers, and hoses. This list is not designed to be all inclusive, but provides some of the known opportunities for parts replacement. In general, metallic parts that have any fatigue requirements are too high risk to pursue for this effort, but other high value parts may be good options if the part requirements and capability of the manufacturing process are well understood.

The capability to certify the process for non-critical parts and certifying the process for a family/class of parts is needed more than point certification for parts. Successful proposals must identify potential parts and demonstrate an understanding of how to identify all part requirements (i.e., to reverse engineer the requirements) to ensure success of replacement efforts. All business cases for developing new manufacturing methods must consider qualification as an important step of replacing the part. Cost and lead time of the part families must be considered from the outset in order to build an appropriate business case for future parts.

Because this effort is geared towards parts replacement, successful proposals will be expected to demonstrate a capability to not only manufacture parts, but also the ability to develop the data and engineering analysis required for qualification of the part. Sign-off from the appropriate engineering authority will be required before new manufacturing methods can be implemented onto actual parts. Projects are more likely to be successful if OEM engineering authorities are brought into advisement. Because of the wide scope of Air Force parts, successful proposals will identify parts to pilot the new manufacturing methods on. Partnering with OEM's or other suppliers to propose efforts with already identified potential parts will likely be more successful than relying on the Air Force to identify a prioritized list of parts to manufacture.

Proposals are limited to $900K.

PHASE I: Contractor will have developed and demonstrated cost and time effective method for reverse engineering and production of non-flight critical aircraft parts. Developed plans and techniques for qualifying families of parts.

FEASIBILITY DOCUMENTATION: Offerors interested in submitting a Direct to Phase II proposal in response to this topic must provide documentation to substantiate that the scientific and technical merit and feasibility described has been met and describes the potential commercial applications. The documentation provided must substantiate that the proposer has developed a preliminary understanding of additive manufacturing to support 100% parts availability. Documentation must include proof of cost and time effective methods for reverse engineering for production of non-flight critical aircraft parts, in addition to plans and techniques for qualifying families of parts. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Read and follow all of Step 1 of the Air Force 15.3 Instructions. The Air Force will not evaluate the offeror's related DP2 proposal where it determines that the offeror has failed to demonstrate the scientific and technical merit and feasibility of the Phase I project.

PHASE II: Develop and demonstrate a process for rapidly manufacture and qualification of non-critical aerospace parts. Document steps on how parts were chosen, how key qualification issues were addressed, and lessons learned for implementing new manufacturing methods on similar parts in the future. Pilot the process on 2-3 identified Air Force parts, working with appropriate engineering authorities to work through qualification of manufacturing processes.

PHASE III DUAL USE APPLICATIONS: Further commercialize the capability to qualify replacement parts. Identify another round of parts or parts families to replace. Enhance the automation of the process.

REFERENCES:
1. Additive manufacturing technologies rapid prototyping to direct digital manufacturing, By: Gibson, I., and D. W. Rosen.

2. SAE AS 8796, Hose, Air Duct, Flexible Aircraft http://standards.sae.org/as8796/

KEYWORDS: Additive Manufacturing, Sustainment, Reverse engineering, ducting, non-flight critical, qualification, FDM, SLS, 3D printing

AF153-004 TITLE: Additive Manufacturing of Masking to Support Turbine Engine Sustainment

TECHNOLOGY AREA(S): Materials/Processes

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the solicitation and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the AF SBIR/STTR Contracting Officer, Ms. Gail Nyikon, gail.nyikon@us.af.mil.

OBJECTIVE: Develop, demonstrate, and deliver a capability that includes necessary materials, machines, and processes to produce masking and tooling for thermal spray, shot peening, and other coating processes to support sustainment of aircraft turbine engines.

DESCRIPTION: Additive manufacturing and new rapid manufacturing methods may have the capability to transform the cost and the lead time required to produce and maintain many kinds of parts for the aerospace industry. Tooling, fixtures, shop aids, and prototypes are low-risk applications for additive manufacturing to assist the depot maintenance of aircraft. Other DoD facilities such as the NAVAIR's Fleet Readiness Centers have utilized additive manufacturing to assist in the repair of aircraft to decrease cost and time associated with non-flying parts.

Plasma spray, shot peening, flame spray, and other similar processes are typically used in the sustainment of aircraft engines by the 76th Propulsion Maintenance Group (PMXG) at the Oklahoma City Air Logistics Center. Masking is required to protect some surfaces of parts during these processes, requiring manually intensive mask taping or expensive, long lead custom masks made from RTV or similar materials that have a limited shelf life. Additive manufacturing has the potential to transform the cost and lead time to mask these parts, transforming the process that is required in preparing parts for the deposition or peening processes.

The desired outcome of this program is a delivered machine, material system, and process that can be used to cost and time effectively produce reusable masks for thermal spray. The materials used for the mask need to withstand the thermal environment that is expected during thermal spray processes. The masks must sufficiently protect the unsprayed area to result in a quality coating. The end state is to lower the time required to produce a mask, so a rough comparative analysis must be undertaken to compare traditional masking techniques to the proposed technique.

Potential solutions could be the direct manufacture of masks via a 3D printer or the use of a 3D printer to produce a mold for these masks. Close interaction with AFRL and PMXG is expected to ensure technical requirements are met. Commercialization potential for this process exists for all thermal spray masking applications. PMXG currently is acquiring a production scale FDM machine that is capable of producing parts over 1ft x 1ft x 1ft. It would be

advantageous if the technical solution was compatible with the already existing equipment, however, it is not a requirement of this program. Other types of machines can be considered for use in the end technical solution.

Material requirements for produced masks include ability to conform to the part being sprayed (roots of blades, cases, knife edge seals, stators, etc.) within tolerance to create a clean masking line. Temperatures of the material are expected to see temperatures in excess of 400 degrees F and must be able to handle or resist the heat of the sprayed particles and flame. UV degradation of the materials must also be considered due to the UV emissions of the plasma spray.

Proposed projects should include research and development of processes to produce masks and demonstrations to assist in the sustainment of Air Force parts.

Proposals are limited to $900K.

PHASE I: Contractor will have piloted a capability to produce plasma spray masking directly via additive manufacturing. Demonstrated capability of masking material to withstand plasma spray environment.

FEASIBILITY DOCUMENTATION: Offerors interested in submitting a Direct to Phase II proposal in response to this topic must provide documentation to substantiate that the scientific and technical merit and feasibility described has been met and describes the potential commercial applications. The documentation provided must substantiate that the proposer has developed a preliminary understanding of additive manufacturing of masking to support turbine engine sustainment. Documentation must include proof of plasma spray masking production via additive manufacturing. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Read and follow all of Step 1 of the Air Force 15.3 Instructions. The Air Force will not evaluate the offeror's related DP2 proposal where it determines that the offeror has failed to demonstrate the scientific and technical merit and feasibility of the Phase I project.

PHASE II: Develop, demonstrate, and deliver the machines, materials, and processes to Air Force Sustainment Center necessary to cost and time effectively produce reusable masks for plasma spray, flame spray, shot peening, and similar processes for turbine engine sustainment.

PHASE III DUAL USE APPLICATIONS: Further develop system for commercialization of the various technologies developed in Phase II for government applications in sustainment of military aircraft engines, to include a broader array of masking types and support for other masking applications.

REFERENCES:
1. http://www.ncms.org/wp-content/NCMS_files/AdditiveManufacturing/AddManMorning.pdf

2. http://www.asminternational.org/documents/17679604/17683439/White+paper.pdf/fba0eade-d6db-4921-b42f-668965d7c70a

KEYWORDS: Additive Manufacturing, Sustainment, Reverse engineering, tooling production, fixture production, FDM, SLS, Thermal spray, ULTEM, RTV