

AIR FORCE
16.2 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>
The offeror is responsible for ensuring that their proposal complies with the requirements in the most current version of this instruction. Prior to submitting your proposal, please review the latest version of these instructions as they are subject to change before the submission deadline.

Please note that there have been changes made to these instructions. Firms must ensure their proposal meets all requirements of the solicitation currently posted on the DoD website at the time the solicitation closes. Incomplete proposals will be rejected.

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" implementation of this authority for this 16.2 SBIR solicitation and does not guarantee Direct to Phase II opportunities will be offered in future solicitations. Each eligible topic requires documentation to determine that Phase I feasibility described in the Phase I section of the topic 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 16.2. The Air Force (AF) 16.2 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 (22 April 2016 through 22 May 2016), 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 (23 May 2016 through 22 June 2016), 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 this Direct to Phase II solicitation. 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.

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

STEP 1:

1. Offerors must create a Cover Sheet using the DoD Proposal submission system (follow the DoD Instructions for the Cover Sheet located in section 5.4.a. Offerors must provide documentation that satisfies the Phase I feasibility requirement* that will be included as an Appendix to the Phase II proposal. Offerors must demonstrate that they have completed research and development through means other than the SBIR/STTR program to establish the feasibility of the proposed Phase II effort based on the criteria outlined in the topic description.

The Cover Sheet and applicable documentation must be submitted to <https://sbir.defensebusiness.org> by 6:00 a.m. (ET) 22 June 2016.

STEP 2:

1. Offerors must submit a 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), 22 June 2016.

* 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. **Feasibility documentation MUST NOT be solely based on work performed under prior or ongoing federally funded SBIR or STTR work.**

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 may 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.

III. 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/> Only

one Phase II proposal file 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.**

Complete proposals must include all of the following:

- a. Cover Sheet
- b. Technical Volume
- c. A signed Non-Disclosure Agreement and inserted at the end of the Technical Volume
- d. A signed Certificate of Training inserted at the end of the Technical Volume
- e. Cost Volume
- f. DD2345 if applicable
- g. Commercialization Report
- h. SBIR/STTR Environment, Safety and Occupational Health (ESOH) Questionnaire

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 up to a maximum value of \$1.5M per contract award. **Please refer to individual topic write-ups for specific award funding limits.** 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 16.2 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.

IV. PHASE II PROPOSAL PREPARATION INSTRUCTIONS AND PROPOSAL REQUIREMENTS

The technical proposal is limited to 50 pages. The commercialization report, advocacy letters (if any), "SBIR/ STTR Environment, Safety and Occupational Health (ESOH) Questionnaire", (Attachment 1) and the additional cost proposal itemized listing (17a through 17i) should be included as the last pages of the uploaded technical volume. This documentation and the Cover Sheet will not count toward the 50-page limitation.

The Air Force SBIR/STTR Program Office is instituting new requirements in an initiative to combat fraud in the SBIR/STTR program. As a result, each Small Business is required to visit the AF SBIR Program website: <http://www.afsbirsttr.com/Firm/downloads/SBIRSTTR%20Program%20Rules.pdf> **and read through the "Compliance with Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program Rules" training. The Certificate of Training Completion at the end of the training presentation and/or as pg. AF-18 of this document, MUST be signed by an official of**

your company, AND ATTACHED to your proposal. Failure to do this will result in your proposal being removed from consideration. This will not count toward the 50-page limitation.

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 5.3 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:** **Detail the specific objectives of the Phase II work, and describe the technical approach and methods to be used in meeting these objects.** The proposal should also 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.

Foreign Nationals (also known as Foreign Persons) means any person who is NOT:

- a. a citizen or national of the United States; or
- b. a lawful permanent resident; or
- c. a protected individual as defined by 8 U.S.C. § 1324b

ALL offerors proposing to use foreign nationals MUST follow Section 5.4. c. (8) of the DoD Program Solicitation and disclose this information regardless of whether the topic is subject to ITAR restrictions.

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.

The following will apply to all projects with military or dual-use applications that develop beyond fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community):

- (1) The Contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this contract. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate licenses or other approvals, if required, for exports of (including deemed exports) hardware, technical data, and software, or for the provision of technical assistance.
 - (2) The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technologies, including technical data or software.
 - (3) The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.
 - (4) The Contractor shall be responsible for ensuring that these provisions apply to its subcontractors.
- (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 award 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 section does not apply, state in the proposal, "No prior, current, or pending support for proposed work."

- (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.

18. Feasibility Documentation

- 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. DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated and WILL be redacted.

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/>.

V. 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. Phase II proposals will be disqualified and will not be evaluated if the Phase I equivalency documentation does not establish feasibility and technical merit of the proposed technical approach.

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 or your proposal will be considered incomplete and will not be evaluated. This form will not count against the 50-page limitation.

VI. 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.

VII. 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
16.2 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 SMALL BUSINESS INNOVATION RESEARCH (SBIR)/
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAMS
“COMPLIANCE WITH SBIR/STTR PROGRAM RULES”**

The undersigned has fully and completely reviewed this training on behalf of the proposer/awardee, understands the information presented, and has the authority to make this certification on behalf of the proposer/awardee. The undersigned understands providing false or misleading information during any part of the proposal, award, or performance phase of a SBIR or STTR contract or grant may result in criminal, civil or administrative sanctions, including but not limited to: fines, restitution, and/or imprisonment under 18 USC 1001; treble damages and civil penalties under the False Claims Act, 31 USC 3729 et seq.; double damages and civil penalties under the Program Fraud Civil Remedies Act, 31 USC 3801 et seq.; civil recovery of award funds; suspension and/or debarment from all federal procurement and non-procurement transactions, FAR Part 9.4 or 2 CFR Part 180; and other administrative remedies including termination of active SBIR/STTR awards.

Signature

Date

Name

Firm Name and Position Title

Proposal Number

AIR FORCE SBIR 16.2 Direct to Phase II Topic Index

AF162-D001	Mitigation of Small Unmanned Aircraft Systems (sUAS) Threats
AF162-D002	Commercial Space Catalog
AF162-D003	Autonomous Robot for Unmanned Air Vehicle Operations
AF162-D004	Modern Command Center for Missile Field Operations

AIR FORCE SBIR 16.2 Direct to Phase II Topic Descriptions

AF162-D001 TITLE: Mitigation of Small Unmanned Aircraft Systems (sUAS) Threats

TECHNOLOGY AREA(S): Air Platform

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 cost effective system or sub-system that can detect, identify and manage or defeat sUAS. Management or defeat of sUAS range from effects that deter sUAS approach and entry into prohibited areas to kinetic and non-kinetic effects that destructively defeat sUAS while minimizing collateral effect to surrounding assets.

DESCRIPTION: The increasing popularity and proliferation of recreational sUAS, also referred to as drones or Remote Controlled Model Aircraft (such as DJI Phantom, UDI U818A, and 3DR Solo), has resulted in safety and security concerns for the Air Force and the Department of Defense (DoD). Among these concerns are recent sUAS overflights of military installations, flight safety hazards to manned aircraft, and illicit use by criminals and adversaries. Transfers from innovations in other industries, including mobile phones, electric cars, and consumer electronics, have caused a convergence of technological developments that have rapidly advanced the capabilities of sUAS. Collaborative development of advanced flight controllers with integrated GPS and inertial navigation mean that the skill and experience needed to successfully execute a standoff attack on exposed resources is relatively easy and can be done without attribution on the part of the attacker.

The breadth of this threat is both wide in scope and deep in complexity and warrants a variety of solutions for different circumstances. The various configurations of current sUAS make a single optimized solution both impractical and improbable. The final solution will likely be composed of a system of systems that can be tailored to application and budget. The ability of a threat to operate under autonomous control without an active command link can render ineffective those solutions that rely solely on intercepting or jamming of that link. Emerging low cost sensors in the sUAS domain enable enhanced and reliable autonomy and guidance that may make physical engagement approaches necessary. However, the potential threat of biological or explosive payloads may make destructive kinetic effects less desirable because of the potential for collateral damage. Regardless, destructive kinetic effects may be required to stop the vehicle under the appropriate circumstances.

The system must at a minimum detect, identify and manage or defeat sUAS (although there is interest to 'capture' and have a full recovery of the aircraft) using solutions that are cost effective and scalable to larger fixed sites and multi-sUAS attacks.

PHASE I: Proposal Must Show:

- A) Broad understanding of the sUAS state of the art and capability projections.
- B) Understanding of control architecture of modern sUAS autopilots and other subsystems.
- C) Ability to design and construct a system that can detect, identify and locate targets or receive queuing onto a target.
- D) Creative concept development for both destructive and non-destructive mitigation of sUAS.

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. The documentation provided must substantiate that the proposer has developed a preliminary understanding of the technology to be applied in their Phase II proposal to meet the objectives of this topic. 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 the feasibility documentation portions of the Air Force 16.2 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 an affordable system that can detect, identify and manage or defeat sUAS. The system will likely integrate affordable sensors (e.g., vehicle anti-collision radars, 360 degree cameras, etc.), software for target tracking and intelligent assessment of intent or nature of the threat, and integration of destructive (e.g., interceptor, munition, projectiles) or a non-destructive means of aircraft mitigation (e.g., nets, harpoons, lift disruption). The capability to be effective against a range of potential sUAS threats is a critical metric for the performance of the system. The ability to rapidly set up and operate the system, and to employ the system on moving platforms (e.g., for convoy protection) is also desired.

PHASE III DUAL USE APPLICATIONS: DUAL USE APPLICATIONS: A number of government agencies (military and civil) require this capability to protect facilities, operations, critical infrastructure and personnel. Commercial interest in such a system for security and safety applications is also anticipated.

REFERENCES:

1. "Terrorist Use of Improvised or Commercially Available Precision-Guided UAVs at Stand-Off Ranges: An Approach for Formulating Mitigation Considerations"; Mandelbaum, Jay; Ralston, James; Institute for Defense Analysis, Document D-3199, Oct 2005.
2. "Terrorist and Insurgent Unmanned Aerial Vehicles: Use, Potentials, and Military Implications"; Bunker, R.J; U.S. Army War College, Strategic Studies Institute; Aug 2015.

KEYWORDS: Drone, Unmanned Aerial Vehicle (UAV) or System (UAS), Counter UAS, Air Defense, Aerial Threats, Target Tracking

AF162-D002 TITLE: Commercial Space Catalog

TECHNOLOGY AREA(S): Battlespace

OBJECTIVE: Develop and demonstrate the ability of a global network of commercial and/or university telescopes to collect satellite tracking data to build and maintain, at a minimum, a near-GEO (geo-synchronous orbit) catalog, with the goal of a deep-space catalog, either of which would have a similar or better accuracy as the US Space Surveillance Network (SSN). The project shall serve as a path finder in assessing the feasibility and affordability of developing and maintaining a commercially developed catalog as a commodity.

DESCRIPTION: The modern axiom "Space is becoming more congested and contested" becomes more relevant as the world continues to place more satellites in orbit, becoming increasingly reliant on the services they provide. The Air Force Space Surveillance Network currently maintains a catalog of over 4200 objects in deep-space and over 1500 objects in near-GEO, and it is known that there are many smaller objects that are difficult to detect or cannot be tracked with current systems. For the purposes of this solicitation, deep-space is defined as orbits having a mean period of 225 minutes or greater and near-GEO is defined to include orbits having a mean period of approximately 24hours, or an apogee near 35,768km, and having any values of inclination angle and orbital eccentricity. The inherent responsibilities of Space Situational Awareness are vast and becoming more demanding of the Joint Functional Component Command for Space (JFCC Space) mission. JFCC Space, through its Joint Space

Operations Center (JSpOC), provides surveillance of all space objects and activities, maintains detailed reconnaissance of space assets, fuses space data, maintains awareness of cooperative space assets, and allows JFCC-Space to conduct integrated C2 of space forces. Our current space surveillance operations are challenged to keep up with the growing number of space objects indefinitely.

Routine catalog maintenance places a large burden on space surveillance operations and is impacting the ability of orbital analysts to effectively perform the space protection mission. The Air Force Space Commander has called for alternative approaches to execute the function of “Space Traffic Cop” in order to free up JSpOC resources. Many companies are collecting observations (both metric and light curve data) on space objects every day, amateur astronomers are consistently tracking and reporting on satellite positions, and networks of university astronomical research telescopes can be time shared and/or used collaboratively to detect and report on satellite positions. Leveraging the commercial industry, academia and other government agencies has proven to be an invaluable asset for our military in the past, and is expected to provide similar benefits in this area of space catalog maintenance.

PHASE I: Proposal must show

- A) Demonstrated understanding of space surveillance technology and data products including calibration.
- B) Demonstrated expertise and capability in processing and fusing satellite tracking data for catalog generation and maintenance.
- C) Demonstrated feasibility of automated processing of a large volume of tracking data in an ongoing and timely manner.
- D) Relevant experience demonstrating successful data ingest and processing using observations from non-government telescope network(s) for space object tracking.

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 above has been met and to identify the potential commercial applications. The documentation provided must substantiate that the proposer has developed a preliminary understanding of the technology to be applied in their Phase II proposal to meet the objectives of this topic. 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 the feasibility documentation portions of the Air Force 16.2 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 shall perform the following tasks:

1. Determine the available (commercial, university, etc.) tracking sources to be employed in the feasibility demonstration and secure cooperation agreements with them.
2. Obtain sample tracking data of representative types and demonstrate planned techniques for data calibration and usage.
3. Using simulated or real data, demonstrate large scale tracking data processing and catalog maintenance in an ongoing and timely fashion.
4. Using real commercial and/or university tracking data, demonstrate catalog generation and maintenance of the public near-GEO (minimum)/deep-space (goal) catalog for a minimum period of 1 month at the end of the contract period of performance.
5. Provide cost estimates for employing the demonstrated concept for operational support to the US Government. Estimates shall include cost for data acquisition, catalog maintenance center operations, and data archiving and distribution.

- All work should be accomplished in a contractor and/or university facility.
- Government tracking data will not be provided and should not be used or mixed with the commercial and university tracking data.
- The results of the 1 month test will be compared to the corresponding month of performance of the US Space Surveillance Network to determine achievement of similar or better accuracy. Additionally, catalog completeness will also be an important metric. This evaluation will be performed by the Government with the help of the contractor team.

PHASE III DUAL USE APPLICATIONS: DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to an operational capability in support of routine space situational awareness operations. Additionally, applications of the technology to support commercial satellite operators are envisioned for collision avoidance and anomaly resolution.

REFERENCES:

1. N. R. Council, Continuing Kepler's Quest: Assessing Air Force Space Command's Astrodynamics Standards, Washington DC: The National Academies Press, 2012.
2. B. Weeden, "The Numbers game," The Space Review, pp. 1-2, 13 July 2009.
3. USSTRATCOM Space Control and Space Surveillance.

KEYWORDS: space situational awareness, space object identification, space control, space surveillance, space catalog, orbit tracking, deep-space, geo-synchronous orbit, data fusion, data processing, data acquisition, space catalog maintenance, data archiving

AF162-D003 TITLE: Autonomous Robot for Unmanned Air Vehicle Operations

TECHNOLOGY AREA(S): Air Platform

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 a drop-in robotic system or device to rapidly convert a variety of traditionally manned aircraft to robotically piloted, autonomous aircraft. This robotic system will operate the aircraft (e.g. observe gauges, operate controls, etc.) similar to a human pilot and will not require any modifications to the aircraft.

DESCRIPTION: Automation and autonomy have broad value to the Department of Defense (DoD), with the potential to; (1) enhance system performance of existing platforms, (2) reduce costs, and (3) enable new missions and capabilities, especially with reduced human exposure to dangerous or life threatening situations. This project leverages existing aviation assets and advances in vehicle automation technologies to develop a drop-in robotic system or device to rapidly convert a variety of traditionally manned aircraft to robotically piloted, autonomous aircraft. This robotic system will operate the aircraft (e.g. observe gauges, operate controls, etc.) similar to a human pilot and will not require any modifications to the aircraft.

Considerable advances have been made in aircraft automation systems over the past 50 years. These advances have enabled reduced pilot workload, improved mission prosecution, and improved flight safety. Similarly, unmanned aircraft have developed and leveraged new automation systems to permit operation via remote crew. However, large aircraft are capital-intensive developments generally subject to rigorous safety and reliability standards. The expense of new developments limits the rate at which new automation or autonomy capabilities can be developed, tested, and fielded.

Unmanned flight operations utilizing traditionally manned airplanes offer an increase in mission planning flexibility for a large set of missions and reduced cost while leveraging existing traditionally manned airframes. Non-invasive approaches to robotically piloted aircraft using existing commercial technology and components offer the benefits of

unmanned operations without the complexity and upfront cost associated with the development of new unmanned vehicles. Such a system will have the ability to automatically pilot an aircraft using only the gauges and cockpit controls available to a human pilot thus eliminating custom design and integration costs. Mechanical manipulation of existing control effectors and optical sensing of gauges are possible with commercially available products and offer reduced system setup timelines. Non-invasive installations offer the benefit of rapid conversion between manned and unmanned modes while maintaining the airframe's integrity required for subsequent manned operations. Unmanned, low cost cargo transportation, resupply, refueling, and ISR missions are envisioned applications of this technology.

To operate various aircraft, the system will have to perform four essential sets of tasks: (A) receive/select appropriate control settings, limitations, and parameters necessary to successfully operate a selected aircraft, (B) interface with the control stick/yoke, pedals, throttle, etc. to "fly the plane", (C) monitor the aircraft state and systems (e.g. flight parameters (i.e. airspeed, altitude, attitude, etc.) propulsion, hydraulics, electrical, etc.) via the gauges and audio alarms, and (D) control the systems via knobs, switches, valves, buttons, etc. in the cockpit.

Some key technical elements for consideration include vision-based cockpit sensing and perception, physical manipulation, procedural verification, algorithmic implementation, flexible flight control techniques, optimized feasible trajectory computation, rule-based routing suggestions, vehicle or health management systems, and consumer-technology based human interfaces. This list is by no means exhaustive and is not intended to be prescriptive.

PHASE I: Proposal must show: (A) demonstrated feasibility of system architecture, (B) demonstrated capability of humanoid-like robotic manipulation, and (C) demonstrated capability of vision-based recognition.

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 the technology to be applied in their Phase II proposal to meet the objectives of this topic. 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 the feasibility documentation portions of the Air Force 16.2 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 develop and demonstrate a robotic system that can perform the following: (A) ability to interface with and operate existing aircraft control systems across multiple aircraft types, (B) ability to capture knowledge about the aircraft's state to include both nominal and off-nominal states, and (C) ability to be programmed to accommodate various aircraft's flight properties and limitations.

All of this will be done without making any modifications to the aircraft. Installation of the robot in the cockpit should be with little or no hard attachment to either the flight controls, avionics, or power system, i.e., completely independent of the aircraft's systems.

The robot should be capable of performing all activities/procedures in an FAA practical test standards, with possible waivers allowed (e.g. radio calls). At a minimum, the robotic system will operate the aircraft to autonomously taxi, take off, follow a predefined flight plan, and land.

This capability will be demonstrated on an FAA Level C or D cockpit flight simulator for a relatively "simple" class of aircraft (e.g. Caravan or King Air).

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 cargo, resupply, refueling, airdrop, or ISR type missions.

REFERENCES:

1. Heejin Jeong, Jeongwoon Kim, and David Hyunchul Shim. "Development of an Optionally Piloted Vehicle using a Humanoid Robot", 52nd Aerospace Sciences Meeting, AIAA SciTech, (AIAA 2014-1165).
2. Stefan Kohlbrecher, David C. Conner, Alberto Romay, Felipe Bacim, Doug A. Bowman, and Oskar von Stryk. "Overview of Team ViGIR's Approach to the Virtual Robotics Challenge", 2013 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR), IEEE, 21-26 Oct 2013.
3. Julia Badger, J.D. Yamoski, Brian Wightman, "Towards Autonomous Operation of Robonaut 2", Infotech@Aerospace 2012, Infotech@Aerospace conferences, (AIAA 2012-2441).
4. Rocco Dell'Aquila, Giampiero Campa, Marcello Napolitano, Marco Mammarella, "Real-time machine-vision-based position sensing system for UAV aerial refueling", Journal of Real-Time Image Processing, April 2007, Volume 1, Issue 3, pp 213-224.
5. Christopher Rasmussen, Kiwon Sohn, Qiaosong Wang, Paul Oh, "Perception and Control Strategies for Driving Utility Vehicles with a Humanoid Robot", International Conference on Intelligent Robots and Systems (IROS 2014), September 14-18, 2014, 2014 IEEE/RSJ pp 973-980.

KEYWORDS: Robotics, automation, autonomous operation, flight controls, unmanned air vehicle, unmanned aircraft system, vision based sensing, remotely piloted vehicle, aircraft conversion, drone

AF162-D004 TITLE: Modern Command Center for Missile Field Operations

TECHNOLOGY AREA(S): Information Systems

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 apply modern command center technology to provide capabilities for collaborative and efficient conduct of ICBM operations, including status monitoring, maintenance, security and missile launch.

NOTE: Work under this topic will require access to classified information. The proposing firm must have a Secret facility clearance and cleared personnel in order to perform the Phase II work. For more information on facility and personnel clearance procedures and requirements, please visit the Defense Security Service Web site at: <http://www.dss.mil/index.html>.

NOTE: All information in this solicitation is unclassified; do not include any classified information in your proposal.

DESCRIPTION: The nation's Minuteman III intercontinental ballistic missile (ICBM) system provides a land-based nuclear deterrence and strike capability to the President. The current system comprises 450 missiles and their associated C3 facilities located in several northern US states that stand on alert to provide a day-to-day, safe, secure, responsive, global nuclear strike capability to assure our allies, dissuade proliferation, deter adversaries, and, should deterrence fail, decisively defeat adversary targets and retaliatory capabilities as authorized and directed by the President. The operation of this capability encompasses a range of activities, including monitoring of health and status, maintenance of missiles and launch hardware and software systems, physical and cyber security, training for and actual operation of, and if directed, missile launch operations. Because of the strategic significance and nature of

this mission, the coordination and conduct of these operations is of paramount importance requiring unprecedented communication and collaboration, shared situational awareness of ongoing and planned activities, assured integrity and timeliness of information, and man-power efficiency.

The ICBM system is comprised of three wings in separate geographical areas, each with a Wing Commander that provides oversight and direction of wing operations. The 20th Air Force's Task Force 214 (TF214) Command Center is located at F.E. Warren AFB, and provides coordination, command and control of wing activities and reporting of status to higher command authorities (USSTRATCOM and AFGSC). Modernizing the Command Center functions at each of the three missile wings is the focus of this modernization effort, but the architectural concept should look forward to integrating information from the various wings (e.g., security, weather, force tracking, missile status, etc.) and other agencies (for example intelligence and law enforcement) to develop a site picture that can be tailored for the TF214 Command center and other key stakeholders to provide near real-time situational awareness. The Missile Wing Command Centers also serves to integrate and coordinate wing activities, in response to higher leadership directives and contingencies and is ultimately responsible to the Commander 20th Air Force for the operational mission, and for all actions taking place within the missile field with the exception of Emergency Action Message processing. These activities include coordination of 1) maintenance operations which encompasses monitoring and assessing weapon system component and major subcomponent performance, and performing scheduled and pre-emptive maintenance and repairs, and 2) physical and cyber security operations which encompasses monitoring, diagnosing, and assessing security devices, providing routine threat assessments, prioritizing and directing the appropriate security teams during routine operations including maintenance and convoys, directing and dispatching emergency response teams, and providing battlespace awareness provided from on-site cameras, sensors, and other responding elements during a security incident.

This topic area is intended to explore novel social, architectural and functional aspects of these operations, including methods to maintain Shared Situational Awareness and Missile Field Order of Battle, provide effective human interfaces for visualization and collaboration of operational data, automate the mining, fusion, and presentation of data supporting commanding, controlling, and reporting status of ICBM assets and support systems/activities, and enable capabilities for operators to proactively plan and respond to events in real time.

PHASE I: Proposal must show, as appropriate to the proposed effort, technical feasibility of the underlying technology, whether data fusion, human-machine interfaces, etc., via lab or field experiments or related applications.

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 the technology to be applied in their Phase II proposal to meet the objectives of this topic. 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 the feasibility documentation portions of the Air Force 16.2 Instructions. The Air Force will not evaluate the offeror's related D2P2 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: Design and develop command center systems to encompass the range of ICBM operations and functions, and provide the technical (hardware, software, communications) and physical (building, layout, human-machine interfaces) elements of such an operations center, focusing on the Wing Command Center implementation. These elements might include some or all of the following, categorized into two broad areas, for which the contract may propose to address either or both:

Data Fusion and Information Processing

- a) Improved information systems to support enhanced operator awareness and efficiency;
- b) Tools that automate the mining, fusion, and presentation of data supporting commanding, controlling, and reporting status of ICBM assets;

Architectural and Functional Modernization

- c) Effective human machine interfaces (touch screen, immersive environments, user specific adaptation, speech recognition, etc.) for enhanced understanding of situations and rapid decision making;

- d) Enhanced presentation capabilities for shared situational awareness, both large and small scale;
- e) Organizationally and socially effective floor plans (human and operations centric, not equipment centric)

PHASE III DUAL USE APPLICATIONS: 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 cargo transport operations centers, industrial systems monitoring, and security response command centers.

REFERENCES:

1. "Utilization of a Multi-disciplinary Approach to Building Effective Command Centers: Process and Products"; Galdorisi, G.; Tolentino, G.; The Tenth International Command & Control Research and Technology Symposium, Jun 2005.
2. "Leveraging Net-Centric Monitoring Techniques with Information Fusion to Increase US Air Force Information Dominance"; Jos, B.; Culbertson, T., Military Communications Conference, 2006.
3. "Use of Collaborative Software to Improve Nuclear Power Plant Outage Management"; St. Germain, S.; 9th International Conference on Nuclear Plant Instrumentation, Control and Human Machine Interface Technologies; February 2015.

KEYWORDS: Command and Control, Human-Machine Interfaces, Data Processing, Data Mining/Fusion, Automation