DEPARTMENT OF THE AIR FORCE (DAF)
24.1 SMALL BUSINESS INNOVATION RESEARCH (SBIR) DIRECT TO PHASE II (D2P2)
PROPOSAL SUBMISSION INSTRUCTIONS
AMENDMENT 1

The purpose of this Amendment is to provide additional information for all D2P2 applicants. This Amendment modifies the D2P2 instructions as follows:

1. The following language is deleted from the "Introduction" section on page 3 of the instructions:
~~Feasibility documentation MUST NOT be solely based on work performed under prior or on-going Federally funded SBIR and/or STTR work.~~

   The following language is added to the "Introduction" section on page 3 of the instructions:
Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

2. The following language is deleted from the "Technical Volume (Volume 2) Subheading 7(a)(i):
~~The draft is due 30 days after Phase II technical effort.~~

3. The following language is deleted from the heading of "Technical Volume (Volume 2)" Subsection (9):
~~Company Commercialization Report (CCR)~~

   The following language is deleted from the body of "Technical Volume (Volume 2)" Subsection (9):
   ~~a) Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by the Air Force during proposal evaluations. Note, even though the CCR is listed here under the Volume 2 heading, as stated in this document, the CCR comprises Volume 4 of the proposal submission.~~

4. The following language is added as "Technical Volume (Volume 2)" as part of a newly-created Subsection (e):
Note, the "Commercialization Plan" and the "Company Commercialization Report" are distinct documents. The Company Commercialization Report (CCR) comprises Volume 4 as separately indicated in these instructions.

   The following language is deleted from "Technical Volume (Volume 2)" numbered subsection (8):
~~reviewers~~
   The following language is added to the "Technical Volume (Volume 2)" numbered subsection 8:
applicant-identified subject matter experts, regardless of affiliation

5. The following language is deleted from the subheading of "Supporting Documents Volume (Volume 5)":
~~documents~~
   This word has been replaced by:

solicitation attachments

The following language has been added to the "Feasibility Documentation" subheading under "Supporting Documents Volume (Volume 5)" (additions in yellow):

"Feasibility documentation (required for all proposal submissions, contained within Volume 5, not subject to page limitations)

The following language has been deleted from the "Feasibility Documentation" subheading under "Supporting Documents Volume (Volume 5)" numbered subsection (1) (deletions in ~~red~~):

~~Offerors must adequately document completion of the Phase I feasibility requirement*. Offerors must demonstrate completion of R/R&D through means not solely based on previous efforts under the SBIR/STTR Programs to establish Phase II proposal feasibility based on criteria provided in the D2P2 topic descriptions.~~

The following language has been added to the "Feasibility Documentation" subheading under "Supporting Documents Volume (Volume 5)" numbered subheading (1) (additions in yellow):

Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

The following language has been added to the "Feasibility Documentation" subheading under "Supporting Documents Volume (Volume 5)" numbered subheading (2) (deletions in ~~red~~):

~~as part of the Technical Volume (Volume 2)~~

The following language has been added to the "Feasibility Documentation" subheading under "Supporting Documents Volume (Volume 5)" numbered subheading (2) (additions in yellow):

Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

6. Topic Language

All topics are edited to include the following language:

As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.

7. This Amendment emphasizes the points of contact information that is contained within this solicitation to reiterate to applicants there are cognizant POCs to answer questions about these instructions:

Points of Contact:

- General information related to the AF SBIR/STTR program and **proposal preparation instructions**, contact the AF SBIR/STTR One Help Desk at usaf.team@afsbirsttr.us.
- Questions regarding the **DSIP electronic submission system**, contact the DoD SBIR/STTR Help Desk at dodsbirsupport@reisystems.com.
- For **technical questions about the topics** during the pre-announcement and open period, please reference the DoD 24.1 SBIR BAA.
- Air Force SBIR/STTR Contracting Officer (CO):
  Mr. Daniel J. Brewer, Daniel.Brewer.13@us.af.mil

All other terms and provisions remain unchanged as a result of this Amendment.

DEPARTMENT OF THE AIR FORCE (DAF)
24.1 SMALL BUSINESS INNOVATION RESEARCH (SBIR) DIRECT TO PHASE II (D2P2)
PROPOSAL SUBMISSION INSTRUCTIONS

The DAF intends these proposal submission instructions to clarify the Department of Defense (DoD) Broad Agency Announcement (BAA) as it applies to the topics solicited herein. **Firms must ensure proposals meet all requirements of the 24.1 SBIR BAA posted on the DoD SBIR/STTR Innovation Portal (DSIP) at the proposal submission deadline date/time.**

Proposers are encouraged to thoroughly review the DoD Program BAA and register for the DSIP Listserv to remain apprised of important programmatic and contractual changes.

- The DoD Program BAA is located at: https://www.defensesbirsttr.mil/SBIR-STTR/Opportunities/#announcements. Be sure to select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at: https://www.dodsbirsttr.mil/submissions/login.

Complete proposals **must** be prepared and submitted via https://www.dodsbirsttr.mil/submissions/ (DSIP) on or before the date published in the DoD 24.1 SBIR BAA. Offerors are responsible for ensuring proposals comply with the requirements in the most current version of this instruction at the proposal submission deadline date/time.

The DAF recommends early submission, as computer traffic gets heavy near the proposal submission date/time and could slow down the system. **Do not wait until the last minute.** The AF is not responsible for incomplete proposal submission due to system lag or inaccessibility. Please ensure contact information, i.e., names/phone numbers/email addresses, in the proposal is current and accurate. The DAF is not responsible for ensuring notifications are received by firms for which this information changes after proposal submission without proper notification. Changes of this nature shall be sent to the Air Force SBIR/STTR One Help Desk.

Please ensure all e-mail addresses listed in the proposal are current and accurate. The DAF is not responsible for ensuring notifications are received by firms changing mailing address/e-mail address/company points of contact after proposal submission without proper notification to the DAF. **If changes occur to the company mail or email addresses or points of contact after proposal submission, the information must be provided to the AF SBIR/STTR One Help Desk.** The message shall include the subject line, "24.1 Address Change".

Points of Contact:

- General information related to the AF SBIR/STTR program and **proposal preparation instructions**, contact the AF SBIR/STTR One Help Desk at usaf.team@afsbirsttr.us.
- Questions regarding the **DSIP electronic submission system**, contact the DoD SBIR/STTR Help Desk at dodsbirsupport@reisystems.com.
- **For technical questions about the topics** during the pre-announcement and open period, please reference the DoD 24.1 SBIR BAA.
- Air Force SBIR/STTR Contracting Officer (CO):
  Mr. Daniel J. Brewer, Daniel.Brewer.13@us.af.mil

General information related to the AF Small Business Program can be found at the AF Small Business website, http://www.airforcesmallbiz.af.mil/. The site contains information related to

contracting opportunities within the AF, as well as business information and upcoming outreach events. Other informative sites include those for the Small Business Administration (SBA), www.sba.gov, and the Procurement Technical Assistance Centers (PTACs), http://www.aptacus.us.org. These centers provide Government contracting assistance and guidance to small businesses, generally at no cost.

DIRECT TO PHASE II

15 U.S.C. §638 (cc), as amended by the SBIR AND STTR EXTENSION ACT OF 2022, allows DoD to make a SBIR Phase II award to a small business concern 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. DAF is conducting a "Direct to Phase II" implementation of this authority for these 24.1 SBIR topics and does not guarantee D2P2 opportunities will be offered in future solicitations. Each eligible topic requires documentation to determine whether the feasibility requirement described in the Phase I section of the topic has been met.

DIRECT TO PHASE II PROPOSAL SUBMISSION

The DoD SBIR 24.1 Broad Agency Announcement, https://www.dodsbirsttr.mil/submissions/login, includes all program requirements. Phase I efforts should address the feasibility of a solution to the selected topic's requirements.

The complete proposal must be submitted electronically through DSIP. Ensure the 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.**

The System for Award Management (SAM) allows proposing small business concerns interested in conducting business with the Federal Government to provide basic information on business structure and capabilities as well as financial and payment information. Proposing small business concerns must be registered in SAM. To register, visit www.sam.gov. A proposing small business concern that is already registered in SAM should login to SAM and ensure its registration is active and its representations and certifications are up-to-date to avoid delay in award.

On April 4, 2022, the DUNS Number was replaced by the Unique Entity ID (SAM). The Federal Government will use the UEI (SAM) to identify organizations doing business with the Government. The DUNS number will no longer be a valid identifier. If the proposing small business concerns has an entity registration in SAM.gov (even if the registration has expired), a UEI (SAM) has already been assigned. This can be found by signing into SAM.gov and selecting the Entity Management widget in the Workspace or by signing in and searching entity information. For proposing small business concerns with established Defense SBIR/STTR Innovation Portal (DSIP) accounts, update the Small Business Concern profile with the UEI (SAM) as soon as possible.

For new proposing small business concern registrations, follow instructions during SAM registration on how to obtain a Commercial and Government Entry (CAGE) code and be assigned the UEI (SAM). Once a CAGE code and UEI (SAM) are obtained, update the Small business concern's profile on the DSIP at https://www.dodsbirsttr.mil/submissions/.

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

1. Offerors must create a Cover Sheet in DSIP; follow the Cover Sheet instructions provided in the DoD SBIR 24.1 BAA.Offerors must provide documentation satisfying the Phase I feasibility requirement* to be included in the Phase II proposal. Offerors must demonstrate

completion of research and development through means other than the SBIR/STTR Programs to establish the feasibility of the proposed Phase II effort based on the criteria outlined in the topic description.

2. Offerors must submit D2P2 proposals using the instructions below.

*NOTE: DAF will not consider the offeror's D2P2 proposal if the offeror fails to demonstrate technical merit and feasibility have been established. It will also not be considered if it fails to demonstrate the feasibility effort was substantially performed by the offeror and/or the principal investigator (PI). Refer to the topics' Phase I descriptions for minimum requirements needed to demonstrate feasibility. ~~Feasibility documentation MUST NOT be solely based on work performed under prior or on-going Federally funded SBIR and/or STTR work.~~ Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

DIRECT TO PHASE II PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

B. Proposal Requirements. A Direct To Phase II proposal shall provide sufficient information to persuade the AF the proposed technology advancement represents an innovative solution to the scientific or engineering problem worthy of support under the stated criteria.

C. Proprietary Information. Information constituting a trade secret, commercial/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, the Work Plan will be incorporated into the resulting contract by reference. Therefore, DO NOT INCLUDE PROPRIETARY INFORMATION in the work plan. See the DoD BAA regarding proprietary information marking.

D. 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 consecutivelynumbered. Offerors are discouraged from including promotional and non-programmatic items. If included, such material will count toward the page limit.

DIRECT TO PHASE II PROPOSAL FORMAT

Complete proposals must include all of the following:

Volume 1: DoD Proposal Cover Sheet

Note: If selected for funding, the proposal's technical abstract and discussion of anticipated benefits will be publicly released. Therefore, do not include proprietary information in this section.

Volume 2: Technical Volume

Volume 3: Cost Volume

Volume 4: Company Commercialization Report

Volume 5: Supporting Documents, e.g. DoD Form 2345 (if applicable), Militarily Critical Data Agreement (if applicable); etc.

Volume 6: Fraud, Waste, and Abuse Training Completion

Phase II proposals require a comprehensive, detailed description of the proposed effort. AF D2P2 efforts are to be proposed in accordance with the information in these instructions. 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 D2P2 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 SBIR 24.1 BAA. The Principal Investigator's (PI's) primary employment must be with the small business concern at the time of awardand during the entire period of performance. Primary employment means more than one-half the PI's time is spent in the small business' employ. This precludes full-time employment with another entity.

Knowingly and willfully making false, fictitious, or fraudulent statements or representations may be a felony under18 U.S.C. Section 1001, punishable by a fine up to $250,000, up to five years in prison, or both.

Please note the FWA Training must be completed prior to proposal submission. When training is complete and certified, DSIP will indicate completion of the Volume 6 requirement. The proposal cannot be submitted until the training is complete. The DAF recommends completing submission early, as site traffic is heavy prior to solicitation close, causing system lag. **Do not wait until the last minute.** The AF will not be responsible for proposals not completely submitted prior to the deadline due to system inaccessibility unless advised by DoD. The DAF will not accept alternative means of submission outside of DSIP.

DOD PROPOSAL COVER SHEET (VOLUME 1)

Complete the proposal Cover Sheet in accordance with the instructions provided via DSIP. 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 keywords/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.

TECHNICAL VOLUME (VOLUME 2)

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

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

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

(3) **Milestone Identification:** Include a program schedule with all key milestones identified.

(4) **Identification and Significance of the Problem or Opportunity:** Briefly reference thespecific technical problem/opportunity to be pursued under this effort.

(5) **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 eachobjective.

(6) **Work Plan:** The work plan shall be a separate and distinct part of the proposal package, using a page break to divide it from the technical proposal. It 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 work plan; begin this section on a new page. **DO NOT include**

proprietary information.

a) 1.0 – Objective: This section is intended to provide a brief overview of thespecialty area. It should explain the purpose and expected outcome.
b) 2.0 – Scope: This section should provide a concise description of the work to beaccomplished, including the technology area to be investigated, goals, and majormilestones. The key elements of this section are task development and deliverables, i.e., the anticipated end result and/or the effort's product. This section must also be consistent with the information in Section 4.0 below.
c) 3.0 – Background: The offeror shall identify appropriate specifications, standards, andother documents applicable to the effort. This section includes information or explanation for, and/or constraints to, understanding requirements. It may include relationships to previous, current, and/or future operations. It may also include techniques previously determined ineffective.
d) 4.0 – Task/Technical Requirements: The detailed individual task descriptions 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 the work to be performed by subtask. The work plan MUST contain every task to be accomplished in definite, realistic, and clearlystated terms. Use "shall" whenever the work plan 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."

(7) **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, ItemIdentification 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 Announcement generally remain with the contractor. The Government obtains SBIR/STTR data rights in all data developed or generated under the SBIR/STTR contract for a period of 20 years, commencing at contract award. Upon expiration of the 20-year SBIR/STTR license, the Government has Government purpose rights to the SBIR data.

i. Final Report: ~~The draft is due 30 days after Phase II technical effort.~~ The first page of the final report will be a single-page project summary, identifying the work's purpose, providing a brief description of the effort accomplished, and listing potential result applications. 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 project objectives met, work completed, results obtained, and technical feasibility estimates.

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

b) Additional Reporting: AF may require additional reporting 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 ortotal development and delivery of hardware; and
   v. Updates to the commercialization results.

(8) **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 applicant-identified subject matter experts, regardless of affiliation, ~~reviewers~~ providing comments regarding the offeror's knowledge of the state-of-the-art in the specific approach proposed.

(9) ~~Company Commercialization Report (CCR)/~~Commercialization Potential:

~~a) Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by the Air Force during proposal evaluations. Note, even though the CCR is listed here under the Volume 2 heading, as stated in this document, the CCR comprises Volume 4 of the proposal submission.~~

b) 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.

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

   i. The existence of private sector or non-SBIR/STTR Governmentalfunding sources demonstrating commitment to Phase II efforts/results.
   ii. The existence of Phase III follow-on commitments for the research subject.
   iii. The presence of other indicators of commercial technology potential,including the firm's commercialization strategy.

d) If awarded a D2P2, the contractor is required to periodically update the commercialization results of the project via SBA. These updates will be required at completion of the 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 the D2P2 completion.
e) Note, the "Commercialization Plan" and the "Company Commercialization Report" are distinct documents. The Company Commercialization Report (CCR) comprises Volume 4 as separately indicated in these instructions.

(10)**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 include not more than one to two paragraphs. Include agency point of contact names and telephone numbers.

(11)**Relationship with Future R/R&D Efforts**:

i. State the anticipated results of the proposed approach, specifically addressing plans for Phase III, if any.
ii. Discuss the significance of the D2P2 effort in providing a basis for the Phase III R/R&D effort, if planned.

E. **Key Personnel:** In the technical volume, identify all key personnel involved in the project. Include information directly related to education, experience, and citizenship. Atechnical 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. 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 held, and identify the tasks they are anticipated to perform.

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 the DoD 24.1 BAA 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 becapable 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 BAA.

The following will apply to all projects with military or dual-use applications

developing beyond fundamental research (basic and applied research ordinarily published and sharedbroadly 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, andthe 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 thework 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.

F. **Facilities/Equipment:** Describe instrumentation and physical facilities necessary and available to carry out the D2P2 effort. Justify equipment to be purchased (detail in cost proposal). State whether proposed performance locations meet environmental laws andregulations of Federal, state, and local Governments for, but not limited to, airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulkwaste disposal practices, and handling and storage of toxic and hazardous materials.

G. **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. These requests can only be made upon proposal submission. 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 statements of work and detailed cost proposals. 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 E above.

H. 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 forconsideration 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 BAA is substantially the same as another proposal previously, currently, or in the process of being funded by another Federal

agency/DoD Component or the DAF, the offeror 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) towhich proposals were or will be submitted, or from which an awarded is expected or has been received;
b) The proposal submission or award dates;
c) The proposal title;
d) The PI's name and title for each proposal submitted or award received; and
e) Solicitation(s) title, number, and date under which the proposal was or will besubmitted, 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."

COST VOLUME (VOLUME 3)

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 if the proposal is selected. Generally, Firm-Fixed-Price contracts are appropriate for Phase II awards. In accordance with the SBA SBIR/STTR Policy Directive, Phase II contracts must include profit or fee.

Cost proposal attachments do not count toward proposal page limitations. The cost proposalincludes:

a) **Direct Labor:** Identify key personnel by name, if possible, and labor category, if not. Direct labor hours, labor overhead, and/or fringe benefits, and actual hourly rates for each individual are also necessary for the CO to determine whether these hours, fringe rates, and hourly rates are fair and reasonable.

b) **Direct Cost 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 theneed 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.

d) **Special Tooling, Special Test Equipment, and Material:** The inclusion of equipment and materials will be carefully reviewed relative to need and appropriateness to the work proposed. Special tooling and special test

equipment purchases must, in the CO's opinion, be advantageous to the Government and relate directly to the effort. These toolings or equipment should not be of a type that an offeror would otherwise possess in the normal course of business. These may include such items as innovative instrumentation and/or automatic test equipment.

e) **Subcontracts:** Subcontract costs must be supported with copies of subcontract agreements. Agreement documents must adequately describe the work to be performed and cost bases. The agreement document should include a SOW, assignedpersonnel, 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, unless otherwise approved in writing by the Contracting Officer.

   The prime contractor must accomplish price analysis, including reasonableness, of the proposed subcontractor costs. If based on comparison with prior efforts, identify the basis upon which the prior prices were determined reasonable. If price analysis techniques are inadequate or the FAR requires subcontractor cost or pricing data submission, provide a cost analysis. Cost analysis includes but is not limited to, consideration of materials, labor, travel, other direct costs, and proposed profit rates.

f) **Consultants:** For each consultant, provide a separate agreement letter briefly stating the service to be provided, hours required, and hourly rate, as well as ashort, concise resume.

g) **Travel:** Each effort should include, at a minimum, a kickoff or interim meeting. Travel costs must be justified as required for the effort. Include destinations, numberof trips, number of travelers per trip, airfare, per diem, lodging, ground transportation, etc. Per Diem and lodging rates may be found in the Joint Travel Regulation (JTR),Volume 2, www.defensetravel.dod.mil.

h) **Indirect Costs:** Indicate proposed rates' bases, 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 are required.

i) **Non-SBIR Governmental/Private Investment:** Non-SBIR Governmental and/or private investment is allowed. However, it is not required, nor will it be a proposal evaluation factor.

NOTE: If no exceptions are taken to an offeror's proposal, the Government may award a contract without exchanges. Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. If there are questions regarding the award document, contact the Phase I CO identified on the cover page. The Government reserves the right to reopen exchanges later if the CO determines doing so to be necessary.

COMPANY COMMERCIALIZATION REPORT (VOLUME 4)

Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR 24.1 BAA for full details on this requirement. Information contained in the CCR will not be considered by the Air Force during proposal evaluations.

SUPPORTING DOCUMENTS VOLUME (VOLUME 5)

The following ~~documents~~ solicitation attachments are required for all proposal submissions:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment (Attachment 1 to the DOD SBIR 24.1 BAA)
2. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Attachment 2 to the DOD SBIR 24.1 BAA)
3. Disclosure of Funding Sources (Attachment 4 to the DOD SBIR 24.1 BAA)

The following documents may be required if applicable to your proposal:

1. DD Form 2345: For proposals submitted under export-controlled topics, either International Traffic in Arms or Export Administration Regulations (ITAR/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.dla.mil/HQ/InformationOperations/Offers/Products/LogisticsApplications/JCP/DD2315Ins tructions.aspx. DD Form 2315 approval will be required if proposal if selected for award.
2. Verification of Eligibility of Small Business Joint Ventures (Attachment 3 to the DOD SBIR 24.1 BAA)
3. Technical Data Rights Assertions (if asserting data rights restrictions)

Feasibility Documentation (required for all proposal submissions, contained within Volume 5, not subject to page limitations)

1. ~~Offerors must adequately document completion of the Phase I feasibility requirement*. Offerors must demonstrate completion of R/R&D through means not solely based on previous efforts under the SBIR/STTR Programs to establish Phase II proposal feasibility based on criteria provided in the D2P2 topic descriptions.~~ Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work. Phase II proposals require a comprehensive, detailed effort description. Proposals should demonstrate sufficient technical progress or problem-solving results to warrant more extensive RDT&E. Developing technologies with commercial and military potential is extremely important. Particularly, AF is seeking proposals emphasizing technologies' dual-use applications and commercialization.
2. * NOTE: The offeror shall provide information to enable the agency to make the 15 U.S.C. 638(cc) determination of scientific and technical feasibility and merit. Offerors are required to provide information demonstrating scientific and technical merit and feasibility has been established ~~as part of the Technical Volume (Volume 2)~~. The DAF will not review the Phase II proposals if it is determined the offeror 1) fails to demonstrate technical merit and feasibility are established or 2) the feasibility documentation does not support substantial performance by the offeror and/or the PI. Refer to the Phase I description within the topic to review the minimum requirements needed to demonstrate scientific and technical feasibility. ~~**Feasibility documentation MUST NOT be solely based on work performed under prior or ongoing Federally funded SBIR or STTR work.**~~ **Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.**
3. If appropriate, include a reference or works cited list as the last page.
4. Feasibility efforts detailed must have been substantially performed by the offeror and/or the PI. If technology in the feasibility documentation is subject to intellectual property (IP) rights, the

offeror must provide IP rights assertions. Additionally, proposers shall provide a short summary for each item asserted with less than unlimited rights describing restriction's nature and intellectual property intended for use in the proposed research. Please see DoD SBIR 24.1 BAA for technical data rights information.

5. DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated.

FRAUD, WASTE, AND ABUSE TRAINING (VOLUME 6)

Note that the FWA Training must be completed prior to proposal submission. When training is complete and certified, DSIP will indicate completion of the Volume 6 requirement. The proposal cannot be submitted until the training is complete.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

The DAF does not participate in the Discretionary Technical and Business Assistance (TABA) Program. Proposals submitted in response to DAF topics should not include TABA.

METHOD OF SELECTION AND EVALUATION CRITERIA

D2P2 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. D2P2 proposals will be disqualified and not evaluated if the Phase I equivalency documentation does not establish the proposed technical approach's feasibility and technical merit.

Proposals will be evaluated for overall merit in accordance with the criteria discussed in the 24.1 BAA. DAF is seeking varying technical/scientific approaches and/or varying and new technologies that would be responsive to the problem statement(s) and area(s) of interest in the topic. Multiple procurements are planned and anticipated to be awarded as a result of the topic, each proposal is considered a separate procurement and will be evaluated on its own merit, and that the Government may award all, some, or none of the proposals. Any per-award or per-topic funding caps are budgetary estimates only, and more or less funding may become available. Funding decisions are made with complete disregard to the other awards under the same topic.

In accordance with Section 4 of the SBIR and STTR Extension Act of 2022, the DAF will review all proposals submitted in response to this BAA to assess security risks presented by small business concerns seeking a Federally funded award. The DAF will use information provided by the small business concern in response to the Disclosure of Foreign Affiliations or Relationships to Foreign Countries and the proposal to conduct a risk-based due diligence review on the cybersecurity practices, patent analysis, employee analysis, and foreign ownership of a small business concern, including the small business concern and employees of the small business concern to a foreign country, foreign person, foreign affiliation, or foreign entity. The DAF will also assess proposals utilizing open-source analysis and analytical tools, for the nondisclosures of the information set forth in 15 U.S.C. 638(g)(13). If DAF assesses that a small business concern has security risk(s), DAF will review the proposal, the evaluation, and the security risks and may choose to either 1) create a plan to mitigate the risk(s) or 2) DAF may decide not to select the proposal for award based upon a totality of the review.

DAF USE OF SUPPORT CONTRACTORS

Restrictive notices notwithstanding, proposals may be handled for administrative purposes only, by support contractors: APEX, Peerless Technologies, Engineering Services Network, HPC- COM, Mile Two, REI Systems, MacB (an Alion company), Montech, Oasis, and Infinite Management Solutions. In addition, 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 AF Life Cycle Management Center and Space Force may evaluate proposals. All support contractors are bound by appropriate non-disclosure agreements. **Contact the AF SBIR/STTR Contracting Officer (Daniel.Brewer.13@us.af.mil) with concerns about any of these contractors**.

PROPOSAL STATUS AND FEEDBACK

The Principal Investigator (PI) and Corporate Official (CO) indicated on the Proposal Cover Sheet will be notified by e-mail regarding proposal selection or non-selection. Small Businesses will receive a notification for each proposal submitted. Please read each notification carefully and note the Proposal Number and Topic Number referenced.

Automated feedback will be provided for proposals designated Not Selected. Additional feedback may be provided at the sole discretion of the DAF.

IMPORTANT: Proposals submitted to the DAF are received and evaluated by different organizations, handled by topic. Each organization operates within its own schedule for proposal evaluation and selection. Updates and notification timeframes will vary. If contacted regarding a proposal submission, it is not necessary to request information regarding additional submissions. Separate notifications are provided for each proposal.

The Air Force anticipates that all proposals will be evaluated and selections finalized within approximately 90 calendar days of solicitation close. Please refrain from contacting the BAA CO for proposal status before that time.

Refer to the DoD SBIR Program BAA for procedures to protest the Announcement.
As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests after Award should be submitted to: Air Force SBIR/STTR Contracting Officer Daniel J. Brewer, Daniel.Brewer.13@us.af.mil.

AIR FORCE SUBMISSION OF FINAL REPORTS

All Final Reports will be submitted to the awarding DAF organization in accordance with Contract instructions. Companies will not submit Final Reports directly to the Defense Technical Information Center (DTIC).

Air Force SBIR 24.1 Direct to Phase II Topic Index

Topic Number	Topic Name	Maximum Value*	Maximum Duration ** (in months)	Technical Volume Page Limit***
AF241-D001	Rapidly Deployable Base Fortification Systems	$1,800,000.00	24	35
AF241-D002	Machine Vision Work Assistance	$1,800,000.00	24	35
AF241-D003	Securing AI/ML Models Against Adversarial Threats for Advanced Command and Control (AC2) Missions	$1,800,000.00	24	35
AF241-D004	Explainable Reinforcement Learning (XRL) for Command and Control (C2)	$1,800,000.00	24	35
AF241-D005	UAS TRACKING SYSTEM	$1,800,000.00	24	35
AF241-D006	Rapid Deployment Sensor System	$1,800,000.00	24	35
AF241-D007	Air Force Defense and Biometric Network	$1,800,000.00	24	35
AF241-D008	Adaptive Robotic Behavior for Dynamic Environments	$1,800,000.00	24	35
AF241-D009	Rapidly Deployable Airborne Fuel Flowmeter (RDAFF)	$1,800,000.00	24	35
AF241-D010	Wireless Airborne Instrumentation Network (WAIN)	$1,800,000.00	24	35
AF241-D011	Robotic Electronic Component Replacement and Soldering in a Digital Depot Environment	$1,800,000.00	24	35
AF241-D012	Mandatory Declassification Review (MDR) Natural Language Processing (NLP) Tool	$1,800,000.00	24	35

AF241-D013	Trustworthy Generative Artificial Intelligence (GenAI) to Structure Data and Deliver Accurate Insights of Command, Control, Communication and Computer (C4) Systems	$1,800,000.00	24	35
AF241-D014	Optical Air Data System (OADS)	$1,800,000.00	24	35
AF241-D015	Collaborative Airborne Sensor Fusion via Maximizing Information under Constraints	$1,800,000.00	24	35
AF241-D016	Large RF Windows for High-Temperature Seekers	$1,800,000.00	24	35
AF241-D017	Augmented Reality Enhanced Corrosion Control Systems	$1,800,000.00	24	35
AF241-D018	Long Range Strike System	$1,800,000.00	18	35
AF241-D019	Low-Cost Long-Range Airdrop Delivery	$1,800,000.00	18	35
AF241-D020	Counter-UAS Long Bow	$1,800,000.00	18	35
AF241-D021	In-Place Heat Treat for Incrementally Formed Parts	$1,800,000.00	24	35
AF241-D022	Microelectronics Inoculation	$1,800,000.00	24	35
SF241-D023	Automated MBSE Model Generation of Space Systems	$1,800,000.00	24	35
SF241-D024	15 SPSS Path to Production Development for Electro-Optical Sensor Scheduling Software Modernization	$1,800,000.00	24	35
SF241-D025	Alternative Position, Navigation, and Timing	$1,900,000.00	24	35
SF241-D026	Digital Spaceport of the Future	$1,900,000.00	24	35

***Proposals that exceed this amount will be disqualified**
**** Proposals that exceed this duration will be disqualified**
*****Pages in excess of this count will not be considered during evaluations**

AF241-D001 TITLE: Rapidly Deployable Base Fortification Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Development of improved base fortification systems that provide rapid defense for personnel in an austere environment. Maximum utilization of readily available resources in the field it to be utilized in order to minimize transportation weight, deployment time, and destruction for withdrawal time. Technology should be about to be transportable on aircraft with minimal footprint.

DESCRIPTION: Currently, military personnel must bring equipment with them to austere environments in order to fortify their fighting position. For shorter durations, the sandbag is the most likely fortifying material to be utilized by personnel in the field. Additionally, the sandbag serves a pivotal function in long-term defensive applications. The basic sandbag requires ready access to dirt, sand, or similar earth material that be excavated to fill the bag and then it is arranged in a manner to provide a makeshift protection wall. Of particular interest are technologies that can reduce the employment time of sandbags or completely replace the sandbag system with a comparable system that provides equal, or better, levels of protection for personnel. Currently, the sandbag is manually filled with some in-field improvements that have been created by personnel. However, even with these manual creations, the process of filling and deploying sandbags is extremely time consuming, which increase personnel fatigue and reduces defensive capabilities. Improvement points may include, but not limited to: prefilled sandbags that fully deploy under certain conditions, lightweight systems capable of rapidly filling sandbags, lightweight systems capable of quickly deploying multiple sandbags, or a total sandbags replacement system. Further, the systems need to be minimal in size and weight to reduce cargo size and weight such that impact for transportation is minimized. This work is to be done at the unclassified level for Phase I and II.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. In order to be awarded a D2P2, the applicant’s technology should have a fully developed blueprint, concept or, at best, prototype to further develop. The proposer should demonstrate the feasibility of their design and its readiness for a Phase II.

PHASE II: Perform in-depth research and develop, resulting in a full-scale prototype package that demonstrates the capability of the product and the time to deploy as compared to a comparable dimension of standard fortification products in use today. Delivery and demonstration of the product will be conducted in the customer's environment, and performance will be evaluated.

PHASE III DUAL USE APPLICATIONS: Explore and pursue paths for military and commercial applications. Potential users may include, but are not limited to, Federal Emergency Management Agency, Department of Homeland Security, Border Patrol, and local governments. This phase will also focus on inserting and evaluating performance of the developed capability in operational environments.

REFERENCES:

1. Base defense fortification;

KEYWORDS: fortification; sandbag; emplacements; base building

AF241-D002 TITLE: Machine Vision Work Assistance

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Human-Machine Interfaces

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Maintainers gather data from multiple sources to diagnose and sustain weapon systems. These run the spectrum from cockpit dials and digital interfaces, to portable maintenance aids on laptops and tablets. To enable AR systems to capture that data for reference and logging, the sponsoring organization needs a machine vision system capable of observing an interface in various poses and extracting data from it. Key to scaling this capability will be a no code tool for a maintainer to train the system on a small number of example pictures that they can label. During maintenance the machine vision utility will integrate with other work tracking tools to record and reference the data.

DESCRIPTION: The next major goal for AR/VR systems is AI and ML to support work as it is performed. This requires a large data set to effectively develop. The sponsoring organization requires a framework to capture multidimensional data from AR/VR systems to create and sustain a corpus of data for development and refinement of ML/AI algorithms. This framework should integrate into cloud based storage concepts and be rapidly adaptable to new AR/VR systems as they develop. The work tracking itself is done in software which will be important context to the data and should be included in the framework.

Safety Assistant AI
Maintenance work on weapon systems frequently involves exposure to hazardous conditions, hot surfaces, pinch points, loud noises, etc. Initial, scalable development of an AI agent that can alert the maintainer to observable hazards via an AR system is of interest. Supporting good PPE and safety habits without annoying or disengaging the operator is the key balance of effective systems.

Work Recognition AI
A long term goal of AR/VR is to help maintainers accomplish work more effectively. With the work procedures digitized into a machine comprehensible form and the maintainer stepping through them in either AR or VR, the next enhancement is for an AI to be able to recognize the work that has been accomplished and assist with logging or proceeding to the next step. This enables virtual instructors and AI assistants to be developed from examples of the work being performed.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. In order to be awarded a D2P2, the applicant’s technology should have a fully developed blueprint, concept or, at best, prototype to further develop. The proposer should demonstrate the feasibility of their design and its readiness for a Phase II.

PHASE II: Perform in-depth research and development, resulting in a full-scale prototype package that

demonstrates the capability of the product and the expense required to deploy as compared to personnel commensurate actions today (non-value added tasks). Delivery and demonstration of the product will be conducted in the customer's environment, and performance will be evaluated.

PHASE III DUAL USE APPLICATIONS: Explore and pursue paths for military and commercial applications. Potential users may include any organization that must record accomplished work, operate in a hazardous environments, verify the quality of accomplished work, evidence collection, or similar verification tasks. This phase will also focus on inserting and evaluating performance of the developed capability in operational environments.

REFERENCES:

1. Machine Vision;
2. Machine Learning;

KEYWORDS: machine learning; artificial intelligence; ai; ml; augmented reality; AR; computer vision; machine vision; work recognition; task recognition; safety; data analytics

AF241-D003 TITLE: Securing AI/ML Models Against Adversarial Threats for Advanced Command and Control (AC2) Missions

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber; Trusted AI and Autonomy

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this SBIR Phase II is to examine and develop effective methods for safeguarding AI/ML models from malicious threats. Specifically, the prototype should aim to identify vulnerabilities in AI/ML models, such as adversarial examples, data poisoning, and model extraction attacks. Additionally, it intends to propose innovative defense mechanisms that can mitigate the impact of these attacks. The research will also investigate the trade-off between the effectiveness of defense mechanisms and the computational resources required for their implementation. Ultimately, the goal is to improve the security and resilience of AI/ML models, thereby increasing their reliability and trustworthiness for real-world applications. There is an immediate demand for this capability across strategic, operational, and technical guidance and policies mandated by the Secretary of the USAF as follows: • Operational Imperatives o II - Achieving Operationally Optimized Advanced Battle Management Systems (ABMS) / Air Force Joint All-Domain Command & Control (AF JADC2) o IV - Achieving Moving Target Engagement at Scale in a Challenging Operational Environment

DESCRIPTION: The significance of artificial intelligence (AI) and machine learning (ML) has grown in various military applications. However, the susceptibility of AI/ML models to adversarial attacks has raised concerns regarding the security and reliability of these models in C2 real-world applications. Adversarial attacks involve deliberate attempts to manipulate or deceive an AI/ML model by introducing carefully crafted inputs that cause the model to misclassify or produce incorrect outputs [1]. Such attacks can have severe consequences in safety-critical applications like autonomous agent route planning or medical diagnosis, and they can also result in privacy violations and data breaches. The most prevalent form of adversarial attack is the generation of adversarial examples, which are inputs slightly altered from legitimate inputs but can cause the model to produce incorrect outputs. Adversarial examples can be created using various techniques, such as gradient-based methods or evolutionary algorithms, and they can be challenging to detect and defend against. Other types of adversarial attacks include data poisoning, where an attacker injects malicious data into the training dataset to bias the model towards a specific outcome, and model extraction, where an attacker attempts to steal the model's architecture or parameters to replicate or enhance the model. Consequently, the development of effective techniques to secure AI/ML models against adversarial attacks has become imperative for operational performance within the USAF. Therefore, this proposal seeks innovative prototypes to engage and deter cyber threats under AI/ML models, which will incorporated into the Air Force’s core operational mission.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. The scope of the phase I feasibility study should include at minimum research on identifying vulnerabilities in AI/ML models, such as adversarial models, data

poisoning, and model extraction attacks and others securing AI/ML techniques innovative defense mechanisms that can mitigate the impact of these attacks as the minimum basis for qualifications for this phase II solicitation proposal.

PHASE II: Proposals should include development, installation, integration, demonstration and/or test and evaluation of the proposed solution prototype system. This demonstration should evaluate the proposed solution against the proposed objectives; describe how the solution will fulfill the AF's requirements; identify the technology's transition path; specify the technology's integration; and describe the technology's sustainability. Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning the developed technology to a working commercial or warfighter solution. If a viable business model for the developed solution is demonstrated, the offeror or identified transition partners would be in a position to supply future processes to the Air Force and other DoD components as this new technology is adopted.

REFERENCES:

1. Ibitoye, Olakunle, et al. "The Threat of Adversarial Attacks on Machine Learning in Network Security--A Survey." arXiv preprint arXiv:1911.02621 (2019);
2. Song, Liwei, Reza Shokri, and Prateek Mittal. "Privacy risks of securing machine learning models against adversarial examples." Proceedings of the 2019 ACM SIGSAC Conference on Computer and Communications Security. 2019;
3. Apruzzese, Giovanni, et al. "Addressing adversarial attacks against security systems based on machine learning." 2019 11th international conference on cyber conflict (CyCon). Vol. 900. IEEE, 2019;

KEYWORDS: Adversarial Threats;data poisoning;model extraction attacks;adversarial attacks;

AF241-D004 TITLE: Explainable Reinforcement Learning (XRL) for Command and Control (C2)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this topic is to develop an effective (SBIR Phase II) prototype to enable practical application (s) of Reinforcement Learning (RL) to be explained for interpretability (i.e., generating explanations that are intuitive and understandable to humans), trust (i.e., to verify an agent's behavior), performance-explanation trade-off (i.e., strike a balance between the performance of the RL agent and the quality of explanations it provides), accountability and safety (i.e., RL agents to be held accountable for their actions to be able to identify and rectify potential risks/errors in agent's behavior) and finally, human-AI collaboration (i.e., collaboration by effective communication and collaboration). This topic undertakes the operational imperatives as follows: • Operational Imperatives o II - Achieving Operationally Optimized Advanced Battle Management Systems (ABMS) / Air Force Joint All-Domain Command & Control (AF JADC2) o V - Defining optimized resilient basing, sustainment, and communications in a contested environment

DESCRIPTION: RL represents a groundbreaking technology with the ability to perform long-term decision-making in complex and dynamic domains at a level surpassing human capabilities [1]. Leveraging this capability holds immense strategic significance for the United States Department of Defense (DoD), given that RL-enabled systems have the potential to outperform even the most exceptional human minds in a wide range of tasks [2]. Its adoption in high-risk real-world domains like military applications has been limited due to the challenges associated with explaining RL agent decisions and establishing user trust in these agents, despite remarkable improvements. For instance, while the AI AlphaStar competes against highly skilled StarCraft 2 players, comprehending its inner workings necessitates extensive and impractical empirical investigations [3]. This substantial and inhibitory constraint arises because current Explainable Reinforcement Learning (XRL) methods inadequately address the fact that autonomous decision-making agents can alter future data observations through their actions and effectively reason about long-term objectives aligned with the agent's mission. Therefore, it is imperative to develop effective XRL approaches that overcome these limitations to unlock the widespread utilization of RL's capabilities. Therefore, we seek to have proposals that would adhere to effective and efficient models for XRL, which will be used for the US Air Force's direct operational use.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. The Offeror is required to provide detail and documentation in the Direct-to-Phase-II (D2P2)proposal which demonstrates accomplishment of a "Phase I-type" effort where the Offeror demonstrate a case study or prototype of having performed explainable reinforcement learning for any practical applications where they have been able to provide intuitive and understandable explanations to humans based off their AI/ML inference findings to verify an agent behavior.

PHASE II: This phase II topic proposal seeks 6.2 explainable AI/ML solutions using reinforcement

learning for command and control applications. Proposals should include development, installation, integration, demonstration, test and evaluation of the proposed solution prototype system that verifies an agent behavior, provides performance trade-off, trust, quality explanation that ultimately translates into intuitive interpretability for human understanding of how the agent arrived at such decision.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning the developed technology to a working commercial or warfighter solution. The offeror will identify the transition partners. The technology will meet a minimum of TRL 6 and will be mature and operationally ready. Solution will be configured, tailored, further developed to match the customer requirements and specific environment configuration for deployment. A transition plan will be required to be developed and delivered. Phase III are not competed thus it is the responsibility of the offeror to seek funding opportunities.

REFERENCES:

1. V. Mnih, K. Kavukcuoglu, D. Silver, A. A. Rusu, J. Veness, M. G. Bellemare, A. Graves, M. Riedmiller, A. K. Fidjeland, G. Ostrovski and S. Petersen, "Human-level control through deep reinforcement learning," Nature, vol. 518, pp. 529-533, 2015, February;
2. "THE NATIONAL ARTIFICIAL INTELLIGENCE RESEARCH AND DEVELOPMENT STRATEGIC PLAN: 2019 UPDATE, "https://www.nitrd.gov/pubs/National-AI-RD-Strategy-2019.pdf" A Report by the SELECT COMMITTEE ON ARTIFICIAL INTELLIGENCE of the NATIONAL SCIENCE & TECHNOLOGY COUNCIL, 2019, JUNE.;

KEYWORDS: Reinforcement Learning interpretability; Reinforcement Learning explanations;

AF241-D005 TITLE: UAS TRACKING SYSTEM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Integrated Sensing and Cyber

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The Air Force Security Forces Center (AFSFC) has identified the need to develop effective countermeasures to mitigate the emerging threat of unmanned aerial systems (UAS). The AFSFC's objective is to enhance UAS tracking capabilities, which align with the Secretary of the Air Force's (SECAF) operational imperative of achieving tactical air dominance, moving target engagement and operationally focused Advanced Battle Management System (ABMS).

DESCRIPTION: To effectively mitigate the threat posed by unmanned aerial systems (UAS) to USAF personnel, assets, and operations, the UAS tracking device must be designed to be easily deployable and operable by personnel in the field. The device should be compact and lightweight to allow for easy transport to different locations and quick setup. The UAS tracking device should be able to detect and track multiple UAS simultaneously and provide real-time updates on their position, speed, altitude, and other relevant information. It should also be able to differentiate between friendly and hostile UAS and provide alerts when potential threats are detected. These features will help provide an accurate and timely understanding of the UAS activity in the surrounding airspace, allowing USAF personnel to respond quickly and effectively to any potential threat. To ensure maximum effectiveness, the UAS tracking device should be designed to integrate with other USAF systems and equipment, such as command and control systems and other UAS detection and tracking devices. The integration will provide a comprehensive view of the UAS activity in the surrounding airspace and enhance situational awareness, enabling rapid response to potential threats. Furthermore, the UAS tracking device should be capable of operating in diverse environments and weather conditions. It should be rugged and durable, able to withstand harsh weather conditions, and operate in extreme temperatures. This ensures the device can be deployed in different locations and environments, providing comprehensive UAS tracking capabilities across the entire spectrum of operations.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. "Phase I-type" development will have involved a comprehensive requirements analysis to determine the exact capabilities and features needed for the UAS tracking device. This "phase" would have involved gathering input from a wide range of stakeholders, including USAF operators, cybersecurity experts, and other technical experts to understand the operational and technical requirements. This would have also included a review of the current UAS threat landscape to identify potential risks and vulnerabilities that need to be addressed. The requirements analysis would lay the groundwork for the subsequent development phases and help ensure that the final product meets the needs of the USAF.

PHASE II: Technology Development; The second phase of development would focus on the design and

development of the UAS tracking device. This would involve selecting the appropriate technology components, such as sensors, processors, and communication systems, and integrating them into a functional system. This phase would require a team of experts in various technical fields, such as electronics, software development, and mechanical engineering, to work together to develop a prototype UAS tracking device. The device would be tested extensively in a controlled environment to ensure that it meets the requirements identified in the first phase. Once the device has been successfully developed and tested, it can be further refined and optimized for deployment in the field.

PHASE III DUAL USE APPLICATIONS: Tracking device development could involve exploring dual-use applications for the product. Dual-use applications are those that can be utilized by both military and civilian organizations for a range of purposes. The UAS tracking device, designed for military use, could have several potential dual-use applications, such as; Border Security; UASs have increasingly been used by criminal organizations to smuggle drugs, weapons, and other contraband across borders. The UAS tracking device could be utilized by border security agencies to detect and track these UASs and help prevent illegal activities. Critical Infrastructure Protection: UASs have the potential to be used as weapons to target critical infrastructure, such as power plants, airports, and government buildings. The UAS tracking device could be used to detect and track UASs near these sensitive locations and provide alerts to security personnel to respond appropriately.

REFERENCES:

1. Air Force Instruction (AFI) 13-204 https://static.e-publishing.af.mil/production/1/af_a3/publication/afman13-204v1/afman13-204v1.pdf
2. Unmanned Aircraft Systems (UAS) Operations; https://www.faa.gov/uas
3. Department of Defense Directive (DoDD) 3200.11 https://www.esd.whs.mil/#

KEYWORDS: Unmanned Aerial Systems (UAS); Tracking; Security; Air Force; Countermeasures; Detection; Threats; Situational awareness; Technology;

AF241-D006 TITLE: Rapid Deployment Sensor System

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Integrated Sensing and Cyber

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this project is to develop mobile sensors that can be deployed to remote and rough terrain using robotic dogs or unmanned aerial systems (UAS). The sensors should be designed to withstand harsh environmental conditions and provide reliable and accurate data in real-time. The use of robotic dogs or UAS would enable efficient and safe deployment of the sensors to remote or difficult-to-reach locations. The sensors should be lightweight and compact, enabling easy transport and deployment by the robotic dogs or UAS. The goal is to enhance surveillance and monitoring capabilities in challenging environments where traditional methods of deployment are not feasible or safe.

DESCRIPTION: The system must be capable of overcoming the limitations of traditional data collection methods that are often hindered by hazardous conditions or difficult terrain, thereby minimizing the risks and increasing efficiency. The mobile sensor system has the potential to revolutionize data collection by providing a reliable solution that can access locations that were previously inaccessible, enabling critical insights into environmental conditions and security threats. The system must consist of lightweight and compact sensors that can be easily transported and deployed by robotic dogs or unmanned aerial systems (UAS). The sensors must be designed to withstand harsh environmental conditions, ensuring reliable data collection in challenging environments. The system must also integrate with navigation and positioning technology to ensure accurate data collection. The sensors must be able to collect data in real-time and transmit it wirelessly to a central location for analysis. The development of a custom robotic dog or UAS platform is crucial for the successful implementation of the mobile sensor system. The platform must be designed to be lightweight, compact, and durable, enabling it to navigate rugged terrain and harsh environmental conditions with ease. The robotic dog or UAS platform must be capable of transporting and deploying the sensors in difficult terrain, thereby reaching previously inaccessible locations. A robust wireless communication system is necessary for transmitting data from the sensors to a central location in real-time. This system must ensure that the data collected is transmitted quickly and reliably, providing real-time insights into environmental conditions and security threats. The system must also be secure and resilient, ensuring that data is protected from unauthorized access or interference. Data analysis software must be developed to process, analyze, and visualize the data collected by the sensor system. This software must provide critical insights into environmental conditions and security threats, enabling informed decision-making. The software must be designed to be user-friendly, allowing non-experts to easily interpret the data collected.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Offerors are expected to provide a white paper containing the following information: 1. A detailed technical design of the mobile sensor system. 2. A detailed technical explanation of the data analysis software that will be incorporated into the sensor system. 3. An

explanation of how the sensors will be deployed and retrieved by either UAS or Robotic Dogs or both.

PHASE II: Develop and test a suite of capabilities to address any issues or limitations identified in the previous phases. The development plan for this phase involves identifying potential areas for improvement based on feedback from previous testing and evaluation. This includes addressing any issues or limitations in the current system and exploring new capabilities that could enhance the system's effectiveness and versatility. Once potential areas for improvement have been identified, the development team will create a plan to design and test the new capabilities. The team will conduct rigorous testing and evaluation to ensure the safety, effectiveness, and compatibility of the new capabilities with the existing system. Throughout the development and testing process, the team will collaborate with security forces personnel to ensure that the new capabilities meet their needs and can be effectively integrated into existing operational procedures. Ongoing training and education for security forces will also be necessary to use the new capabilities effectively. Once the new capabilities have been successfully tested and integrated into the system, the team will conduct a final round of testing and evaluation to ensure that the system is functioning at its full potential.

PHASE III DUAL USE APPLICATIONS: The third phase of this project will focus on the identification and implementation of dual-use applications for the mobile sensor system. Dual-use applications refer to the adaptation of military technology for civilian use. This phase will involve conducting research and development to identify additional features or improvements that could enhance the system's effectiveness and versatility for both military and civilian applications. Ongoing testing and evaluation will ensure the safety and effectiveness of the system for both applications. This phase will also involve ongoing training and education for both military and civilian users to ensure the effective use of the system. The goal is to maximize the potential of the mobile sensor system beyond military applications and leverage its capabilities to benefit civilian industries such as environmental monitoring, disaster response, and infrastructure inspections.

REFERENCES:

1. AFI 11-202V3;
2. AFI 13-1;
3. AFI 14-202;
4. AFI 31-101;

KEYWORDS: Wireless communication; Robotic dogs; Unmanned aerial systems; Rough terrain; Mobile sensors; Data collection; Real-time analysis; Environmental monitoring; Security surveillance; Logistical challenges.

AF241-D007 TITLE: Air Force Defense and Biometric Network

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Integrated Sensing and Cyber; Integrated Network System-of-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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The current access control systems utilized by Air Force Installations are becoming outdated, inefficient, and costly to maintain. Considering the SECAF's Operational Imperative of Achieving Operationally Optimized Advanced Battle Management Systems/Air Force Joint All-Domain Command and Control, there is a critical need to design and build a biometric system for deployment at Access Control Points (ACPs) across Air Force Installations. The objective of this system is to verify the access authorization of individuals entering Air Force installations and facilities by utilizing advanced technologies, including artificial intelligence, machine learning, cloud computing, and advanced sensors, to create a networked system that can provide real-time information to warfighters at all levels of command. This will allow for more effective and efficient operations, enabling decision-making based on up-to-date information in any environment.

DESCRIPTION: As technology advances rapidly, the United States Air Force (USAF) must stay current to remain relevant. Older systems are becoming increasingly difficult and expensive to maintain, and current USAF systems are quickly becoming outdated, slow, bulky, and cost-ineffective. To address this issue, the Air Force Security Forces Center seeks a cloud-based software solution meeting specific criterion. This effort aligns with the Secretary of the Air Force's operational imperative, Achieving Operationally Optimized Advanced Battle Management Systems/Air Force Joint All-Domain Command and Control. This initiative requires the integration of various technologies, including artificial intelligence, machine learning, cloud computing, and advanced sensors, to create a networked system that can provide real-time information to warfighters at all levels of command. The system must enable decision-making based on the most up-to-date information, allowing for more effective and efficient operations in any environment by meeting the following criteria: Credential Verification- The system must be capable of verifying credentials through scanning of Common Access Cards (CAC) or other forms of identification such as temporary passes. This must be done at the ACP through a handheld scanner or, in some cases, a stationary scanner. • Be able to integrate with the Identity Matching Engine for Security and Analysis (IMESA) for access to authoritative data sets (RAPIDS, NCIC, TSDB) • Personal Identification Verification (PIV) compliant • Provide the capability to vet credentials to authoritative law enforcement databases including but not limited to: National Crime Information Center (NCIC) Person Files (including Wanted Persons, Violent Persons, Immigration Violators, Known or Appropriately Suspected Terrorists, and National Sex Offender Registry), Interstate Identification Index (III), National Law Enforcement Telecommunications System (Nlets), and Commercial criminal background screening. The system must be able to scan a barcode or Quick Response code (QR code) on an authorized credential to compare the information to the individual's biometric data and access authorization. The system should be designed to quickly and accurately scan the credentials, allowing for efficient and streamlined access control. • Examples include, but not limited to: o State issued ID o State issued Driver's License o DoD Common Access Card (CAC) o Federal Employee CAC o Teslin IDs (Military/Civil Service retiree, Military Dependent, etc.) o Personal Identity Verification (PIV) credentials

o Personal Identity Verification-Interoperable (PIV-I) credentials o Passport o Locally produced credentials containing a barcode/QR Code • Provide the service while adhering to the following: o Web based system accessible from GOV NIPR network o No major infrastructure requirements o Discrete handheld screens o Flexible credential scanning options (barcode, contact, contactless) o Flexible vetting options • Provide equipment that meets following criteria: o Mobile Handheld devices for scanning credentials o Docking/charging station o Spare batteries o Local servers to store local cache o Wireless router o Web based Registration software o Public access to Registration site for Non-DoD personnel requesting access o Ability to upload documents and pictures Proper training and protocols should be established to ensure that personnel are properly trained to use the credential scanning feature and that any issues with scanning or verification are addressed promptly. The integration of credential scanning capabilities into the biometric system will enhance the overall security of Air Force installations and facilities by ensuring that only authorized personnel are granted access. Cloud-Based- A cloud-based system offers several advantages over traditional on-premises systems. First, a cloud-based system provides flexibility, scalability, and easy access to data from anywhere, anytime. This is essential for Air Force installations with multiple ACPs spread across large geographic areas. Additionally, a cloud-based system can be easily integrated with other systems, such as security cameras and sensors, to provide a comprehensive security solution. Cloud-based systems also offer high levels of security and reliability, as data is stored in secure data centers with multiple levels of redundancy and backups. Finally, a cloud-based system is typically more cost effective than traditional on-premises systems, eliminating the need for expensive hardware, software, and maintenance costs. Overall, a cloud-based system is a logical choice for the Air Force as it offers several advantages over traditional on-premises systems. Web-Based Dashboard- A web-based dashboard must be included in the design and build of the system. It must provide real-time visibility into system performance and can quickly alert operators to any issues or anomalies. The dashboard must display key performance indicators (KPIs) such as the number of access requests, success rates, and average processing times. These metrics will help operators identify areas for improvement and optimize system performance. In addition, the web-based dashboard should provide a user-friendly interface for operators to interact with the system. It must allow them to quickly and easily view and manage access requests, monitor system performance, and generate reports. This must help operators to make informed decisions and take timely action to address any issues. Moreover, a web-based dashboard must enable authorized and verified personnel to remotely access the system from any location with a verified internet connection. This is particularly important for Air Force installations with multiple ACPs across large geographic areas. With a web-based dashboard, operators can manage the system from a central location, increasing operational efficiency and reducing costs. Virtual Visitors Center capability: A virtual visitors center capability must be added to the system. This will allow visitors to remotely submit their access requests and provide the necessary information, such as identification and purpose of visit. The virtual visitors center can also provide information on installation procedures, security policies, and directions to various locations on the installation. The virtual visitor center must generate an electronic pass for the visitor to use at the ACP. The virtual visitors center capability will reduce the burden on ACP operators by allowing them to focus on security and access control tasks. It will also increase convenience for visitors by reducing wait times and allowing them to submit their requests before arrival at the installation. The virtual visitors center should have a user-friendly interface that guides visitors through the process and provides clear instructions and feedback. Moreover, the virtual visitors center should be integrated with the cloud-based system and web-based dashboard to provide real-time access requests and visitor information updates. This will enable ACP operators to process requests and identify potential security threats quickly. Integration: The system must be integrated with various law enforcement and administrative networks, such as Defense Manpower Data Center (DMDC), Identity Matching Engine for Security Analysis (IMESA), Real-Time Automated Personnel Identification System (RAPIDS) and NCIC (National Crime Information Center). This will enable ACP operators to quickly verify the identity and access authorization of individuals entering the installation by accessing relevant databases and information. Integration with DMDC will allow for real-time verification of personnel information, such as rank, status, and clearances. I In contrast, integration

with NCIC will provide access to criminal history and warrant information. Other law enforcement networks, such as state and local databases, can also be integrated to provide additional security and background checks. The integration with these law enforcement networks should be designed to ensure secure and timely data transmission, with appropriate access controls and encryption methods in place. The system should also have built-in protocols to ensure compliance with relevant regulations and policies, such as the Privacy Act and the Electronic Communications Privacy Act, as well as many other Air Force and DOD operating instructions specifically Air Force Instruction 31-101 v3.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Offerors are expected to demonstrate feasibility by submitting a white paper that details: A detailed description of the system requirements, including the types of biometric identification to be used, the number of ACPs to be equipped with the system, the system's capacity to handle peak-hour traffic, and the level of security required to protect sensitive data. A detailed description of the system architecture, including hardware components (such as cameras, scanners, and servers), software that will process and store biometric data, and the network infrastructure that will connect the system to the ACPs and other relevant Air Force facilities. A discussion of the development and testing process for the system, including creating software that performs biometric identification, integrating hardware components, and testing the system in various scenarios to ensure reliability and accuracy.

PHASE II: System Development, Testing, Deployment The system must apply for and receive an Authority to Operate (ATO) to ensure compliance with security regulations and standards. Once the ATO is received, the system can be deployed at the designated ACPs. • Develop and Test the System: Develop software that performs biometric identification, integrates hardware components, and test the system in various scenarios to ensure reliability and accuracy. Ongoing testing and evaluation should ensure the system meets the operational requirements of Achieving Operationally Optimized Advanced Battle Management Systems/Air Force Joint All-Domain Command and Control. • Deploy the System: Deploy the system at the designated ACPs, including site preparation, installation of hardware and software, and integration with existing ACP systems. Personnel should be trained to operate the system and respond to potential issues. • Maintain the System: Ongoing maintenance requirements should be carried out, including software updates, hardware maintenance, and security updates. Ongoing testing and evaluation should ensure the system meets the operational requirements of Achieving Operationally Optimized Advanced Battle Management Systems/Air Force Joint All-Domain Command and Control. • Monitor the System: Monitor the system's performance and security to identify and address potential issues promptly.

PHASE III DUAL USE APPLICATIONS: Phase III dual-use applications involve transitioning the biometric system from military to commercial or civilian applications. This may involve modifications to the system to meet the unique requirements of non-military applications and obtaining necessary certifications and approvals for commercial use. Potential civilian applications could include access control for government buildings, airports, and other secure facilities and authentication for financial transactions or other sensitive operations. The development of dual-use applications can provide additional revenue streams for the system and broaden its impact beyond military use.

REFERENCES:

1. Protection of Sensitive Compartmented Information and Controlled Access Programs," February 2012;
2. Joint Publication 1-02: "Department of Defense Dictionary of Military and Associated Terms," December 2010;
3. Department of Defense Biometrics Enterprise Strategy, January 2013;

4. Department of Defense Biometrics Task Force, "Biometrics in Support of Military Operations: Lessons from Afghanistan," September 2011;
5. Defense Advanced Research Projects Agency (DARPA) Information Innovation Office (I2O), https Air Force Instruction 31-501, Personnel Security;
6. Air Force Instruction 31-113, Installation Security;
7. Air Force Instruction 10-701, Information Assurance Management;
8. Air Force Instruction 10-2501, Air Force Emergency Management Program Planning and Operations;
9. Air Force Instruction 31-101, Integrated Defense;
10. Air Force Instruction 31-204, Air Force Physical Security Program;
11. Air Force Manual 31-222, Physical Security;
12. Air Force Manual 31-201, Security Forces Management Operations Air Force Manual 31-113, Installation Security;
13. Air Force Manual 31-201, Security Forces Management Operations;
14. Air Force Handbook 31-214, Security Forces Investigations and Reports;

KEYWORDS: Biometric; Access Control Points; Air Force Installations; Cloud-based system; Joint All-Domain Command and Control (JADC2); Advanced Battle Management Systems (ABMS);Artificial intelligence; Machine learning; Network infrastructure; Scalability; Reliability; Security; Testing and evaluation; Virtual visitors center; DMDC; NCIC; Law enforcement networks; Authority to operate; Dual-use applications; System architecture

AF241-D008 TITLE: Adaptive Robotic Behavior for Dynamic Environments

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Human-Machine Interfaces

OBJECTIVE: Research, evaluate, and ultimately determine the proper sensing required to develop the software control needed to enable existing mobile heavy industrial robots (non-collaborative) to work in the same areas as humans and everchanging environments without the need for static safety fencing, door interlocks, and/or light/laser curtains.

DESCRIPTION: Recent developments in robotic controls have allowed the number of industrial robotic systems, both mobile and stationary, in sustainment and depot environments to grow significantly. These systems provide great improvements in safety, quality, agility, and throughput metrics. This growth shows no signs of slowing down. As these systems are scaled across more locations, the issue that needs to be addressed is the dynamic nature of the depot environment. In the depot environment, toolboxes move daily, work stands are continuously repositioned, and people must be present when these robotic systems are performing their work. The use of industrial robotics for aircraft maintenance operations currently requires very controlled (static) and well-protected "cells" that give the robot a place to work where it understands its surroundings and protects/prevents humans from entering that cell. This can severely limit where these robots can be used, and the safety devices used take up valuable floor space. In the case of mobile robots, this is even more difficult. These systems are designed to move from building to building, meaning there must be "safe cells" in each location so the systems can be used in those buildings. This multiplies the lost space problem by the number of buildings the robot has the potential to operate in. With the proper sensing and controls in place, these systems will be able to function efficiently in dynamic environments and allow for safe interactions with humans. Existing technologies allow the interaction between humans and industrial robots, but again only in very static and controlled situations. The development of this technology will allow this interaction to expand outside of the "safe cells", making industrial robotic systems (especially mobile systems) even more agile and impactful for all production sectors in governmental and private manufacturing areas. The discrete defense need addressed in this will be more effective and more reconfigurable industrial layout designs and utilizations, hence enhancng thoughputs such aircraft and other weapon system availabilities.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. For this topic, the Government expects that Offerors demonstrate the ability to detect unexpected obstacles and humans with COTS sensors, and demonstrate the accuracy and integration of these sensors into robotic systems.

PHASE II: Develop working prototype to detect and respond to unexpected obstacles and humans and command the robotic system to respond accordingly. Maximizing the efficiency of the robotic system by allowing the robot to operate in a real-world depot and other manufacturing environments in both military and private sectors with minimal external safety systems.

PHASE III DUAL USE APPLICATIONS: Refine hardware and software to increase accuracy and reliability. Achieve production-ready state for marketing to the Air Force, other related federal agencies, and private industries involved in all manner of production or manufacturing.

REFERENCES:

1. Villani, et al. "Survey on human–robot collaboration in industrial settings: Safety, intuitive interfaces and applications." November 2018, Survey on human–robot collaboration in industrial settings: Safety, intuitive interfaces and applications - ScienceDirect;

2. Moretz. . “Mobile Robot Standard R15.08-1-2020 – What You Need to Know.” February, 2021, https://www.automate.org/industry-insights/mobile-robot-standard-r15-08-1-2020-what-you-need-to-know;
3. Pedrocchi, et al. “Safe Human-Robot Cooperation in an Industrial Environment”, January 2013, Safe Human-Robot Cooperation in an Industrial Environment - Nicola Pedrocchi, Federico Vicentini, Malosio Matteo, Lorenzo Molinari Tosatti, 2013 (sagepub.com);

KEYWORDS: Mobile Robotics, Industrial Robots, Human Sensing, Safety

AF241-D009 TITLE: Rapidly Deployable Airborne Fuel Flowmeter (RDAFF)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software

OBJECTIVE: Develop a flowmeter that can be attached to the outside of aircraft fuel lines and accurately read fuel flow within the pipe.

DESCRIPTION: Current methods for gathering fuel flow measurements during military flight test events involve the installation of highly precise, highly accurate and commercially available turbine-type flow meters in-line with fuel supply lines. This invasive process results in significant aircraft down-times to accommodate these in-line fuel flowmeters through substantial re-engineering and modification of OEM fuel supply lines. The primary purpose of the Rapidly Deployable Airborne Fuel Flowmeter (RDAFF) is to allow for rapid installation and removal of fuel flowmeter instrumentation components from the system under test, while retaining the accuracy, linearity and repeatability of legacy turbine-type flowmeters. Solutions must conform to the following: 1) Be easily and quickly, attached, calibrated and removed when needed. 2) Be versatile and non-invasive to fuel lines, i.e., mounted on the exterior of fuel lines. 3) Operate with excitation voltage supplied by standard aircraft power (28VDC). 4) Provide flow measurements with an accuracy ≤ +/-0.5% on any straight-pipe length, including non-ideal locations. 5) Provide fuel flow measurements on various aircraft fuels (JP-8, JP-5, Jet-A, Jet-A-1, AVGAS) up to 20,000 lbs./hr. 6) Data is time correlated with IRIG or IEEE 1588 v2 standards. 7) Compensate for changes in fuel temperature and density. 8) Provide output in RS-422 as engineering units for mass flow and temperature. 9) System packaging will comply with Air Force Airworthiness standards. 10) Final system will comply with Air Force standards for Technical Readiness Level (TRL) 6. 11) Able to withstand high performance aircraft flight envelopes. 12) Able to survive hostile aircraft environments, such as engine bays.

PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. Offerors interested in participating in D2P2 must include in their response to this topic "Phase I-type" feasibility documentation that substantiates the scientific and technical merit and "Phase I-type" effort such as developed a concept for a workable prototype or design to address, at a minimum, the basic requirements as described above. As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Documentation should include all relevant information including, but not limited to technical reports, test data, prototype designs/models, and performance goals/results for establishing the scientific and economic feasibility of the proposed work. Work submitted within the feasibility documentation must have been substantially performed by the Offeror and/or the principal investigator (PI).

PHASE II: Prototype testing that can withstand an airborne environment. Obtain a TRL 6 based on Air Force standards and ready to test in an operational environment.

PHASE III DUAL USE APPLICATIONS: Military Application: Fuel flowmeter that reduces aircraft modification times to more efficiently perform the mission. Commercial Application: Rapidly measure fuel flows in petroleum extraction and refining (oil fields), automotive and industrial applications.

REFERENCES:

1. “Ultrasonic Mass Flowmeter for Army Aircraft Engine Diagnostics”,Lawrence C. Lynnworth, Panametrics Incorporated, https://apps.dtic.mil/sti/pdfs/AD0758462.pdf;
2. “Turbine Flowmeter Fuel Flow Calculations, ARP4990”, SAE;

KEYWORDS: turbine-type flow meters in-line with fuel supply lines; OEM fuel supply lines

AF241-D010 TITLE: Wireless Airborne Instrumentation Network (WAIN)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber; Advanced Computing and Software

OBJECTIVE: Develop a network-based data acquisition system to wirelessly transmit airborne instrumentation data from point A to point B.

DESCRIPTION: Existing instrumentation data system passes data over wires/cables that bend and stretch over lengths up to 50ft. Any solutions must have the following: Capability to transmit 2 signals wirelessly around impediments of various size, shapes and locations with the following figures of merit; 1) BER less than 10^-6. 2) Time correlation per IEEE 1588 Version 2. 3) 1 Sensor/Signal 4) Bit Rate of 1 kHz. 5) Time tagged to an accuracy of 1usec. 6) Comply with Air Force Cyber Security standards. 7) Comply with Air Force Airworthiness standards. 8) Output packets compliant with IRIG-106 Chapters 20-28. The government will provide drawings/sketches of a scale model test fixture.

PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. Offerors interested in participating in D2P2 must include in their response to this topic "Phase I-type" feasibility documentation that substantiates the scientific and technical merit and "Phase I-type" effort such as developed a concept for a workable prototype or design to address, at a minimum, the basic requirements as described above. As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Documentation should include all relevant information including, but not limited to technical reports, test data, prototype designs/models, and performance goals/results for establishing the scientific and economic feasibility of the proposed work. Work submitted within the feasibility documentation must have been substantially performed by the Offeror and/or the principal investigator (PI).

PHASE II: Develop and manufacture an integrated wireless instrumentation system that can withstand airborne environments associated with high performance military aircraft. Obtain a Technical Readiness Level (TRL) of 6 based on Air Force standards and ready to function in an airborne operational environment.

PHASE III DUAL USE APPLICATIONS: 1) Military Application- Wireless instrumentation implementations will reduce aircraft down time for Type-2 Modification installations. 2) Commercial Application- Solutions will be equally useful for commercial aircraft manufacturers to be utilize for flight testing and operational use.

REFERENCES:

1. Torres, O, et.al.; Enabling Wireless Avionics Intra-Communications; NASA Langley, December 2016
2. Collins, D.; Wireless data Acquisition in Flight Test Networks; Curtiss-Wright, May 2016
3. Yedavalli, R; Application of Wireless Sensor Networks to Aircraft Control and Health Management Systems; Ohio State University; October 2010;

KEYWORDS: airborne instrumentation data; signals wirelessly; Wireless data Acquisition in Flight Test Networks

AF241-D011 TITLE: Robotic Electronic Component Replacement and Soldering in a Digital Depot Environment

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

OBJECTIVE: Research, evaluate, and develop a robotic system to enable automated removal and replacement of through-hole and surface mount electronic components during repair of printed circuit board assemblies with high reliability in low-volume, high-mix environments.

DESCRIPTION: The need for computer controlled fully automated rework stations has increased recently due to increasing difficulties involved in manual rework of printed circuit board assemblies (PCBAs). Current USAF depot rework of printed circuit board assemblies is primarily a manual process for through-hole and surface mount components. One exception is ball grid array parts which require machine aided mounting and inspection for high reliability assembly. Recent developments in robotic control have allowed the number of industrial robotic systems, in sustainment and depot environments to grow significantly. On average three electronic components are replaced per depot repair, with an average time of 15 minutes per component to perform a part replacement. Automated systems would provide vast improvements in safety, quality, agility, and throughput metrics. Ideally, these systems could be scaled across all depot electronics repair facilities. The main issue would be ensuring the system is robust enough to adapt to high-mix, low volume production. As opposed to a factory environment, in the depot environment, repairs and rework happen across many unique circuit card assemblies with varying configurations. There is a continuing need to have a robotic soldering solution with the flexibility of a human to solve the requirements for reducing direct labor costs. The aim of this project is to design and build a proof-of-concept, low-cost prototype robot soldering solution to use as a base for further development, through which a production-worthy system would eventually be reached. This system should be able to handle the flexibility required in the PCBAs that are manually operated on, both in terms of physical maneuverability and a large number of different products. The system shall be constrained to use commercial off-the-shelf (COTS) soldering technology, lead-based and non-lead solder and comply with IPC J-STD-001F, MIL-STD-2000A, and ANSI/ESD STM13.1-2015. While the final system will have more features in material handling and safety, the scope of this effort is limited around the part removal and replacement functionality. Apart from building the robot system, user-friendly software for teaching components must be developed.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. For this Direct-to-Phase II topic, the Government expects that the successful Offeror(s) demonstrate the ability to design and build a low-cost robot electronics component replacement solution and associated software to use as a base for further development. Submitters shall demonstrate the accuracy and integration of this robotic system.

PHASE II: Develop working prototype robotic electronics component replacement solution and associated software to use as a base for further development, through which a production-worthy system would eventually be reached. The design should supply a machine solution capable of directly replacing a reasonable subset of conformal coating removal, desoldering, component removal, component replacement and resoldering in electronics rework. Submitters shall maximize the efficiency of the robotic system by allowing the robot to operate in a real-world depot environment with minimal external safety systems.

PHASE III DUAL USE APPLICATIONS: Refine hardware and software to increase accuracy and reliability. Achieve production-ready state for marketing to the Air Force, other related federal agencies,

and private industry.

REFERENCES:

1. Geren, Necdet & Lo, E.K.. (1997). Automated removal and replacement of through-hole components in robotic rework. Components, Packaging, and Manufacturing Technology, Part C, IEEE Transactions on. 20. 236 - 248. 10.1109/3476.649447.
2. Staretu, I. (2021). Robotized application of assembly and soldering – case study. IOP Conference Series: Materials Science and Engineering. 1009. 012056. 10.1088/1757-899X/1009/1/012056.
3. Pop, Emanuela, Emilia Campean, Ion Cristian Braga, and Darius Ispas. (2022). "New Product Development of a Robotic Soldering Cell Using Lean Manufacturing Methodology" Sustainability 14, no. 21: 14057. https://doi.org/10.3390/su142114057;

KEYWORDS: Robotic Soldering, Robotic Desoldering, Printed Circuit Card, Electronics Rework

AF241-D012 TITLE: Mandatory Declassification Review (MDR) Natural Language Processing (NLP) Tool

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

OBJECTIVE: Finding a solution to assist AFDO's Mandatory Declassification Review (MDR) program in increasing efficiencies, achieving consistency of line-by-line review and redaction of information to remain classified, and promote cost savings through use of new technologies and industry best practices. A successful solution has potential to become a program of record for the program, upon completion of the appropriate acquisition process, obtaining an Authority to Operate (ATO) via Certification and Accreditation (C&A), with an established funding line, and deployment to an approved host location.

DESCRIPTION: There are six milestones a selected company would need to achieve and gain approval by AFDO, to meet the aforementioned objective:
Milestone 1: Refine and enhance the AI/ML models for line-by-line reviews for cases assigned under the Mandatory Declassification Review program.
Milestone 2: Conduct extensive testing and evaluation of the solution in collaboration with AFDO (MDR) personnel.
Milestone 3: Optimize the solution based on feedback and lessons learned during testing.
Milestone 4: Develop a user-friendly interface and integrate the solution with any potential AFDO workflow system.
Milestone 5: Complete documentation for a deployment plan, addressing security and operational requirements, and any other required documentation.
Milestone 6: Upon approval by AAI Director & AFDO Leadership, ensure compliance requirements are met to deploy tool to specified environment/platform.

PHASE I: ~~This is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made because of this topic. To qualify for this D2P2 topic, the Government expects the applicant to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior SBIR/STTR funding agreement.~~ As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Applicants are expected to provide a white paper containing the following information on Artificial Intelligence, Machine Learning such as:
1. Refine and enhancing AI/ML models for line-by-line reviews for cases assigned under Mandatory Declassification Review (MDR).
2. MDR Tool Prototype Outline: AI/ML driven line-by-line review capabilities, highlighting areas requiring classification determination based on relevant SCDGs.
3. Optimization of the solution based on feedback and lessons learned during "Phase-I-type".
AFDO strongly encourages companies to submit Direct-to-Phase II proposals to facilitate a demo and hands-on use of a prototype by the end of the phase. Unlike Phase I submissions, Direct-to-Phase II offers extended time and allocated funds, enabling companies to better meet the Government'sour specific prototype requirements.

PHASE II: AFDO leadership are looking to establish a tool for this organization's newly owned requirement of handling the Department of the Air Force (DAF) Mandatory Declassification Review (MDR) program. MDRs may either be requested direct from a public requestor or referred to DAF (AFDO) for review from another government agency, based on potential Air Force equities. AFDO reviewers must conduct a line-by-line review and provide specific alignment to Executive Order 13526 based on the appropriate exemption selected in Security Classification and Declassification Guides (SCDGs).

With this newly acquired program, there is a large backlog of cases for AFDO to review, task out to other organizations/agencies, all while new cases continue to trickle in. Given the typical content of the requests from the public and other government agencies, the sponsoring organization has a need to:
- Respond to requests in a quicker manner;
- Provide consistency & accuracy during the document review;
- Identify similar topics from previous cases that may apply in the future;
- And identify potential equity of other organizations/agencies during intake of the case.
The sponsoring organization's current process is almost entirely manual, therefore this topic's focus is to truly enhance the review process altogether, while ensuring compliance with mandated standards. Information requested under MDR may still retain its classification, and therefore AFDO must pay close attention to information released, as the impact of releasing current classified information could cause up to exceptionally grave damage to national security.

PHASE III DUAL USE APPLICATIONS: Phase III would incorporate the solution into the daily business processes at AFDO, including:

- Transition of AFDO reviewers to new innovative process and addressing any issues;
- Workflow incorporation, adding in the administrative piece for MDR's initially and upon reviewer decision notification;
- Rule development (adjustment) and management of the tool in-house;
- Training the tool, encompassing continued updates and feeding the tool data sets;
- Full deployment to approved DAF host location.

REFERENCES:

1. Atomic Energy Act of 1954, as amended;
2. 10 CFR Part 1045, Subpart A-D;
3. 32 Code of Federal Regulations (CFR) Parts 2001 and 2003 Classified National Security Information;
4. Executive Order 13256;
5. DoDI 5210.02 Access to and Dissemination of Restricted Data and Formerly Restricted Data;
6. DoDM 5200.01 DoD Information Security Program;
7. DAFMAN 16-1404 Information Security Program;
8. Air Force Declassification Guide for Historical Records;

KEYWORDS: Artificial Intelligence; AI; Machine-Learning; ML; Contextual Search; Natural Language Processing; NLP; Mandatory Declassification Review; MDR; Security Classification Guide; SCG; Declassification Guide; Executive Order 13526; Exemption; Restricted Data; RD; Formerly Restricted Data; FRD; Atomic Energy Act; Exclusion; Line-by-line; Redaction; E.O. 13526 Section 1.4; E.O. 13526 Section 3.3 (b); E.O. 13526 Section 3.3 (h);

AF241-D013 TITLE: Trustworthy Generative Artificial Intelligence (GenAI) to Structure Data and Deliver Accurate Insights of Command, Control, Communication and Computer (C4) Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE:
The objective of this SBIR Phase II topic is to develop an efficient prototype based on a prior feasibility study to utilize/develop GenAI models (e.g., transformer-based models, variational auto-encoders, generative adversarial networks (GAN)) on C4 systems to structure data, and deliver accurate insights of these systems to explain the decisions made by these models to develop trust between the models and an operator.

According to secretary of the USAF, this SBIR topic follows two of the seven operational imperatives as an urgent need to be developed as below:
- II - Achieving Operationally Optimized Advanced Battle Management Systems (ABMS) / Air Force Joint All-Domain Command & Control (AF JADC2)
- V - Defining optimized resilient basing, sustainment, and communications in a contested environment

DESCRIPTION: Though novel technology like ChatGPT dominated headlines recently based on transformer-based models (i.e., a type of GenAI (a class of machine learning (ML) algorithms that can learn from content such as text, images, and audio to generate new content)), it has not yet gained enough credibility to be used in the DoD systems due to its inability to provide accurate explainable decisions by deciphering the inner-workings of the models [1]. To be straightforward, commanders are not going to trust a tool unless they understand how and what data their system was trained on, and how decisions are made to execute an operation [5]. There are still numerous unresolved inquiries surrounding the enhancement of GenAI's capabilities and operator-friendliness. One such open inquiry: how can we enable explainability, allowing operators to grasp and form a clearer mental model of GenAI? Recent research conducted by Goodfellow et al. [2] and Ross et al. [3] has delved into the development of more explainable GenAI models that align with human-understandable processes. However, a comprehensive perspective on explainability of GenAI model such as ChatGPT is still missing. That begs another question: what does an operator need to understand/trust about a GenAI model easily to achieve his/her goals during operational use? Because of these unanswered questions about the model to build trust and transparency within the warfighters' system usages, it is imperative for the DoD operations to develop a system accordingly [4].

Therefore, this SBIR topic seeks proposals to develop a DoD based trustworthy GenAI (described above) system that will not only provide ChatGPT like information but also perform to structure data effectively and deliver/explain accurate insights/decisions about the system to build trust between an operator and a GenAI model. Additionally, proposal should address which uncertainty they are trying to solve such as

epistemic or aleatoric in developing/utilizing GenAI based large language models (LLM).

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.

A "Phase I-type" feasibility study is needed as minimum threshold to satisfy requirement for this Direct-to-Phase-II (D2P2)solicitation. The candidate applying to this solicitation will provide proof of having at least two or more of having extended, explored, analyzed or used ChatGPT in an applicable/similar case scenario that is being explored in the objective of this topic to utilize/develop GenAI models (e.g., transformer-based models, variational auto-encoders, generative adversarial networks (GAN), deep reinforcement learning (DRL)) on C4 systems to structure data, and deliver accurate insights of these systems to explain the decisions made by these models to develop trust between the models and an operator.

PHASE II: This direct to phase description will seek to directly implement the objective of this topic setforth as to develop an efficient prototype based on a prior feasibility study to utilize/develop GenAI models (e.g., transformer-based models, variational auto-encoders, generative adversarial networks (GAN), deep reinforcement learning (DRL)) on C4 systems to structure data, and deliver accurate insights of these systems to explain the decisions made by these models to develop trust between the models and an operator. Performers will develop design and specifications and implementation to demonstrate a suitable prototype to proof the explainability factor of GenAI models to create trust between the models and an operator.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning operationally ready technology to a commercial sector or DoD environment. The offeror will identify transition partners. TRL should be at a minimum of a TRL 6. The ChatGPT solution will should have a well developed transition plan to deliver the realization of such technology to the war fighter or commericial sector. The transition plan should work on identifying a program of record where the technology will be reside.

REFERENCES:

1. Sun, Jiao, et al. "Investigating explainability of generative AI for code through scenario-based design." 27th International Conference on Intelligent User Interfaces. 2022;
2. Ian Goodfellow, Jean Pouget-Abadie, Mehdi Mirza, Bing Xu, David Warde-Farley, Sherjil Ozair, Aaron Courville, and Yoshua Bengio. 2020. Generative adversarial networks. Commun. ACM 63, 11 (2020), 139–144.;

KEYWORDS: ChatGPT;GENAI;explainable GenAI;trustworthy GenAI

AF241-D014 TITLE: Optical Air Data System (OADS)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Hypersonics

OBJECTIVE: The objective of this project is to test and evaluate the accuracy of Optical Air Data Systems and determine their suitability and utility as flight-test-specific instrumentation and primary aircraft equipment. The proposed effort is focused on maturing the technology to be able to provide additional measurements of ambient temperature, density, angle of attack and sideslip as well as true airspeed on high performance aircraft in regimes faster than the speed of sound.

DESCRIPTION: All aircraft rely on accurate air data measurements to either be used by the pilot, or to be used by more complicated aircraft with flight control systems. These air data measurements typically include altitude, airspeed, ambient temperature, angle of attack (AoA), and angle of sideslip (AoS). Pilots will target altitudes and airspeeds for tasks such as takeoff, approach, and landing. Being at the correct speed ensures safe handling characteristics while being at the correct altitude ensures safe clearance from the ground and obstacles. Flight control systems will schedule inputs based on the flight computer's understanding of the aircraft's airspeed, AoA, and AoS. Whether used by the pilot or the flight control computer, accurate air data measurements are essential to the safe operation of aircraft.

Typical air data systems rely on combinations of probes that extend from the aircraft and flush static ports. Unfortunately, these systems cannot measure the ambient conditions because either the probes, or the aircraft itself distorts the flow. So providing accurate air data measurements by existing means requires careful consideration during the design phase. Even with careful design considerations, the overall flight test campaign still requires costly and dedicated flight test time and techniques to determine the errors associated with their installation.

Optical Air Data Systems (OADS) use lasers to interrogate the air mass without physically disturbing the flow. OADS effectively provide the necessary information free from errors associated with traditional pitot-static or flush air data systems. Several efforts have demonstrated this capability, but only in subsonic environments and none have actually compared the accuracy of OADS to currently accepted methods. Aircraft that travel in the transonic to supersonic regimes create larger disturbances and OADS would have to interrogate packets of air across a shock front.

Initial evaluations of overall accuracy will be performed with the OADS integrated into a flight test pod installed on a specially modified F-16 test aircraft, known as a Pacer, that can make precise air data measurements. Air data measured by the OADS would be compared to the solution provided by the F-16 Pacer. On subsequent test efforts, the OADS would be integrated into a larger bomber type aircraft for evaluations of suitability and utility as flight-test-specific instrumentation and as primary aircraft equipment replacing traditional air data systems.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Offerors are expected to provide a white paper providing a comprehensive feasibility assessment that outlines the technical viability of using Optical Air Data Systems (OADS) for flight-test-specific instrumentation and primary aircraft equipment at speeds more than the speed of sound and at altitudes up to 50,000 feet.

This assessment should address the suitability of the systems for accurate air data measurements and their potential integration into different aircraft platforms. Additionally, I expect Accuracy Testing, where the contractor conducts initial evaluations of the overall accuracy of the OADS as implemented in wind

tunnel environments. Offerors should specify the testing methodologies and procedures to ensure precise air data measurements during the evaluations.

Furthermore, Data Analysis is essential, and I anticipate the Offerors to conduct a thorough analysis and provide meaningful conclusions about the accuracy, suitability, and utility of the OADS as flight-test-specific instrumentation and primary aircraft equipment. Lastly, I also expect a rugged integration of the OADS into the flight test pod, which will be installed on a specially modified F-16. The Offerors should then demonstrate how the system can effectively be integrated into several aircraft design structure and predict its performance in real-flight scenarios.

PHASE II: The proposed effort is focused on maturing the technology to be able to provide additional measurements of ambient temperature, density, angle of attack and sideslip as well as true airspeed on high performance aircraft in regimes faster than the speed of sound. As a result, the Phase II Period of Performance objectives:
1.) Integrate Optical Air Data System into a flight test pod to be carried on an F-16.
2.) Collect flight test data used to evaluate the Optical Air Data System against the Air Force Test Center's specially modified Pacer F-16.
3.) Evaluate the suitability and utility of Optical Air Data Systems to serve as a flight-test-unique truth source of air data measurements.
4.) Evaluate the suitability and utility of Optical Air Data Systems to replace the primary air data system in lieu of traditional pitot-static or flush air data system. Success criteria includes gathering information on the measurement of the following five air data measurements throughout the flight envelope of the flight test pod as installed on an F-16 and through the flight envelope of the large bomber type aircraft.

Air Data Measurements:
1.) True Airspeed
2.) Ambient Pressure
3.) Ambient Temperature
4.) Angle of Attack
5.) Angle of Sideslip
As integrated on to the F-16, operating parameters are from zero to 50,000 feet Pressure Altitude, and zero airspeed up to 1.2 Mach Number. The operating parameters for the large bomber type aircraft will depend on the platform selected.

PHASE III DUAL USE APPLICATIONS: Phase III would transition this type of hardware to be the primary means of measuring air data parameters on aircraft to replace traditional air data installations. Phase II is expected to increase the TRL of this technology to a 7-8 prior to entrance to Phase III. Stealth aircraft and hypersonic platforms would be able to eliminate thousands of hours of design and development on flush air data systems typically used in these applications. Additionally, these aircraft would be able to eliminate required dedicated flight test efforts to calibrate said systems. Additional commercial applications extend to airliners for detecting Clear-Air-Turbulence (CAT). CAT is not typically associated with weather phenomena and is much more difficult to detect and avoid. The National Transportation Safety Board reported 197 turbulence-related accidents between 2009 and 2018, all caused serious injuries. Nearly 30 percent of these accidents were caused by CAT. Optical Air Data Systems can potentially be used to detect CAT with enough advanced notice to avoid the area and prevent accidents.

REFERENCES:
1. NASA/TP-2004-210735, Optical Air Flow Measurements in Flight, Bogue, R. K., and Jentink, H. W., National Aeronautics and Space Administration Dryden Flight Research Center, Edwards AFB, California, December 2004.;

KEYWORDS: Optical Air Data System

AF241-D015 TITLE: Collaborative Airborne Sensor Fusion via Maximizing Information under Constraints

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Collaborative Automatic Target Acquisition (ATA) in munitions is a burgeoning research field with a unique set of challenges. DOD guidance on the use of machine learning/artificial intelligence for safety-of-life applications necessitates that munitions that employ ATA are highly confident and correct in their target classifications. Some viewing angles and perspectives provide better target discrimination than others, depending on the target, the ATA algorithm being used, the type of sensor, and the observations that have already been made by the munitions. The objective of this topic is to investigate and demonstrate algorithms that can determine the next measurement or next “best look” on a set of targets to maximize correct identification/classification by the munitions, while minimizing the total number of measurements/observations and collaborative communication required to achieve that goal.

DESCRIPTION: There are two primary concepts of operation that are supposed by this topic: standalone munitions and swarming munitions. In the case of swarming munitions, each munition would have a different viewing angle/attitude on the target, or “look”. The “best look” algorithm developed under this topic would determine what the next optimal “look” would be, and task the sensor on a munition to gather that observational data. After determining what the most informative data to collect is, communication bandwidth is conserved by choosing to only communicate observations that are both independent of previous observations and from optimal sensor/viewing perspective combinations.

This mathematical determination of observation independence and optimal “look” can also be applied to the case of a single munition. A single munition could be fusing together the predictions from multiple types of onboard sensors to correctly identify a target, and knowing which sensor is providing the best observations at any one time would increase the accuracy of the sensor fusion ATA algorithm. Additionally, the mathematical determination of any given observation’s independence could be used to avoid feeding fusion algorithms multiple iterations of dependent observations, falsely increasing the influence of one “look” on the outcome of a fusion algorithm’s target identification.

Challenges such as enemy anti-air weapons, communication/processing constraints, battery limitation, maneuverability, obscuration, and a multitude of deception methods all impede target identification, and can could be included in as constraints on a “best look” algorithm spawning from this research. These constraints will iteratively be introduced into the “best look” algorithms. An objective goal will be modifying the “best look” algorithms to provide sensor tasking on munitions that increases survivability by avoiding adversarial air defenses and minimizing battery usage.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. For a Offeror to demonstrate that their technology is at an

appropriate level for a D2P2 award, the Offeror should have experience developing autonomy algorithms for applications similar to the topic above. Similar applications may include swarming for search and rescue, ISR, or other kinds of drone teaming. The Offeror should also have experience simulating autonomy algorithms with tools such as Airsim, CODE, or Golden Horde Colosseum. Offerors should be capable of simulating the performance of multiple sensors and multiple Automatic Target Recognition (ATR) algorithms while factoring in sensor degradation and object obfuscation.

PHASE II: Given a variety of target types, a set of targets in the environment, and a set of distributed seeker sensors and their associated ATR algorithms, a prototype deliverable should be able to simulate and demonstrate the concept of operations of maximal information measurement fusion, provide the statistics concerning number of looks required, and other statistics such as the percent of correct target classifications as a function of the number of observations. The algorithm should be capable to perform under additional possible constraints. The algorithm should be able to variably set the number and type of targets, the layout of the targets, and the obscuration of the targets. Simulation data may need to be generated as part of the effort, to provide quantitative statistics of in the "best look" algorithm performance under a variety of conditions. Both the single and swarming concept of munitions should be demonstrated and evaluated.

After functional demonstration of the "best look" algorithm in a simulation environment, constraints will be added in to more accurately reflect the operational environment. These constraints may include, but are not limited to, adversarial air defenses against munitions, communication/processing constraints, battery limitation, maneuverability, and obscuration of targets of interest to the ATR algorithm.
Size, weight, and power (SWAP) efficiency metrics will also be used to judge the performance of the "best look" algorithm. Proposers should expect their algorithm to be implementable on a System on Module embedded computer running alongside an ATR algorithm. The training of any machine learning models is not SWAP constrained, but the trained model is.

PHASE III DUAL USE APPLICATIONS: Other potential military applications of this technology in PH III include advances made towards fusing automatic targeting information across other distributed airborne platforms, such as ISR. A PH III could be applied commercially in autonomous aircraft and automobiles, and the sensor input independence research could be applied to a number of commercial fields dealing with real-time statistical analysis.

REFERENCES:

1. K. Saleh, S. Szénási and Z. Vámossy, "Occlusion Handling in Generic Object Detection: A Review," 2021 IEEE 19th World Symposium on Applied Machine Intelligence and Informatics (SAMI), Herl'any, Slovakia, 2021, pp. 000477-000484, doi: 10.1109/SAMI50585.2021.9378657;
2. J. He, S. Yan, J. Hu, and Y. Wang, "Learning-based airborne sensor task assignment in unknown dynamic environments," Engineering Applications of Artificial Intelligence, vol. 111, May 2022. doi:2022.104747;
3. A. O. Hero and D. Cochran, "Sensor Management: Past, Present, and Future," in IEEE Sensors Journal, vol. 11, no. 12, pp. 3064-3075, Dec. 2011, doi: 10.1109/JSEN.2011.2167964;
4. DoD Directive 3000.09, "AUTONOMY IN WEAPON SYSTEMS", January 25, 023.;

KEYWORDS: Networked Collaborative Autonomy; Automated Target Acquisition; Automatic Target Recognition; Digital Engineering; Modeling Simulation and Analysis; Sensor Fusion; Loitering Munitions; Distributed Sensing.

AF241-D016 TITLE: Large RF Windows for High-Temperature Seekers

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Hypersonics; Advanced Materials

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective for this effort is to mature window technologies for use in RF seeker systems for extreme hypersonic environments. Specifically, the sponsoring organization seeks to advance the technical and manufacturing maturity of novel materials for large form-factored RF transparent windows that can be conformally mounted in the nose section of a hypersonic vehicle (e.g.: doubly shaped). This challenging mission environment demands technical solutions with specialized thermomechanical properties, structural designs, manufacturing optimizations, and RF performance across a wide range of operational temperatures.

DESCRIPTION: As hypersonic strike systems become more prolific across the DoD munitions community, there is an increasing need to develop, mature, and improve upon the various specialized sensors and associated apertures or windows necessary to strike ground mobile and maritime targets. Conventional legacy sensors and associated apertures or windows do not survive through the extreme thermal environments associated with hypersonic weapons. The art and science of specialized high-temperature seeker RF windows that are manufacturable at scale is still very immature, and this is especially true for large RF windows. This topic aims to address material science, mechanical design, manufacturability, and RF performance challenges towards dramatically increasing the TRL and MRL of large high-temp RF windows.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.
For this Direct-to-Phase-II topic, the Offeror is expected to have previously demonstrated competence in the design of high-temperature ceramics and/or ceramic matrix composites for RF windows. Offerors should have demonstrated experience in high-temperature materials engineering, testing, and designing for manufacturability.

PHASE II: For this Direct-to-Phase-II topic, the proposer shall design, characterize, prototype, and test an advanced large-form-factor RF window for hypersonic strike applications. Emphasis shall be placed on RF performance, ease of manufacturability, reliability and system safety despite the inhospitable environment, and follow-on production costs. Six prototype large-form-factor RF windows will be delivered. Testing of the prototypes shall include RF performance across the operational thermal profile and across the operational shock/vibration profile. Testing shall also include weather particulate impact assessments.

PHASE III DUAL USE APPLICATIONS: Following successful completion of this Direct-to-Phase-II topic, AFRL and our transition partner will assess any remaining TRL or MRL gaps needed to ready this large-form-factor RF window design for integration with a DoD Prime contractor's hypersonic seeker

system and work to address those gaps via a Phase III contract or other mechanism.

REFERENCES:

1. Properties of large scale ultra-high temperature ceramic matrix composites;
2. D. Sciti, P. Galizia, T. Reimer, A. Schoberth, C.F. Gutiérrez-Gonzalez, L. Silvestroni, A. Vinci, L. Zoli;
3. Composites Part B: Engineering Volume 216, 01 Jul 2021, 108839;
4. Dielectric and mechanical properties of hypersonic radome materials and metamaterial design: A review;
5. T. Kenion, N. Yang, C. Xu;
6. Journal of the European Ceramic Society, Volume 42, Issue 1, Jan 2022, Pages 1-17.;

KEYWORDS: Keywords: High-temp materials; hypersonics; RF seekers; seekers; manufacturability; CMC; RF windows; RF apertures.

AF241-D017 TITLE: Augmented Reality Enhanced Corrosion Control Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber

OBJECTIVE: To develop an integrated suite of Augmented Reality (AR) technology to address Corrosion Control

DESCRIPTION: Aircraft maintenance maintainers have identified an opportunity to increase efficiency, lower cost, and increase safety of Corrosion Control professionals by enhancing existing corrosion control detection and measurement systems with wearable Commercial-Off-the-Shelf Augmented Reality technology to provide data as a visual overlay within the user's field of view, tag measurement data in Three Dimensional Space to specific aircraft, save data for future use and users, and export data and live video to additional users and digital twins. Aircraft maintainers envision enhancement of two systems: one which measures the thickness of paint on a metal or composite substrate and one which serves as an Eddy Current Non-destructive Testing system.

Corrosion Control professionals use a variety of systems (e.g., Eddy Current, Ultrasound, X-ray) to detect problems, but these systems do not share a common interface, cannot save results associated to a particular aircraft, and can be unwieldy to handle while scanning and recording results manually. Most systems cannot export data; they only show video on other monitors. There is limited ability for remote experts to support maintainers without traveling to site.

Aircraft maintainers estimate an AR-integrated Paint Scanning system would increase aircraft maintenance production efficiency by 15-25% and throughput of additional aircraft per year per system to a similar degree, directly improving readiness of aircraft fleet. The NDI Eddy Current integrated system is estimated to deliver 15-25% increase in efficiency, 10% or more improvement in detection accuracy, 10% or more improvement in end user safety, and cost savings.

Aircraft maintainers' grand vision for such an integration approach is to arm the maintainer, supervisors, and quality personnel with a suite of AR-enabled corrosion control detection and measurement systems, each with data associated to the aircraft tail number and available at all times for review through the AR headset, enabling an unparalleled capability to toggle through data to fully understand the current and historical corrosion profile of the individual aircraft as well as inform larger analyses of recurring issues and corrosion trends across the fleet.

PHASE I: FEASABILITY DOCUMENTATION. As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. For this Direct-to-Phase II topic, evaluators are expecting that the submittal firm demonstrate the ability to have proven feasibility of importing data (not just video) from multiple detection systems into an AR platform, present data, and store data.

PHASE II: Contractor will integrate a minimum of three Corrosion Control systems with a single AR platform, tag scan data in 3D space to a particular tail number, enable features by user type (maintainer, supervisor, etc.), and toggle through results without rebooting or reorienting the system. User interface will be simple and intuitive. Applications will share a common look and feel. Data will be exported to a digital twin on a phone, tablet, and/or PC. Live data from the AR system can be shared with other users. AR platform displays data for entire aircraft, not individual parts.

PHASE III DUAL USE APPLICATIONS: Contractor will operationalize the Phase II prototype,

obtaining Authority to Operate, developing an API or Plug-in to allow additional Corrosion Control system integrations, productizing AR and enabling components into a kit and obtaining National Stock Number(s), and offering sustainment options. Contractor will integrate additional Corrosion Control systems. AR platform can show scans for individual parts.

REFERENCES:

1. AFRL-RX-WP-TR-2008-4373 RECOMMENDED PROCESSES AND BEST PRACTICES FOR NONDESTRUCTIVE INSPECTION (NDI) OF SAFETY-OF-FLIGHT STRUCTURES, John Brausch, Lawrence Butkus, David Campbell, Tommy Mullis, and Michael Paulk;
2. Ladwig P., Geiger C. (2019) A Literature Review on Collaboration in Mixed Reality. In: Auer M., Langmann R. (eds) Smart Industry & Smart Education. REV 2018. Lecture Notes in Networks and Systems, vol 47. Springer, Cham. https://doi.org/10.1007/978-3-319-95678-7_65;
3. Brown, L.J.: Professional reflection – mixed reality to augment the next generation of aviation professionals. In: Kearns, S.K., Mavin, T.J., Hodge, S. (eds.) Engaging the Next Generation of Aviation Professionals, pp. 163–180. Routledge, New York, NY (2020);

KEYWORDS: Augmented Reality; Non-destructive Inspection; Corrosion Control

AF241-D018 TITLE: Long Range Strike System

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a loitering munition capable of being air launched that can carry a payload appropriate for lightly armed vehicles and a small sensor gimbal of the 6 or 8 inch class.

DESCRIPTION: Moving targets, similar to lightly armed personnel carriers, have always presented challenges to the Department of Defense from a targeting and strike perspective. There is an ongoing need for a loitering munition capable of striking such mobile targets.

Mobile targets present different challenges than standard fixed targets as they require the munition to account for rapid movements up to the moment of strike. A loitering munition can also provide further increased capabilities around the ability for the munition to wait for an appropriate time to make the strike, whether for intelligence, collateral damage, or better effect on target reasons.

Another key benefit of loitering munition is that they can be air launched and greatly increase the capability of the launching system. Common Launch Tubes (CLTs) are one way to launch payloads like loitering munitions, but they can also be dropped from hard mounts on the wings, or launched from an internal payload bay of the launching system.

PHASE I: This is a Direct to Phase 2 (D2P2) topic. Phase 1 like proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort via some other means (e.g. IRAD, or other funded work). As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show, as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the Offeror 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.

PHASE II: Develop a new method or system that is air launched and can loiter and strike and disable a lightly armored moving (up to 80km/h) target while carrying a small sensor payload

i. Develop and demonstrate a system that is capable of safely separating and transitioning to flight when launched from a King Air or similar aircraft

ii. Develop and demonstrate a system that is capable of transiting up to 20km when launched from 5kft AGL at speeds from 80-130 TAS

iii. Develop and demonstrate system that can carry a warhead powerful enough to destroy lightly armored personnel carriers and a small sensor gimbal of the 6″ or 8″ class.
iv. Develop and demonstrate a system that can strike a vehicle moving down a road at up to 80 km/hr
v. Develop matrix of operational tradeoffs relating to employing the new system
vi. Generate Interface Control Document (ICD) and overview descriptions in parallel with the system development.
vii. System needs to be self-contained and easily integrated onto a variety of aircraft
viii. System needs to be based on an open architecture to allow for integration of various sensors
Complete the design of the system, demonstrate performance of a prototype system through field testing, and deliver the prototype for subsequent evaluation by the government.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to existing defense applications. Solution has further applications in ISR missions with the capability of swapping out the warhead for other payloads.

REFERENCES:

1. Department of the Air Force Operational Imperatives, https://www.af.mil/Portals/1/documents/2023SAF/OPERATIONAL_IMPARITIVES_INFOGRAPHIC.pdf;
2. Liebhardt, B., Pertz, J. (2022). Automated Cargo Delivery in Low Altitudes: Business Cases and Operating Models. In: Dauer, J.C. (eds) Automated Low-Altitude Air Delivery. Research Topics in Aerospace. Springer, Cham. https://doi.org/10.1007/978-3-030-83144-8_4;
3. Dauer, J.C., Dittrich, J.S. (2022). Automated Cargo Delivery in Low Altitudes: Concepts and Research Questions of an Operational-Risk-Based Approach. In: Dauer, J.C. (eds) Automated Low-Altitude Air Delivery. Research Topics in Aerospace. Springer, Cham. https://doi.org/10.1007/978-3-030-83144-8_1;

KEYWORDS: Loitering munition, long range, Group 1, Group 2, Group 3, warhead, mobile target engagement, moving target

AF241-D019 TITLE: Low-Cost Long-Range Airdrop Delivery

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop and demonstrate an expendable system capable of being airdropped and delivering a 20 lbs. payload, 200 nautical miles from the drop, which can be procured at a low cost.

DESCRIPTION: Government and industry both have experienced considerable challenges in delivering necessary supplies to the ground assets that need them. These challenges are compounded for the military, where standoff range and safety are imperative to protect both ground and air assets. Current methods used by the Department of Defense are capable but too expensive to proliferate in the force.

To allow use anywhere in the world, the system needs to be capable of being airdropped from both the C-130 and CV-22. Airdrop will require solutions for the structure of the air vehicle to survive the forces undergone during safe separation. This will also require the airdrop package or other delivery method to meet relevant safe separation standards and be capable of fitting within the cargo areas of both aircraft. The autopilot should provide the ability to set or change the coordinates by loadmasters onboard the aircraft prior to the deployment. The system will not be controlled or updated once launched and does not require anti-jam capabilities.

Long standoff ranges allow higher operational safety for both the aircraft and receiving party. Any system to be considered should be appropriate for normal airdrop missions for CV-22 and C130s and capable of performing the mission in light winds.

To be considered, proposals must make every effort to reduce unit cost. The threshold is $30k per unit for 100 units with an objective of $10k for 100 units. This low-cost goal allows for proliferation in mission sets where current capabilities simply would not make sense for one-time-use delivery assets. Any system to be considered must provide accurate cost proposals detailing how their unit cost is calculated and achievable.

In order to align with Operational Imperative 7 (See Ref 1), Readiness to Deploy and Fight, a system need to be developed that allow for transportation with preexisting support systems. This could include the 463L half pallet system and the Joint Modular Intermodal Container (JMIC) (See Ref 2).

PHASE I: This is a Direct to Phase 2 (D2P2) topic. Phase I ~~1 like~~ proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a “Phase I-type” effort via some other means (e.g. IRAD, or other funded work). As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show,

as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the Offeror 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.

PHASE II: Develop and demonstrate a system capable of airdrop and delivery of small payloads at low cost

i. Develop and demonstrate an delivery system capable of airdrop from the cargo envelope of C-130s and CV-22s
ii. System must fly 200 nautical miles from airdrop point
iii. System must be capable of delivering a 20 lbs payload with a volume of 480 in3 notionally 8 in × 20 in × 3 in.
iv. System must be capable of a delivery accuracy within a circle with a diameter of 200 meters
v. Threshold unit cost of $30k per system with an objective $10k unit cost
vi. Develop matrix of operational tradeoffs relating to employing the new system
vii. System must be capable of transport with existing cargo support equipment
viii. System must be able to exfil away from drop zone or support rapid destruction and disposal on the ground

Complete the design of the system, demonstrate performance of a prototype system through field testing, develop detailed per unit cost data and production cost projections, and deliver the prototype for subsequent evaluation by the government.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to for use in military application, but the system could also find further applications in the field of search and rescue and disaster support.

REFERENCES:

1. Department of the Air Force Operational Imperatives, https://www.af.mil/Portals/1/documents/2023SAF/OPERATIONAL_IMPARITIVES_INFOGRAPHIC.pdf;
2. MIL-STD-3028: Joint Modular Intermodal Container https://quicksearch.dla.mil/qsDocDetails.aspx?ident_number=276692;

KEYWORDS: contested logistics, austere operations, airdrop, air delivery, cargo delivery, package delivery

AF241-D020 TITLE: Counter-UAS Long Bow

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Advanced Computing and Software; Integrated Sensing and Cyber; Directed Energy (DE); Microelectronics; Integrated Network System-of-Systems; Advanced Materials; Human-Machine Interfaces

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a system that can detect, ID, track, and defeat UAS up to 100lbs and 100knots at a scale of 10-15 threat UAS, beyond the fence line and using low collateral methods (No High explosives) and minimizing effects on military installations (no significant FOD on runways).

DESCRIPTION: Improvised and near peer UAS operations continue to evolve and morph. Active UAS combat in various parts of the world provide lessons learned and new tactics for UAS and Counter UAS operations teams to experiment with. Tactics include silent flight, mass attack, complex diversion and simple swarming. More dynamic smart swarming employed manually by human control or machine piloting is beginning to emerge and will continue to increase in complexity over the next few years. Many Counter UAS solutions have attributes that allow adversaries to game them and still complete their mission of disrupting DoD military operations or causing loss of life or military equipment. This topic is focused on developing modern concepts that can detect multiple UAS outside the wire and stop them using techniques that are independent of threat speed, altitude, flight path, PNT and inter swarm coordination techniques. These concepts can include air and ground sensors, ground and air launched effectors and air surveillance outside of the wire.

There are significant complexities in all phases of the kill chain and not all these problems can be solved under this topic. This effort is focused on effect on adversary operations and how those effects can evolve or morph throughout an engagement to prevent an adversary from successfully adjusting their tactics (speed, altitude, autonomy) to complete their mission.

PHASE I: This is a Direct-to-Phase 2 (D2P2) topic. Phase I proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a “Phase I-type” effort via some other means (e.g. IRAD, or other funded work). As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show, as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the Offeror 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.

PHASE II: Develop a system that can detect, ID, track, and defeat UAS being employed in autonomous and complex ways against US military entities world-wide. It is permissible to propose only part of the complete solution, as long as defeat is included. If detect, ID, and/or track are not included as a part of your proposed solution, it is necessary to address which technologies and interfaces are required to augment your proposed system. In other words, your proposed defeat should account for the complexities of detect, ID, and track.

i. Develop and demonstrate a real or emulated tracking system for up to 15 UAS up to 100lbs, 100knots and with highly dynamic flight paths

ii. Integrate an appropriate UAS tracking system into an effector management system

iii. The system should be as autonomous as possible but able to be manually controlled based on policy

iv. The system should be able to deal with threats on many sides of an area up to 10km,while minimizing the number of ground or air assets

v. Develop and demonstrate UAS defeat inside and outside the wire with minimal collateral effects to the area of operation

vi. System should be designed to stop 2-3 distinct attacks without significant reload or reset

vii. System will be required to keep human operators aware of the status of each target and where they are in the kill chain

viii. System will provide information on the disposition of targets to support Battle Damage Assessment (BDA)

Complete the design of the system, demonstrate performance of a prototype system through flight experimentation and demonstration.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to provide airfield security, but it could also be used for National Airspace (NAS) policing, commercial UAS fleet management and UAS awareness for commercial use

REFERENCES:

1. Army Planning Demo of Systems to Counter Group 3 UAS, https://www.defensedaily.com/army-planning-demo-of-systems-to-counter-group-3-uas/army/;
2. Pentagons Counter Drone Boss tackles rising threat https://www.defensenews.com/unmanned/2023/03/10/pentagons-counter-drone-boss-tackles-rising-threat/;
3. Layered Defense is the best option https://insideunmannedsystems.com/for-counter-uas-layered-defense-is-the-best-option/;

KEYWORDS: Intelligence, Surveillance and Reconnaissance (ISR), Unmanned Aircraft Systems (UAS), Counter Unmanned Aircraft Systems (C-UAS), Ground Target Moving Indicator (GTMI), Dynamic Targeting (DT), Mobile Ad-Hoc Networking (MANET), Low Collateral Effects Interceptors (LCEI), Ground to Air weapons, Air to Air Weapons, UAS Traffic Management (UTM), Tipping and cueing, Infrared designation, EO/IR UAS tracking, UAS Radar, C-UAS False Alarm Mitigation (CFAM), Vertical Take Off and Landing (VTOL), Position Navigation and Timing (PNT), Counter PNT and Battle Damage Assessment (BDA).

AF241-D021 TITLE: In-Place Heat Treat for Incrementally Formed Parts

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials

OBJECTIVE: Research, evaluate, and ultimately deploy the ability to heat treat incrementally formed sheet metal parts directly on the forming equipment without removing the part.

DESCRIPTION: Metal is typically formed in a soft state. After forming, the part is typically heat treated to make it harder and applicable for use on an aircraft. The process of heat treating tends to warp the part, requiring the part to be placed back in/on the forming machine (called re-striking).

Robotic incremental metal forming provides a perfect use case to heat treat the metal in place directly after the forming process. This eliminates requiring the part to travel to another shop and another piece of equipment and greatly simplifies the re-striking process. Additionally, sourcing certain sheet metal stock with the appropriate starting heat-treated state can be challenging, increasing the associated lead times to form parts and have them installed on aircrafts.

In-place heat treat capability, given that it allows for the heat treat state of the sheet stock to also be manipulated prior to forming, can mitigate this issue. Comprehensively considered, an in-place heat treat capability would make operations more efficient, effective, and safe. These attributes would be realized through a much-lessened logistical footprint, on-time attention per part, and utility input per part. The additional process would also greatly enhance net capacity to produce in surge production and other potential scenarios.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. For this topic, evaluators are expecting that the submittal firm demonstrate the ability to detect warpage and re-strike the part as required.

PHASE II: Characterize the temperature-time profile of the metal as a function of heat treat parameters and test the mechanical behavior of the treated parts. Evaluate and ultimately pick a heating technology that meets the needed requirements. Develop working prototype to heat treat the part on the existing robotic incremental forming equipment at WR-ALC.

PHASE III DUAL USE APPLICATIONS: Refine hardware and software to increase accuracy and reliability. Achieve production-ready state for marketing to the Air Force, other related federal agencies, and private industry.

REFERENCES:

1. Kalveram, Sandra – "Induction heat treatment of sheet-bulk metal formed parts", Feb 26, 2016, https://www.advancedsciencenews.com/induction-heat-treatment-sheet-bulk-metal-formed-parts/
2. Merklein, M, Johannes, M. Lechner, M. Kupper, A. – "A review on tailored blanks—Production, applications and evaluation." J. Mater. Process. Technol. 2014, 214, 151–164. https://www.sciencedirect.com/science/article/abs/pii/S0924013613002653;
3. R Waggott, DJ Walker, RC Gibson, RH Johnson – "Transverse flux induction heating of aluminum alloy strip" Metals Technology 9.1 (1982): 493-498. https://www.tandfonline.com/doi/abs/10.1179/030716982803285954?journalCode=ymst19;

KEYWORDS: Incremental Metal Forming, Industrial Robots, Heat Treating

AF241-D022 TITLE: Microelectronics Inoculation

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Microelectronics; Space Technology; Integrated Sensing and Cyber

OBJECTIVE: The end-state would be a full demonstration of the technology for military use cases. In addition, any tools and process utilized for microelectronics inoculation are fully documented. Develop a plan for scaling the delivery of the solution to military and commercial systems.

DESCRIPTION: Demonstrate capability to detect, protect and defend against hardware insertion against malware and cyber-attack. This should include in an embedded network and as a means of securing the supply chain (should they be different). Develop and demonstrate the tools and process steps used to inoculate the microelectronics. Ensure that this is documented in a user's manual. Provide a plan for deploying the solution to military and civilian systems.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. The potential Offeror should have a minimum viable product (MVP) available. The Offeror should articulate the military use case that it intends to support. Evidence of commercialization is required, to include dual-use solutions. . This can include but not limited to company funding that has been received for the MVP or further development of the MVP.

PHASE II:
TASK 1: Develop plan to demonstrate the capability to detect, protect and defend against hardware insertion (Trojan), network malware and cyber-attacks (including root kits, DOS, ransomware and device destruction) during all lifecycle phases.
Expected Delivery: Award + 1 month
Deliverable: Provide plan + MVP, TPOC will review and accept plan.

TASK 2: Execute plan and demonstrate a capability to detect, protect and defend against both hardware insertion (Trojan) and network malware, and cyber-attacks (including root kits, DOS, ransomware, and device destruction).
Expected Delivery: Award + 6 month
Deliverable: Document outcomes (video, test report, etc) of the demonstration to include recommendations for findings and future research that may be needed.
Acceptance Criteria: The TPOC will witness and accept successful demonstration and report.

TASK 3: Develop a methodology that is practical and can scale the delivery of the solution to DoD and commercial systems.
Expected Delivery: Award + 9 months.
Deliverable: Documented methodology.
Acceptance Criteria: The TPOC will review and accept report.

TASK 4: Fully document tools and processes used to detect, protect, defend microelectronics in DoD systems.
Expected Delivery: Award + 12 months.
Deliverable: Provide the tools and instructions for use. Provide recommendations for tool improvement.
Acceptance Criteria: The TPOC will review and accept tools, documentation, and instructions.

PHASE III DUAL USE APPLICATIONS: TRL6 would be expected at the end of the Phase II. Further,

if the Phase II project is successful, there is interest from the Weapons PEO. The TPOC is a SME from the Weapons PEO and will be in the best position to determine if additional work is needed and the appropriate weapons program office that could transition the work. In addition, there is interest in assured and trusted microelectronics as documented in the recent AF/ST study requested by Congress. With a successful demonstration of technology additional agencies can be contacted for interest and possible adoption of the technology.

REFERENCES:

1. 15 U.S.C. §638;
2. Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Program Policy Directive (Oct 2020);
3. 5 C.F.R. §2635.702(c), Exception (1);

KEYWORDS: Microelectronics Inoculation

SF241-D023 TITLE: Automated MBSE Model Generation of Space Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Advanced Computing and Software

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Design, develop, and demonstrate SysML model generation techniques to automate the creation of new models of systems using static text-based design documentation.

DESCRIPTION: The Department of Defense vision for digital engineering is to modernize how the Department designs, develops, delivers, operates, and sustains systems. The United States Space Force (USSF) uses Model-Based Systems Engineering (MBSE) approaches to acquire new systems, including the delivery of System Modeling Language (SysML) format of architectures and designs. The USSF is also building digital ecosystems and Live, Virtual, Constructive (LVC) capabilities to simulate the employment of space systems through the use of digital models. The USSF needs new model-generation solutions to automate and standardize the creation of new digital models from existing static-based documentation of legacy systems that are not already represented in model-based formats. This will enable the integration of diverse Space Platforms in a common digital environment for warfighting simulation to predict and evaluate the Space Order of Battle.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. As part of the "Phase I-type" feasibility demonstration, Offerors shall provide evidence of their firms' experience developing SysML models and AI/ML applications that can perform similar tasks. Phase I-type efforts include: developing SysML models of DoD space systems, simulating the employment of DoD systems within an integrated simulation framework, modeling new systems using a Government Reference Model (GRM) for a DoD system, and employing Artificial Intelligence techniques to automate the generation of information from existing documentation.

PHASE II: Develop and deliver an AI capability that will be hosted on a government system and used to automate the generation of SysML models from existing system documentation. Demonstrate the ability to use digital threads to integrate newly generated models with an integrated simulation framework. Develop techniques to include a Government Reference Model as a reference for the newly generated models. Demonstrate the ability to generate SysML models of a space system from text-based documentation. GFE is not anticipated.

PHASE III DUAL USE APPLICATIONS: Develop a strategy to transition prototype capabilities for digital transformation across USSF commands and organizations. Develop and support a strategy to adapt model generation from a government-provided GRM to align with evolving MBSE standards across the USSF. Generate the necessary documentation to train engineers to effectively use the AI application to generate new models for various purposes. Support activities to ensure the training of users and sustainment of the application on government information systems. Assist the government in quantifying

the operational impact of model-based design, development, operations, and sustainment.

REFERENCES:

1. Department of Defense Digital Engineering Strategy, Office of the Deputy Assistant Secretary of Defense for Systems Engineering, Washington, D.C., 2018. Accessed: July 5, 2023, [Online]. Available: https://ac.cto.mil/wp-content/uploads/2019/06/2018-Digital-Engineering-Strategy_Approved_PrintVersion.pdf.;

KEYWORDS: Artificial Intelligence; Digital Engineering; Digital Thread; MBSE; Warfighting Simulation

SF241-D024 TITLE: 15 SPSS Path to Production Development for Electro-Optical Sensor Scheduling Software Modernization

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software; Integrated Sensing and Cyber; Directed Energy (DE); Integrated Network System-of-Systems; Space Technology

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To optimize telescope mount and sensor usage for contributing Space Domain Awareness (SDA) operations, R&D, mission partner campaigns, maintenance, upgrades and associated personnel. Develop a DevOps path to production for capabilities that support Squadron business functions. Develop a DevOps path to production for mission capabilities to include Development/Test/Production environments for GEODSS and R&D Operations. Build and deliver a 15 SPSS Portal - marketing/advertising, scheduling, statusing, optimization, assessment, metrics/dashboard, SITREPs/MISREPs.

DESCRIPTION: Host a kickoff meeting with the Government led Product Team, dev team, engineer team and associated stakeholders. Conduct a discovery and findings to address technical and programmatic needs including; re-use of existing tools/code, evaluation of potential platforms and opportunities to deliver new capabilities to the 15 SPSS.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.

In order to demonstrate the feasibility that would have otherwise been demonstrated during Phase I performance, the Government expects Offerors to demonstrate a technical solution for an initial software deployment of an app that tracks telescope mount usesage requests, scheduled downtime due to maintenance, sensor usage, and human resources required for all of the above.

PHASE II: Develop a Path to Production for space sensor resource scheduling prototype. Prototype shall be required to deploy in both laboratory and operational environments.

PHASE III DUAL USE APPLICATIONS: Phase III will continue to provide the same criterium as Phase II but will include more site infrastructure software modernization.

REFERENCES:

1. Department of Defense Software Modernization Implementation Plan Summary-March 2023;

KEYWORDS: DevOps; DevSecOps; Path to Prod; SDA; Digital Transformation; Software Modernization; SaaS; IaaS; PaaS; Cloud

SF241-D025 TITLE: Alternative Position, Navigation, and Timing

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Space Technology

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To provide resilient, multi-source, continuous, high quality, navigation and timing information by providing alternative, GPS-independent, navigation augmentation sources of positioning, navigation, and timing (PNT) data for the warfighter, civil and commercial user. Alt-PNT can augment GPS or serve as a short/medium-term alternative to GPS if access to GPS signals is denied or degraded.

DESCRIPTION: Military/Civil/Commercial users require resilient, integrated, high-precision PNT information in contested environments for vehicle autonomy and other emerging fields. This Alt-PNT effort seeks to leverage both government and commercial investments to develop and demonstrate technology to provide resilient navigation and timing information, either from novel sources or by integrating PNT information from existing sources in novel ways to enhance resilience. The scope of this effort includes provision of Alt-PNT services, hardware, software, and associated enabling technologies and approaches. This solicitation seeks proposals at the level of: Systems-of-Systems, System, Critical Item, and/or Device, which lead to Alt-PNT capability. Proposals may include Alt-PNT technologies and implementations needed within the domains of Alt-PNT Control systems, Space Segments, and User Equipment.

There are many Alt-PNT implementations that can provide PNT information independent of GPS, including (but not limited to): non-GPS space-based RF systems including global navigation satellite systems (GNSS), self-contained inertial navigation systems (INS), celestial navigation, computer vision-based approaches, network-based timing approaches, PNT-over-communications, signals of opportunity, and other land-based RF augmentation systems.

Several recent commercial efforts provide opportunities to increase PNT resilience through Alt-PNT. Those developments include: low cost proliferated LEO (pLEO) communication mega-constellations, low cost reusable launch vehicles, machine learning and artificial intelligence, quantum sensing, low cost high data-rate space laser crosslink networks, chip scale atomic clocks, very high density reconfigurable field programmable gate arrays, Graphical Processing Units, as well as the convergence of satellite communications and 5G/6G cell networks. These developments provide an overarching technological opportunity to enable all new alternative navigation services, completely independent of existing MEO GNSS systems.

Alt-PNT enablers are also of interest, including: low-cost, zero-trust, long-range, space-space networks, GNSS Situational Awareness, Integrity/Authentication Monitors, provision of GNSS Hot-Start data, global timing synchronization, and resilient C2 capability for PNT systems. These enabling capabilities address how Alt-PNT systems can be integrated with future heterogenous, multi-tier, highly integrated space assets to provide the resilient PNT.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this

topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.

This feasibility demonstration should encompass the evaluation of scientific and technical merit and feasibility of ideas with commercial potential. Additionally, it must validate the product-market between the proposed solution and the USSF customer. The feasibility study should identify the prime potential USSF end users for the Defense-modified commercial offering, describe integration feasibility and costs with current mission-specific products, and explore the potential use by other DoD or Governmental customers. Offeror Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Prior work to demonstrate feasibility must meet the minimum technical and scientific merit specified in this description. Work submitted with the feasibility demonstration must have been substantially performed by the Offeror and/or the Principal Investigator.

PHASE II: The emphasis will shift from study/analysis and technology development/selection towards end-to-end capability demonstration. Alt-PNT Phase-II proposals addressing System-of-System, System, and integration of Critical Items will be accepted, with priority placed on proposals that provide the most technically achievable, integrated MGNSS + Alt-PNT, end-to-end, user solutions.

Successful Phase-II proposals and awards will provide an end-to-end capability demonstration in a relevant laboratory operational environment, including initial field testing to prove that the proposed Alt-PNT capability is prepared to move in to limited production and limited operational field testing. The successful Phase-II Alt-PNT capability shall achieve TRL-5 (Threshold) or TRL-6 (Objective), as documented in a final report with laboratory and field demonstration.

PHASE III DUAL USE APPLICATIONS: "Finally, during Fiscal Year 2026 (Threshold) or earlier (Objective), a Phase-III down-select will occur to the most viable Alt-PNT candidates. Technology development should be complete, teaming arraignments should be complete, production details should be complete. All outstanding cyber, integration, and operational details will have been resolved. During Phase-III limited low rate production of sufficient sub-systems will be conducted to enable limited operational demonstration in the actual operational environments. All aspects of Alt-PNT control, space segment, user equipment, integration and operation needed for successful demonstration will be conducted. The successful Phase-III Alt-PNT capability shall achieve TRL-6 (Threshold) or TRL-7 (Objective) as documented in a final report with limited production and operational demonstration. The Alt-PNT capability sought to be developed under this program will directly benefit the warfighter, civil user, and potentially create a new class of pay-for-use commercial PNT user."

REFERENCES:

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2. Protect, Toughen, Augment (PTA) https://www.gps.gov/governance/advisory/subcommittees/#pta
3. DoD Technology Readiness Level Definitions: https://acqnotes.com/acqnote/tasks/technology-readiness-level
4. Stanford GPS Laboratory. https://gps.stanford.edu/
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IEEE/ION Position, Location and Navigation Symposium (PLANS), Monterey, CA, USA, 2023, pp. 1196-1207, doi: 10.1109/PLANS53410.2023.10140052.
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10. 66:199–209.https://doi.org/10.1002/navi.287
11. Babcock-Chi, Jade, Trapani, Lucca, Akos, Dennis, ""Timekeeping with a Chip Scale Atomic Clock in GPS Denied Environments,"" Proceedings of the 2023 International Technical Meeting of The Institute of Navigation, Long Beach, California, January 2023, pp. 34-52.
12. https://doi.org/10.33012/2023.18589

KEYWORDS: Alt-PNT; hybrid user equipment; blended PNT solutions; PNT situational awareness; commercial PNT services; prototypes; hosted payloads; hosting payloads; resilient PNT; GPS resilience; "PNT as a service"; commercial PNT; alternate timing distribution; Open Systems Architecture; GPS; GNSS; Anti-Jam; Anti-Spoof; Complementary PNT; Alternate PNT; inertial; celestial; magnetic; gravimeteric; terrain mapping; Signals of Opportunity; LEO; MEO; GEO; signal processing; antennas; signals; compact atomic clocks; Situational Awareness; M-Code; atomic clocks; machine vision; constellation; cislunar; agile; NAVWAR; absolute nav; relative nav; scalable; multi-tier MGNSS; secure processing; assured PNT; quantum sensing; MGNSS User Equipment; Software Defined MGNSS; certifiable software define radios; comm-PNT convergence; zero trust; post-quantum; authentication; cryptography; key management; ML; AI;

SF241-D026 TITLE: Digital Spaceport of the Future

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software; Integrated Sensing and Cyber; Integrated Network System-of-Systems; Space Technology; Advanced Materials; Human-Machine Interfaces; Renewable Energy Generation and Storage

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 the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The main objective of this proposal is to foster a collaborative partnership with SpaceWERX and small businesses, advancing digital transformation, hardware modernization, and operational enhancement of our future spaceports. This is to be achieved through strategic seeding of innovative small businesses, aiming to develop technological solutions that align with the Assured Access to Space (AATS) vision. The ultimate goal is to leverage the agility, ingenuity, and adaptability of small businesses to revolutionize spaceport operations and services, thereby actualizing the Spaceport of the Future (SOTF).

DESCRIPTION: The Assured Access to Space (AATS) Chief Technology & Innovation office is seeking to partner with SpaceWERX in order to seed small businesses that can develop transformative technologies aimed at the realization of the Spaceport of the Future (SOTF) vision. This strategic investment in small businesses is envisioned to expedite the digital transformation of USSF bi-coastal spaceport operations, augment launch operational efficiency and capacity, and promote standardization, thereby revolutionizing the delivery of launch services. To that end, AATS is interested in making technological investments in the following four strategic areas: (1) Digital Transformation & Legacy Hardware Modernization: Looking for small businesses with expertise in cloud computing, DevSecOps, data analytics, cybersecurity, and especially modernizing legacy range hardware to aid in achieving our vision of being a digital-first service. (2) Agility & Capacity Enhancement Solutions: Seeking technologies that can improve the adaptability of our spaceports, streamline launch data analysis, and facilitate the capability for concurrent launch operations. (3) Data Management & Transport Layer Technologies: Interested in solutions that enable real-time data sharing, comprehensive spaceport health assessment, and secure data transport layers to augment our data-centric operational approach. (4) Standardization Technologies: Looking for innovations that support standardization across both eastern and western launch range operations to enhance user experiences and reduce our logistics footprint.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the Offeror to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement.

This feasibility demonstration should encompass the evaluation of scientific and technical merit and feasibility of ideas with commercial potential. Additionally, it must validate the product-market between the proposed solution and the USSF customer. The feasibility study should identify the prime potential USSF end users for the Defense-modified commercial offering, describe integration feasibility and costs with current mission-specific products, and explore the potential use by other DoD or Governmental customers.

Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Prior work to demonstrate feasibility must meet the minimum technical and scientific merit specified in this description.

Work submitted with the feasibility demonstration must have been substantially performed by the Offeror and/or the Principal Investigator.

PHASE II: AATS is interested in making technological investments in the following four strategic areas: (1) Digital Transformation & Legacy Hardware Modernization: Looking for small businesses with expertise in cloud computing, DevSecOps, data analytics, cybersecurity, and especially modernizing legacy range hardware to aid in achieving our vision of being a digital-first service. (2) Agility & Capacity Enhancement Solutions: Seeking technologies that can improve the adaptability of our spaceports, streamline launch data analysis, and facilitate the capability for concurrent launch operations. (3) Data Management & Transport Layer Technologies: Interested in solutions that enable real-time data sharing, comprehensive spaceport health assessment, and secure data transport layers to augment our data-centric operational approach. (4) Standardization Technologies: Looking for innovations that support standardization across both eastern and western launch range operations to enhance user experiences and reduce our logistics footprint. Successful Phase-II proposals and awards will provide an end-to-end capability demonstration in a relevant laboratory operational environment, including initial field testing to prove that the proposed capability is prepared to move in to limited production and limited operational field testing. The successful Phase-II capability shall achieve TRL-6 or higher, as documented in a final report with laboratory and field demonstration.

PHASE III DUAL USE APPLICATIONS: Phase III efforts generated out of this Specific Topic will be executed by PEO AATS to further operationalize and sustain the prototyped capabilities.

REFERENCES:

1. Spaceport of the Future (SOTF) Strategic Guidance Memorandum;
2. Delta-V Capability Needs Statement;

KEYWORDS: Spaceport Operations, Assured Access to Space (AATS), Digital Transformation, Launch Data Management, Launch Operations Standardization, Cybersecurity, DevSecOps, Cloud Computing, Real-time Data Sharing, Spaceport Health Assessment