DEPARTMENT OF THE AIR FORCE (DAF)
23.1 Small Business Innovation Research (SBIR) Direct to Phase II (D2P2)
Proposal Submission Instructions
Amendment 1
26 January 2023

This Amendment modifies the 23.1 DAF SBIR D2P2 proposal submission instructions in the following manner:

1. The TPOC information for Topic AF231-D016 is changed from

   ~~TPOC-1: 1st Lt. Ryan Collinsworth~~
   ~~Phone: (865) 242-1820~~
   ~~Email: ryan.collinsworth.1@us.af.mil~~

   to

   TPOC-1: Alex Patterson
   Phone: (801) 586-2710
   Email: alex.patterson.2@us.af.mil

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

DEPARTMENT OF THE AIR FORCE (DAF)
23.1 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 23.1 SBIR BAA posted on the DoD SBIR/STTR Innovation Portal (DSIP) at the proposal submission deadline date/time.
Complete proposals **must** be prepared and submitted via https://www.dodsbirsttr.mil/submissions/ (DSIP) on or before the date published in the DoD 23.1 SBIR BAA. Applicants 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 DAF 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, "23.1 Address Change".

Points of Contact:

- General information related to the DAF 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 23.1 SBIR BAA.
- Air Force SBIR/STTR Contracting Officer (CO):
  Mr. Daniel 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.

I. DIRECT TO PHASE II

15 U.S.C. §638 (cc), as amended by NDAA FY2012, Sec. 5106, and further amended by NDAA FY2019, Sec. 854, PILOT TO ALLOW PHASE FLEXIBILITY, 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 23.1 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.

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

1. Applicants must create a Cover Sheet in DSIP; follow the Cover Sheet instructions provided in the DoD SBIR Program BAA. Applicants must provide documentation satisfying the Phase I feasibility requirement* to be included in the Phase II proposal. Applicants 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. Applicants must submit D2P2 proposals using the instructions below.

*NOTE: AF will not consider the applicant's applicant's D2P2 proposal if the applicant fails to demonstrate that technical merit and feasibility have been established. An applicant's D2P2 proposal will also not be considered if it fails to demonstrate the feasibility effort was substantially performed by the applicant 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.

III. PROPOSAL SUBMISSION

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.

Firms shall register in the System for Award Management (SAM) at https://www.sam.gov/, to be eligible for proposal acceptance. Follow instructions located in SAM to obtain a Commercial and Government Entity (CAGE) code and Unique Entity Identifier (UEI) number. Firms shall also verify "Purpose of Registration" is set to "I want to be able to bid on federal contracts or other procurement opportunities. I also want to be able to apply for grants, loans, and other financial assistance programs", NOT "I only want to apply for federal assistance opportunities like grants, loans, and other financial assistance programs." Firms registered to compete for federal assistance opportunities only at the time of proposal submission will not be considered for award. Addresses must be consistent between the proposal and SAM at award. Previously registered firms are advised to access SAM to ensure all company data is current before proposal submission and, if selected, award.

Complete proposals must include all of the following:
Volume 1: DoD Proposal Cover Sheet
Volume 2: Technical Volume
Volume 3: Cost Volume
Volume 4: Company Commercialization Report
Volume 5: Supporting Documents, e.g., SBIR/STTR Environment, Safety and Occupational Health (ESOH) Questionnaire; DoD Form 2315, 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. DAF 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 23.1 BAA. The Principal Investigator's (PI's) primary employment must be with the small business concern at the time of award and 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 DAF 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.

IV. PHASE II PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

Advocacy letters, if any; SBIR/STTR Environment, Safety and Occupational Health (ESOH) Questionnaire; and the additional cost proposal itemized list, 17.a-j, should be included in Volume 5, Supporting Documentation. This documentation and the Cover Sheet will not count toward the technical volume limits. There is no set format requirement for white papers or slide decks, if required.

Complete the SBIR/STTR Environment, Safety, and Occupational Health (ESOH) Questionnaire found at: https://www.afsbirsttr.af.mil/Portals/60/Pages/Overview/Air%20Force%20SBIR_STTR%20Environment%20Safety%20and%20Occupational%20Health_ESOH_Oct%202021_JSH.pdf . Include the completed document in the proposal under Volume 5, Other Documents.

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

B. 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.

C. General Content. Proposals should be direct, concise, and informative. Type shall be no smaller than 11-point on standard 8 ½ X 11 paper, with one-inch margins and pages consecutively numbered. Applicants are discouraged from including promotional and non-programmatic items. If included, such material will count toward the page limit.

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

(1) **Proposal Cover Sheet:** 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. The term "Component" on the Cover Sheet refers to the DAF organization requesting the Phase II proposal.

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

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

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

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

(6) **Phase II Technical Objectives:** Detail the specific objectives of the Phase II work and describe the technical approach and methods to be used in meeting these objects. The proposal should also include an assessment of the potential commercial application for eachobjective.

(7) **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 the specialty area. It should explain the purpose and expected outcome.
b) 2.0 – Scope: This section should provide a concise description of the work to be accomplished, including the technology area to be investigated, goals, and major milestones. 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 applicant shall identify appropriate specifications, standards, and other 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 for accomplishing proposed work are considered to be legally binding on the applicant.Therefore, it must be developed in an orderly progression with sufficient detail to establish overall program requirements and goals. The work effort must be segregated into major tasks and

identified in separately numbered paragraphs.

Each numbered major task should delineate 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."

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

a) Scientific and Technical Reports: Rights in technical data, including software, developed under the terms of any contract resulting from a SBIR 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.

iii. Small Business Online Success Stories: Success Story submissions are due at the end of the technical effort via http://launchstories.org. If selected, refer to the Contract Data Requirements List (CDRL) in the contract for submission instructions.

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.

(9) **Related Work:** Describe significant activities directly related to the proposed effort, including any previous programs conducted by the Principal Investigator, proposing

firm, consultants, or others, and their application to the proposed project. Also list any reviewers providing comments regarding the applicant's knowledge of the state-of-the-art in the specific approach proposed.

(10) <u>Company Commercialization Report (CCR)/Commercialization Potential</u>:

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.

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.

(11)**<u>Military Applications</u>:** 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.

(12)**<u>Relationship with Future R/R&D Efforts</u>**:

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.

(13)**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 applicants proposing to use foreign nationals MUST follow the DoD 23.1 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.

(14)**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 and regulations 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.

(15) **Consultants/Subcontractors**: Private companies, consultants, or universities may be involved in the project. All should be described in detail and included in the cost proposal. In accordance with the Small Business Administration (SBA) SBIR Policy Directive, a minimum of 50% of the R/R&D must be performed by the proposing firm, unless otherwise approved in writing by the Contracting Officer. Signed copies of all consultant or subcontractor letters of intent must be attached to the proposal. These letters should briefly state the contribution or expertise being provided. Include 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.

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

a) The name and address of the Federal agency(ies) or DoD Component(s) to which proposals were or will be submitted, or from which an awarded is expected or has been received;
b) The 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."

E. **Cost Proposal:** A detailed cost proposal must be submitted. Cost proposal information will be treated as proprietary. Proposed costs must be provided by both individual cost element and contractor fiscal year (FY) in sufficient detail to determine the basis for estimates, as well as the purpose, necessity, and reasonableness of each. This information will expedite award 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.

Please review the updated Percentage of Work (POW) calculation details included in section 5.3 of the DoD Program BAA. [Component] will not accept any deviation to the POW requirements / [Component] will occasionally accept deviations from the POW requirements with written approval from the Funding Agreement officer.

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

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 applicant 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, assigned personnel, hours and rates, materials (if any), and proposed travel (if any). A letter from the subcontractor agreeing to perform a task or tasks at a fixed price is not considered sufficient. The proposed total of all consultant fees, facility leases or usage fees, and other subcontract or purchase agreements may not exceed one-half of the total contract price, 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 a short, 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.

j) **DD Form 2315:** For proposals submitted under export-controlled topics (either ITAR or EAR), a certified DD Form 2315, Militarily Critical Technical Data Agreement, or evidence of application submission, must be included. The form, instructions, and FAQs may be found at the US/Canada Joint Certification Program website, http://www.dlis.dla.mil/jcp/. DD Form 2315 approval will be verified if theproposal is selected for award.

F. **Feasibility Documentation –** Should be uploaded to Volume 5, Supporting Documents

a. Applicants must adequately document completion of the Phase I feasibility requirement*. Applicants 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. 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, DAF is seeking proposals emphasizing technologies' dual-use applications and commercialization.

* NOTE: The applicant shall provide information to enable the agency to make the 15 U.S.C. 638(cc) determination of scientific and technical feasibility and merit. Applicants are required to provide information demonstrating scientific and technical merit and feasibility has been established as part of the Technical Volume described in Section 9.7. The DAF will not review the Phase II proposals if it is determined the applicant 1) fails to demonstrate technical merit and feasibility are established or 2) the feasibility documentation does not support substantial performance by the applicant 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.**

b. If appropriate, include a reference or works cited list as the last page.

c. Feasibility efforts detailed must have been substantially performed by the applicant and/or the PI. If technology in the feasibility documentation is subject to intellectual property (IP) rights, the applicant 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 23.1 BAA for technical data rights information. DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated and WILL be redacted.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

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

V. METHOD OF SELECTION AND EVALUATION CRITERIA

A. Introduction: 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.

B. Evaluation Criteria: Phase II proposals will be reviewed for overall merit based on the criteria discussed in the DoD 23.1 BAA.

NOTE: Restrictive notices notwithstanding, proposals may be handled for administrative purposes only, by support contractors: APEX, Peerless Technologies, Engineering Services Network, HPC-COM, Mile Two, Montech, REI Systems, MacB (an Alion company), 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 Officers with concerns about any of these contractors**.

VI. CERTIFICATIONS

In addition to the standard Federal and DoD procurement certifications, the SBA SBIR/STTR Policy Directive requires the collection of certain information from firms at the time of award and during the award life cycle. Each firm must provide these certifications at the time of proposal submission, prior to receiving 50% of the total award amount, and prior to final payment.

VII. FEEDBACK

The PI and Corporate Official indicated on the Proposal Cover Sheet will be notified by email regarding proposal selection or non-selection. The small business will receive one notification for each proposal submitted. Please note the referenced proposal number and read each notification carefully. **If changes occur to the company mail or email addresses or points of contact after proposal**

submission, the information must be provided to the DAF via the AF SBIR/STTR One Help Desk.

The notification letter will include instructions for submitting a feedback request. Applicants are entitled to no more than one feedback per proposal. NOTE: Feedback is not the same as a FAR Part 15 debriefing. Acquisitions under this solicitation are awarded via "other competitive procedures." Therefore, applicants are neither entitled to, nor will they be provided, FAR Part 15 debriefs.

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 Brewer, Daniel.Brewer.13@us.af.mil.

Air Force SBIR 23.1 Direct to Phase II Topic Index

Topic Number	Topic Title	Maximum Value	Maximum Duration (in months)	Volume 2 Technical Volume Page Limit
AF231-D003	FOD Retriever	$1,800,000	24	50
AF231-D004	Event Based Star Tracker for AFNWC Applications	$1,800,000	24	15
AF231-D005	Reserve, Remotely Activated Battery for Missile Guidance Set for Minuteman III ICBM	$1,800,000	24	15
AF231-D006	Large Format Emergency Power Batteries for Minuteman III ICBM	$1,800,000	24	15
AF231-D007	Reserve, Remotely Activated Battery for MK12A Reentry Vehicle for Minuteman III ICBM	$1,800,000	24	15
AF231-D008	Reserve, Remotely Activated Battery for MK21 Reentry Vehicle for Minuteman III ICBM	$1,800,000	24	15
AF231-D009	Reserve, Remotely Activated Battery for Stage 1 Flight Control Unit for Minuteman III ICBM	$1,800,000	24	15
AF231-D010	Digitization and Management of Authoritative Resources	$1,800,000	24	15
AF231-D011	AI for Systems Engineering Assessment Model (SEAM) activities	$1,800,000	24	15
AF231-D012	Digital Engineering Technologies	$1,800,000	24	15
AF231-D013	Intercontinental Ballistic Missiles (ICBM) Test Technologies	$1,800,000	24	15
AF231-D015	Thermal Flux Data Collection Instrument and Data Processing Methods for Concentrated Radiant Energy Beam Target Surface Thermal Exposure Characterizations	$1,800,000	24	15
AF231-D016	Seal Bond Removal	$1,800,000	24	50
AF231-D017	Zero-Trust Data Fabric for Industrial Internet of Things	$1,800,000	24	50
AF231-D018	Laser Paint Mapping System	$1,800,000	24	50
AF231-D019	Bolt Hole Eddy Current (BHEC) Signal Indication Interpretation	$1,800,000	24	50
AF231-D020	Improved Weather Sensor Analysis Algorithms via Machine Learning	$1,800,000	24	50
AF231-D021	Innovative Technology to Automatically Build/Update Required Acquisition Milestone Documentation	$1,800,000	24	50
AF231-D022	FARE - Fully Adaptive Radar Electronics (FARE)	$1,800,000	24	50

AF231-D023	RADS - RAdar Disruption Systems	$1,800,000	24	50
AF231-D024	HiFi - Manufacturing high fidelity full-scale wind tunnel model for next-generation air vehicle development	$1,800,000	24	50
AF231-D025	MagDie - Magneto-dielectric Antennas for Broadband HF Sensing	$1,800,000	24	50
AF231-D026	FOCUS – Future Operational Capabilities for the US	$1,800,000	24	50
AF231-D027	RESINATE - REmoste Sensing IN A TEu	$1,800,000	24	50
AF231-D028	Next-Generation Neural Interface for Real-World Performance Monitoring and Augmentation	$1,800,000	24	50
AF231-D029	Battle Damage Assessment Manager	$1,800,000	24	50

AF231-D003 TITLE: FOD Retriever

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Integrated Network Systems-of-Systems

OBJECTIVE: Develop and demonstrate weatherproof automated Foreign Object retrieval system that is linked to and electronically tethered to the LFOD (Laser Foreign Object Detection) truck by a secure network to eliminate the need for maintenance personnel to retrieve the geo-tagged Foreign Object.

DESCRIPTION: An independent, follow-on industrial vacuum unit, 3-5 feet in width, that is linked to the LFOD system and will go to geo-tagged locations that the LFOD system has identified as FO source to retrieve, while eliminating human source. It should also have a scanning capability on the trailing edge to determine if the FO was removed. FOD deposits should be visible, easily accessible in a clear compartment to confirm FOD contents. Compartment should be large enough to fit a large quantity of hardware, tools and miscellaneous hard/soft FOD. It should have the ability to report failure to pick up FO to the LFOD system. This will require a secure connection to the LFOD vehicle to receive data inputs. The vacuum unit should be wirelessly tethered to the LFOD truck and have a warning system that can be installed on the truck to alert passengers if the tether is broken. Must be environmentally sealed/to operate outdoors and able to withstand ambient temperatures from -20F to 120F and winds up to 50 mph. It should operate on battery power for 3-5 hours before recharging and have an auto-docking capability when it is within _10_ feet of charging station. The unit should be able to travel at a maximum speed of 25 MPH and have 10k Pa (Pascal Pressure Units) of suction. Currently, the LFOD system requires 3 personnel dedicated daily for operations: a System Operator, Vehicle Operator and the third member (FOD Retriever) is required to get out of the vehicle to physically retrieve the FO, which makes the LFOD survey reach a total of 2 hours to clear all taxiways prior to daily flight operations. The quality of checks performed by Flightline workers is subject to any number of external factors affecting the outcome. One primary goal of the FOD Rhumba is to reduce the LFOD Survey time to one hour and eliminate a third person for FOD retrieval.

PHASE I: A feasibility study that encompasses the following at a minimum Problem, Solution, Market, Competition, Team/Stakeholders, Financials, Milestones, Additional Information Address at least the following 1) Annual costs for foreign object damage in military aviation overall broken down by military branch and shown as percent of total military/branch/mission support budget 2) Identify current technology capable of meeting the topic objective 3) Identify if the current technology can retire/replace a current process or technology 4) Identify ways where human lead FOD checks can go wrong, and where technological capabilities are greater than current method used by military 5) Identify security concerns and mitigations 6) Cost overview for both initial purchase, sustainment, and scaling up-to and including use across the Department of the Air Force. 7) Warrantee and service information 8) Solution impacts to cost, quality or speed versus the current method 9) Overview of the technological components to make the solution work 10) Procedural changes needed to make solution work 11) Include a visual of potential solutions complete with descriptors 12) Policy changes needed to make solution work, if any 13) Feasibility for an app component 14) Any discretionary information that may be valuable when choosing a solution proposal This is a Direct to Phase II Topic.

PHASE II: Develop, integrate, install, test, and demonstrate a prototype system to meet topic objective. This demonstration should focus specifically on: 1) Present overview of the technological components to make the solution work 2) Present annual costs for foreign object damage in military aviation overall broken down by military branch and shown as percent of total military/branch/mission support budget 3) Present a visual depiction of the solutions complete with descriptors 4) Modify current technology capable to meet the topic objective 5) Address security concerns and mitigations actions 6) Provide cost overview for both initial purchase, sustainment, and scaling up-to and including use across the

Department of the Air Force. 7) Present warranty and service information 8) Identify any policy changes that would stand in the way of utilizing this capability 9) Real world phase one solution application to a client Air Force base taxiway 10) Testing the scalability of solution 11) Data generation analysis - provide insight to FOD trends 12) Solution/system upgrades based on client Air Force base feedback 13) Provide/cooperate with 3rd party integration for Foreign Object (FO) Rumba Project 14) Beyond government facility priority, integration into civilian airports would be the next step in applicability/usage. 15) Capabilities/issues identified but not address in previous phase can be resolved, added or remove as needed 16) Any discretionary information that may be valuable when choosing a solution proposal"

PHASE III DUAL USE APPLICATIONS: Seek to develop non-military applications for technologies developed during or used by this project. Provide ongoing support to military stakeholders. Capabilities/issues identified but not address in previous phase can be resolved, added or remove as needed. This capability will have applications on military taxi-ways/flight lines in which commercial and private airports could utilize in the same fashion. In addition, it could be modified for use in supply warehousing (if adapted to follow forklifts with LFOD systems or other manned/autonomous vehicles). Fully operational capability requires ability to seamlessly integrate onto the Air Force Information Networks (AFIN) for network transport and Air Forces Network (AFNET) for software utilization. The system will utilize these networks for software application usage (both for on premises and remote access as necessary), security practices and procedures, and data transport requirements. Prior to inclusion on Air Force Installation Base Enclaves, all hardware components must comply with DoD Unified Capabilities Requirements (UCR), and be listed on the Department of Defense Information Network (DoDIN) Approved Products List (APL). All software components must adhere to UCR and be certified per the Air Force Evaluated Products List (EPL). In the event components are not currently authorized, authorization will be completed with support of government sponsorship prior to capability delivery to enable immediate operational usage. Request solution use current common criteria certified components when/where possible.

REFERENCES:

1. DAFI 21-101;
2. lakenheathi21-102

KEYWORDS: Foreign Object Debris; Damage; Aircraft Engines; Taxiway Crossing; FOD, Pebble; Flightline

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AF231-D004 TITLE: Event Based Star Tracker for AFNWC Applications

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber; 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. Applicants 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. Applicants 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 low SWAP, low cost, high angular rate star tracker for missile/rocket, and/or aircraft nuclear enterprise applications.

DESCRIPTION: Existing star tracking attitude sensors are limited in their ability to operate above certain angular rates, thus rendering them useless for spinning and/or high angular rate rocket/missile applications. Recent advances in neuromorphic (a.k.a. event based) sensors have dramatically improved their overall performance, which allows them to be considered for higher angular rate applications. In addition, the difference between a traditional frame-based camera and an event-based camera is simply a matter of how the sensor is read out, which should allow for electronic switching between event based (i.e. high angular rate) and frame (i.e. low angular rate) modes within the star tracker. Additional advantages inherent in an event-based sensor include high temporal resolution (μs) and high dynamic range (140 dB), which could allow for multiple modes of continuous attitude determination (i.e. star tracking, sun sensor, earth limb sensor) within a single small, low cost sensor package. All technology solutions that meet the topic objective are solicited in this call, however, neuromorphic sensors appear ideally suited to meet the technical objectives and should therefore be considered in the solution trade space. The scope of this effort will be to first analyze the capability of event-based sensors to meet a high angular rate star tracker application, define the trade space for the technical solution against the nuclear enterprise requirements, develop a working prototype and test it against the requirements and in Phase 3 move to initial production of a commercial star tracker unit.

PHASE I: Acquire existing state of the art COTS neuromorphic (a.k.a. event based) sensor or modify existing star tracking sensor as appropriate. Perform analysis and testing of the event-based sensor to determine feasibility in the high angular rate star tracking satellite and nuclear enterprise applications.

PHASE II: Development of a prototype event based high angular rate star tracker. Ideally this prototype will have the ability to be operated in both event-based mode, as well as switch back and forth to standard (i.e. frame) mode. Explore and document the technical trade space (maximum angular rate, minimum detection threshold, associated algorithm development, etc.) and potential military/commercial application of the prototype device. All technology solutions that meet the topic objective are solicited in this call, however, neuromorphic sensors appear ideally suited to meet the technical objectives and should therefore be considered in the solution trade space. The scope of this effort will be to first analyze the capability of event-based sensors to meet a high angular rate star tracker application, define the trade space for the technical solution against the nuclear enterprise requirements, develop a working prototype and test it against the requirements.

PHASE III DUAL USE APPLICATIONS: Phase 3 efforts will focus on transitioning the developed high angular rate attitude sensor technology to a working commercial and/or military solution. Potential applications include commercial and military aircraft, as well as missile/rocket applications. The

information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. Tat-Jun Chin, Samya Bagchiy, Anders Eriksson, Andr´e van Schaik, "Star Tracking using an Event Camera", IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), arXiv:1812.02895, 13Apr2019.;
2. Guillermo Gallego et al, "Event-based Vision: A Survey", IEEE Transactions on Pattern Analysis and Machine Intelligence, arXiv:1904.08405, 8Aug2020.

KEYWORDS: Event based camera; neuromorphic sensor; high angular rate star tracker; small satellite

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AF231-D005 TITLE: Reserve, Remotely Activated Battery for Missile Guidance Set for Minuteman III ICBM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants 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 purpose of this effort is to develop a Reserve, Remotely Activated Lithium or Silver Zinc battery capable of providing power to the Missile Guidance Set on the Minuteman III ICBM, where fast activation and high energy is required. Demonstrated performance under simulated ICBM environments.

DESCRIPTION: Reserve batteries serve a specialized purpose, they require fast electrolyte introduction and cathode wetting, but provide unsurpassed shelf-life since many of the reactions that lead to self-discharge cannot occur, due to the isolation of electrolyte from other active components. However, reserve battery electrical performance can suffer from poor or slow cathode wetting. Additionally, the overall battery energy density is lower than non-reserve batteries due to the extra volume required for electrolyte and physical electrode separation. Reserve, Remotely Activated Lithium or Silver Zinc technology is of particular interest as they can meet the fast activation time and high energy density requirements of the current Missile Guidance Set, while providing high quality/reliable manufacturing. The anticipated advantage of Reserve, Remotely Activated Lithium or Silver Zinc battery technology advancements would be improved manufacturing capability, reliable design, and repeatable manufacture. This would provide improved lot to lot reliability and may lead to reduction in cost of future design and manufacture. Areas of research should include electrolyte storage and delivery, residual pressure retention, remote activation, backflow and pressure relief, chemistry specific safety, cell material wicking and wetting improvements, and the repeatable manufacture of such components and battery characteristics. In addition, the ability to develop and integrate prototypes for field experiments and/or tests in a simulated environment for the Missile Guidance Set, at a minimum. The results of this effort are proof of technological feasibility and assessment of subsystem and component operability and producibility. The Technology Readiness Level of this Reserve, Remotely Activated Lithium or Silver Zinc Reserve battery technology should begin at 5 or higher. At the conclusion of this effort, this Reserve, Remotely Activated Lithium or Silver Zinc Reserve battery technology should lead to subsequent development or procurement phases, or at a minimum have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the future years defense program (FYDP).

PHASE I: This is a D2P2 topic, and as such, there will be no Phase I awards. "Phase I-type" feasibility documentation should be provided that demonstrates reliable and repeatable remote activation, electrolyte delivery, and wetting in in either Lithium or Silver Zinc Battery Chemistries as it pertains to electrical performance. Documentation should consist of reports, data (experimental or otherwise), and any prototype testing that has been successfully completed.

PHASE II: Demonstrate significant improvements in battery and key performance parameters (battery capacity, internal leakage, rate capability, remote activation, shelf life, etc.) and how they are improved by innovative delivery methods and configuration. Demonstrate compatibility of the chosen process

technology with volume manufacture. Demonstrate integration of the metric-enhanced battery with the Missile Guidance Set product target. Provide cost projection data to substantiate the design, performance, operational range, acquisition, and life cycle costs. Produce and provide repeatable quality Reserve, Remotely Activated Lithium or Silver Zinc batteries for system level test and evaluation. Refine transition plan and business case analysis.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on demonstration of large volume manufacturability of either Reserve, Remotely Activated Lithium or Silver Zinc Battery Chemistries, associated battery capacity, and performance goals. If successful, further work could include transitioning the proven and developed technology to the MMIII ICBM system, potentially the Missile Guidance Set. Commercial applications include emergency power and other non-power long storage life applications. Military applications include aerospace and naval emergency power. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. 1. D. Linden and T.B. Reddy, eds., Handbook of Batteries, 3rd Edition, McGraw-Hill, New York, 2002.
2. Y. Li, H. Zhan, S. Liu, K. Huang, and Y. Zhao, J. Power Sources, Vol. 195, p. 2945, 2010.

KEYWORDS: Lithium Battery; Shelf Life; Silver Zinc Battery; Remotely Activated; Reserve Battery; ICBM Power

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AF231-D006 TITLE: Large Format Emergency Power Batteries for Minuteman III ICBM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants 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 purpose of this effort is to develop safer high power, large format Lithium Ion, Valve Regulated Lead Acid, or Nickel Zinc Battery for the Minuteman III ICBM.

DESCRIPTION: Rechargeable Lithium Ion batteries can fail violently when subjected to an internal electrical short, are overheated, crushed, or when they are overcharged/over-discharged. Lithium Ion battery fires demonstrate that the safety of Lithium Ion batteries is of major concern. Hazards are amplified by batteries and personnel operating together in confined spaces. Of particular interest are improvements in safety for large-format Lithium Ion batteries by eliminating cell-to-cell thermal transport and cell failure propagation. Safe containment of flames and debris during any possible thermal runaway event is paramount to the usefulness of the battery. Containment would prevent damage to surrounding equipment and personnel outside the battery case. Valve Regulated Lead Acid or Nickel Zinc Batteries are also of interest, as they require very little maintenance and have long life. Interest would be given to solutions that are resistant to long storage and operation in the Launch Facility and Launch Control Center for the Minuteman III ICBM environments. These batteries will demonstrate improved safety under various abuse/extreme conditions while providing low impedance electrical performance. Innovation in this topic should place an emphasis on reducing the acquisition cost to levels competitive with existing Lithium Ion, Valve Regulated Lead Acid, and Nickel Zinc batteries in terms of acquisition and life cycle. In addition, this topic should place emphasis on the ability to develop and integrate prototypes for field experiments and/or tests in a simulated environment for the Launch Facility and Launch Control Center, at a minimum. The results of this effort are proof of technological feasibility and assessment of subsystem and component operability and producibility. The Technology Readiness Level of this Lithium Ion, Valve Regulated Lead Acid or Nickel Zinc Battery technology should begin at 5 or higher. At the conclusion of this effort, this Lithium Ion, Valve Regulated Lead Acid or Nickel Zinc Battery technology should lead to subsequent development or procurement phases, or at a minimum have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the future years defense program (FYDP).

PHASE I: This is a D2P2 topic., and as such, there will be no Phase I awards. "Phase I-type" feasibility documentation should be provided that either demonstrates reliable and repeatable manufacturing of a Lithium Ion that does not have cell-to-cell propagation of a cell failure, demonstrates functioning Valve Regulated Lead Acid Batteries, or demonstrates functioning Nickel Zinc Batteries. Present experimental and other data to demonstrate feasibility of proposed solution.

PHASE II: Produce an alternative, safer battery using Lithium Ion, Valve Regulated Lead Acid, or Nickel Zinc Technology that conforms to the developed configuration for Air Force on demand power application. Ensure the battery can meet required size and will mechanically and electrically be compatible with the target application. Provide cost projection data substantiating the design,

performance, operational range, acquisition, and life cycle cost. Refine transition plan and business case analysis.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on demonstration of large volume manufacturability of Lithium Ion, Valve Regulated Lead Acid, or Nickel Zinc Battery Chemistries, associated battery capacity, and performance goals. If successful, further work could include transitioning the proven and developed technology to the MMIII Missile system. Commercial applications include hybrid and electric vehicles. Military applications include aircraft emergency and pulse power, electric tracked vehicles, unmanned systems, hybrid military vehicles, and unmanned underwater vehicles (UUVs). The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. 1. Kim, G.H., Smith, K., Ireland, J., and Pesaran, A., "Fail-safe design for large capacity lithium-ion battery systems," J. Power Sources, Vol. 210 (2012) pp. 243-253.
2. Bandauer, T.M., Garimella, S., and Fuller, T.F., "A Critical Review of Thermal Issues in Lithium-Ion Batteries," J. Electrochem. Soc., Vol. 158 (2011) R1-R25.
3. Jacoby, M., "Safer Lithium-Ion Batteries," Chemical & Engineering News, Vol. 91 (2013) pp. 33-37

KEYWORDS: Lead Acid Battery; Valve Regulated Lead Acid Battery; Large Format Lithium Ion Battery; Nickel Zinc Battery; Safety; Thermal; Failure; Propagation; Rechargeable

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AF231-D007 TITLE: Reserve, Remotely Activated Battery for MK12A Reentry Vehicle for Minuteman III ICBM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants 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 purpose of this effort is to develop a Remotely Activated, Reserve Lithium Vanadium Pentoxide or Silver Zinc battery capable of providing power to the MK12A Reentry Vehicle on the Minuteman III ICBM, where fast activation and high energy is required. Demonstrated performance under simulated ICBM environments.

DESCRIPTION: Reserve batteries serve a specialized purpose, they require fast electrolyte introduction and cathode wetting, but provide unsurpassed shelf-life since many of the reactions that lead to self-discharge cannot occur, due to the isolation of electrolyte from other active components. However, reserve battery electrical performance can suffer from poor or slow cathode wetting. Additionally, the overall battery energy density is lower than non-reserve batteries due to the extra volume required for electrolyte and physical electrode separation. Lithium Vanadium Pentoxide or Silver Zinc reserve battery technology are of particular interest as they both can meet the fast activation time and high energy density requirements of the current MK12A Reentry Vehicle system, while providing high quality/reliable manufacturing. The anticipated advantage of Lithium Vanadium Pentoxide or Silver Zinc Reserve battery technology advancements would be improved manufacturing capability, reliable design, and repeatable manufacture. This would provide improved lot to lot reliability and may lead to reduction in cost of future design and manufacture. Areas of research should include electrolyte storage and delivery, residual pressure retention, remote activation, backflow and pressure relief, cell material wicking and wetting improvements, and the repeatable manufacture of such components and battery characteristics. In addition, the ability to develop and integrate prototypes for field experiments and/or tests in a simulated environment for the MK12A Reentry Vehicle, at a minimum. The results of this effort are proof of technological feasibility and assessment of subsystem and component operability and producibility. The Technology Readiness Level of this Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc battery technology should begin at 5 or higher. At the conclusion of this effort, this Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc battery technology should lead to subsequent development or procurement phases, or at a minimum have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the future years defense program (FYDP).

PHASE I: This is a D2P2 topic., and as such, no Phase I awards will be made. "Phase I-type" feasibility documentation should be provided that demonstrates reliable and repeatable remote activation, electrolyte delivery, and wetting in either Lithium Vanadium Pentoxide or Silver Zinc Battery Chemistries as it pertains to electrical performance. Documentation should consist of reports, data (experimental or otherwise), and any prototype testing that has been successfully completed.

PHASE II: Demonstrate significant improvements in battery and key performance parameters (battery capacity, internal leakage, rate capability, remote activation, shelf life, chemistry specific safety, etc.) and how they are improved by innovative delivery methods and configuration. Demonstrate compatibility of

the chosen process technology with volume manufacture. Demonstrate integration of the metric-enhanced battery with the MK12A Reentry Vehicle product target. Provide cost projection data to substantiate the design, performance, operational range, acquisition, and life cycle costs. Produce and provide repeatable quality Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc Reserve batteries for system level test and evaluation. Refine transition plan and business case analysis.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on demonstration of large volume manufacturability of either Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc Battery Chemistries, associated battery capacity, and performance goals. If successful, further work could include transitioning the proven and developed technology to the MMIII ICBM system, potentially the MK12A Reentry Vehicle System. Commercial applications include emergency power and other non-power long storage life applications. Military applications include aerospace and naval emergency power. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. 1. D. Linden and T.B. Reddy, eds., Handbook of Batteries, 3rd Edition, McGraw-Hill, New York, 2002.
2. Y. Li, H. Zhan, S. Liu, K. Huang, and Y. Zhao, J., Power Sources, Vol. 195, p. 2945, 2010.

KEYWORDS: Lithium Battery; Lithium Vanadium Pentoxide Battery; Silver Zinc Battery; Reserve Battery; Remotely Activated; ICBM Powers

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AF231-D008 TITLE: Reserve, Remotely Activated Battery for MK21 Reentry Vehicle for Minuteman III ICBM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants 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 purpose of this effort is to develop a Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc battery capable of providing power to the MK21 Reentry Vehicle on the Minuteman III ICBM, where fast activation and high energy is required. Demonstrated performance under simulated ICBM environments.

DESCRIPTION: Reserve batteries serve a specialized purpose, they require fast electrolyte introduction and cathode wetting, but provide unsurpassed shelf-life since many of the reactions that lead to self-discharge cannot occur, due to the isolation of electrolyte from other active components. However, reserve battery electrical performance can suffer from poor or slow cathode wetting. Additionally, the overall battery energy density is lower than non-reserve batteries due to the extra volume required for electrolyte and physical electrode separation. Lithium Vanadium Pentoxide or Silver Zinc reserve technology are of particular interest as they can meet the fast activation time and high energy density requirements of the current MK21 Reentry Vehicle system, while providing high quality/reliable manufacturing. The anticipated advantage of this Lithium Vanadium Pentoxide or Silver Zinc Reserve battery technology advancements would be improved manufacturing capability, reliable design, and repeatable manufacture. This would provide improved lot to lot reliability and may lead to reduction in cost of future design and manufacture. Areas of research should include electrolyte storage and delivery, residual pressure retention, remote activation, backflow and pressure relief, cell material wicking and wetting improvements, and the repeatable manufacture of such components and battery characteristics. In addition, the ability to develop and integrate prototypes for field experiments and/or tests in a simulated environment for the MK21 Reentry Vehicle, at a minimum. The results of this effort are proof of technological feasibility and assessment of subsystem and component operability and producibility. The Technology Readiness Level of this Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc battery technology should begin at 5 or higher. At the conclusion of this effort, this Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc battery technology should lead to subsequent development or procurement phases, or at a minimum have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the future years defense program (FYDP).

PHASE I: This is a D2P2 topic., and as such, no Phase I awards will be made. "Phase I-type" feasibility documentation should be provided that demonstrates reliable and repeatable remote activation, electrolyte delivery, and wetting in either Lithium Vanadium Pentoxide or Silver Zinc Battery Chemistries as it pertains to electrical performance. Documentation should consist of reports, data (experimental or otherwise), and any prototype testing that has been successfully completed.

PHASE II: Demonstrate significant improvements in battery and key performance parameters (battery capacity, internal leakage, rate capability, remote activation, shelf life, chemistry specific safety, etc.) and how they are improved by innovative delivery methods and configuration. Demonstrate compatibility of

the chosen process technology with volume manufacture. Demonstrate integration of the metric-enhanced battery with the MK21 Reentry Vehicle product target. Provide cost projection data to substantiate the design, performance, operational range, acquisition, and life cycle costs. Produce and provide repeatable quality Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc Reserve batteries for system level test and evaluation. Refine transition plan and business case analysis.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on demonstration of large volume manufacturability of either Reserve, Remotely Activated Lithium Vanadium Pentoxide or Silver Zinc Battery Chemistries, associated battery capacity, and performance goals. If successful, further work could include transitioning the proven and developed technology to the MMIII ICBM system, potentially the MK21 Reentry Vehicle System. Commercial applications include emergency power and other non-power long storage life applications. Military applications include aerospace and naval emergency power. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. 1. D. Linden and T.B. Reddy, eds., Handbook of Batteries, 3rd Edition, McGraw-Hill, New York, 2002.
2. Y. Li, H. Zhan, S. Liu, K. Huang, and Y. Zhao, J. Power Sources, Vol. 195, p. 2945, 2010.

KEYWORDS: Lithium Battery; Lithium Vanadium Pentoxide Battery; Silver Zinc Battery; Reserve Battery; Remotely Activated; ICBM Power

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AF231-D009 TITLE: Reserve, Remotely Activated Battery for Stage 1 Flight Control Unit for Minuteman III ICBM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants 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 purpose of this effort is to develop a Reserve, Remotely Activated Thermal Battery capable of providing power to the hydraulics for the Stage 1 Nozzle Control Unit (NCU) on the Minuteman III ICBM, where fast activation and high energy is required. Demonstrated performance under simulated ICBM environments.

DESCRIPTION: Reserve batteries serve a specialized purpose, they require fast electrolyte introduction and cathode wetting, but provide unsurpassed shelf-life since many of the reactions that lead to self-discharge cannot occur, due to the isolation of electrolyte from other active components. Thermal batteries are an ideal reserve battery as they are high energy density for the volume they provide, they also have an extensive shelf life with little to no degradation. Thermal Battery Chemistry is of particular interest as it can meet the fast activation time, storage life, and high energy density required of the Stage 1 Nozzle Control Unit, while providing high quality/reliable manufacturing. The anticipated advantage of technology advancements would be improved manufacturing capability and repeatable manufacture. This would provide improved reliability throughout production lots, reducing cost in future design and manufacture. Areas of research should include remote activation, pressure relief, thermal containment, and the repeatable manufacture of such components and battery characteristics. In addition, the ability to develop and integrate prototypes for field experiments and/or tests in a simulated environment for the Stage 1 Nozzle Control Unit, at a minimum. The results of this effort are proof of technological feasibility and assessment of subsystem and component operability and producibility. The Technology Readiness Level of this Reserve, Remotely Activated Thermal battery technology should begin at 4 or higher. At the conclusion of this effort, this Reserve, Remotely Activated Thermal battery technology should lead to subsequent development or procurement phases, or at a minimum have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the future years defense program (FYDP).

PHASE I: This is a D2P2 topic, and as such, no Phase I awards will be made. "Phase I-type" feasibility documentation should be provided that demonstrates reliable and repeatable manufacture as well as remote activation, pressure relief, and thermal containment in a Thermal Battery Chemistry as it pertains to electrical performance. Documentation should consist of reports, data (experimental or otherwise), and any prototype testing that has been successfully completed.

PHASE II: Demonstrate significant improvements in battery and key performance parameters (battery capacity, internal leakage, rate capability, shelf life, chemistry specific safety, etc.) and how they are improved by innovative delivery methods and configuration. Demonstrate compatibility of the chosen process technology with volume manufacture. Demonstrate integration of the metric-enhanced battery with the Stage 1 Nozzle Control Unit product target. Provide cost projection data to substantiate the design, performance, operational range, acquisition, and life cycle costs. Produce and provide repeatable

quality Reserve, Remotely Activated Thermal Reserve batteries for system level test and evaluation. Refine transition plan and business case analysis.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on demonstration of large volume manufacturability of Reserve, Remotely Activated Thermal Battery Chemistry, associated battery capacity, and performance goals. If successful, further work would include transitioning the proven and developed technology to the MMIII ICBM system, potentially the Stage 1 Nozzle Control Unit. Commercial applications include emergency power and other non-power long storage life applications. Military applications include aerospace and naval emergency power. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. 1. D. Linden and T.B. Reddy, eds., Handbook of Batteries, 3rd Edition, McGraw-Hill, New York, 2002.
2. Y. Li, H. Zhan, S. Liu, K. Huang, and Y. Zhao, J. Power Sources, Vol. 195, p. 2945, 2010.

KEYWORDS: Thermal Battery; Reserve Battery; Remotely Activated; ICBM Power

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AF231-D010 TITLE: Digitization and Management of Authoritative Resources

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): 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. Applicants 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. Applicants are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: There are many documents developed during the procurement of Air Force systems. They provide technical and operational instructions/policies that evolve throughout time. In some cases, it is difficult to determine which document is the authoritative resource (the most current policy/guide). Authoritative resources are a significant factor in the success of developing and integrating tools and infrastructure to facilitate the adoption of Digital Engineering. We are seeking alternatives to establish digitization of such tools and practices. These efforts require resource models and a general way to provide precise descriptions of how to manage such resources. Digitization also requires that the notion of a document and its elements can be distributed, but still be authoritative. The theme may include published reports, patents and lessons-learned materials. The mechanisms, including distributed versioning and tagging and security levels, need to be specified and be part of the resource model. Tooling should allow business rules to be defined around the resource model to establish required and best practices during and maintaining the resource lifecycle. Additionally, resources that are authoritative must be accessible to a variety of stakeholders. These stakeholders desire different views of the resource representing their needs and concerns. For example, the warfighter maintaining a system in the field may utilize a Technical Order (TO) to determine what kind of screwdriver is needed to accomplish the task. However, that information is not relevant to a general officer at the Pentagon who is reviewing TOs to evaluate mission readiness. Other stakeholders may or may not require information on required tools; being able to view resources in multiple ways will greatly increase efficiency in acquisition, operations, and sustainment. At the end of Phase II, we anticipate the development of a system that meets these considerations. This system will process resources used by AFNWC, preserve authority and security, and be accessible to a variety of users.

DESCRIPTION: Examples of resources used by AFNWC will be provided to aid development and for verification and validation. The system will be developed with security in mind, but no classified information will be processed during Phase II. Authority to Operate (ATO) will be pursued from the start of the Phase II contract, as it will be critical to transitioning the finished system. A system developed for general use will require adaptations for AFNWC needs. These adaptations will be needed to address security concerns, resource management, and record keeping, among other topics. Extensive testing will be conducted to verify system effectiveness for resources used within AFNWC. Successful development will enable the system to be deployed in AFNWC acquisition programs. AFNWC needs a contractor to develop or modify an application for digitization and management of authoritative resources. The application will be tailored to process AFNWC data, provided at the start of the contract. ATO will be achieved by the end of Phase II. Training on use of the application will be provided, and demonstration of the application at the end of Phase II will be used to facilitate transition to Phase III. Status meetings will occur at least monthly, with quarterly written reports submitted.

PHASE I: This is a D2P2, and as such, no Phase I awards will be made. In order to meet the D2P2 Topic requirement, applicants must show feasibility by demonstrating familiarity with technology used to

digitize paper-based documents in to a format that is understandable by computers. This is not simply scanning and Optical Character Recognition; information captured should be able to be utilized in areas such as system models. A working platform is desirable. Modifications to the platform will be needed in order to meet AFNWC needs.

PHASE II: Phase II will focus on adapting an existing solution to be used in AFNWC-specific areas. Example resources used by AFNWC will be provided. These will be used to guide development; additional resources will be used for verification and validation of the solution. A successful Phase II solution will be able to process AFNWC resources into a fully digital form, while preserving authority and security. This digital form will be accessible to a wide variety of stakeholders.

PHASE III DUAL USE APPLICATIONS: Phase III efforts will be centered around transitioning the product to a program of record for use in real-world situations. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. "Accelerate Change or Lose," General Charles Q. Brown, Jr., United States Air Force, August 2020.

KEYWORDS: Digitization; Digital Transformation; Authoritative Source of Truth;

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AF231-D011 TITLE: AI for Systems Engineering Assessment Model (SEAM) activities

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. Applicants 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. Applicants 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 Department of Defense requires programs to implement sound systems engineering practices. The Air Force utilizes the Systems Engineering Assessment Model (SEAM) to promote the application and use of standard systems engineering processes across the Air Force and improve performance of the processes within programs. The Air Force Nuclear Weapons Center would like an Artificial Intelligence or other software application that will review program documents, products and models and generate metrics that describe how well the artifacts meet key tenets of Air Force SEAM process. In addition, the center desires to have the application generate reports correlating strengths and weaknesses of the artifacts where they adequately address Air Force policies and areas where the documents/models do not fully comply with policy, and recommendations for improvement.

DESCRIPTION: The Air Force Nuclear Weapons Center would like a contractor to develop an application that will be hosted on a government network and used to review multiple process models or documents in accordance with the government's Systems Engineering Assessment Model (SEAM) practices. The contractor will work with the government to document metrics. The contractor will hold at least quarterly technical interchange meetings with the government to review progress and work through issues. The contractor will also hold monthly status meetings with the government and provide status reports. The contractor will perform work with the government security teams to ensure the application can be installed on the government network. Before completion, the government would like training on the delivered application, a final demonstration using government furnished documents and process models, source code and technical documentation as well as any cybersecurity related documents for the delivered product.

PHASE I: This is a D2P2 topic, and as such, no Phase I awards will be made. As part of the "Phase I-type" feasibility demonstration, applicants shall provide evidence of their firms' experience developing AI/ML applications that can perform similar tasks. A report of at least one similar application describing the application, solution and scale of effort shall be included.

PHASE II: Develop and deliver an AI application that will be hosted on a government system and used to review AFNWC program artifacts and generate reports. The contractor will deliver training materials, software and supporting documentation as well perform one formal training session for up to 25 students.

PHASE III DUAL USE APPLICATIONS: The effort can be expanded to review program technical documents and models and perform assessments based on design review criteria (e.g. SRR, PDR, CDR, etc…). The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. Air Force Systems Engineering Assessment Model Management Guide, Version 2. Air Force Inst of Tech, Wright-Patterson AFB, OH, USA, Sep 2010. Accessed: Aug, 18, 2022. [Online]. Available: https://apps.dtic.mil/sti/pdfs/ADA538786.pdf

KEYWORDS: Artificial Intelligence; machine learning; systems engineering assessment model; SEAM

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AF231-D012 TITLE: Digital Engineering Technologies

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

OBJECTIVE: We are seeking digital engineering solutions (methods, processes, and tools) to transform the engineering, research, requirements, acquisition, test, cost, and sustainment communities. Examples include code inspection to facilitate cyber security, business management and process solutions, modelling and simulation, and data analysis/validation solutions to facilitate nuclear surety certification activities.

DESCRIPTION: AFNWC's Digital Engineering Strategy has clear alignment with OSD's DE Strategy. Below are the goals that AFNWC has not only adopted, but incorporated into their acquisition strategy: 1. Formalize the development, integration, and use of models to inform enterprise and program decision-making 2. Provide an enduring, authoritative source of truth (ASoT) 3. Incorporate technological innovation to improve the engineering practice 4. Establish a supporting infrastructure and environments to perform activities, collaborate, and communicate across stakeholders to include Enterprise Protection/Defense 5. Transform the culture and workforce to adopt and support digital engineering across the lifecycle AFNWC is building a secure, cloud enabled Digital Engineering System (DES) which is the collective capability intended to provide capabilities for ICBMs. The DES supports Management & Operations (non-mission ops); Engineering Design; Test and Evaluation; Acquisition and Product Support/Maintenance. The DES is built upon on 3 key pillars: • IT Infrastructure Services: In order to ensure AFNWC is able to deliver the next generation of nuclear deterrence, we need to have a resilient and scalable IT infrastructure to support our growing enterprise • Data Integration: MBSE and DE drives integration of data and capabilities. AFNWC requires an environment that integrates data in a way that supports decisions through timely and accurate information • Decision Analytics and Visualization: Establish the sources of data, analytic structures, and methods & implement the capabilities required to support decision-making and exercise situational control within the limits of understanding

PHASE I: This is a D2P2 topic, and as such, no Phase I awards will be made. This topic is intended for technology proven ready to move directly into a Phase II. Applicants are required to provide detail and documentation in their proposals which demonstrates accomplishment of a "Phase I-type" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. The feasibility study should have: -Identified the prime potential AF end user(s) for the non-Defense commercial offering to solve the AF need, i.e., how it has been modified; -Described integration cost and feasibility with current mission-specific products; -Described if/how the demonstration can be used by other DoD or Governmental customers.

PHASE II: AFNWC is seeking a wide award of solution to enhance the DES. The three use cases below are of priority to ANFWC, but a wide range of innovative ideas are encouraged. 1) Enhance the usability of the significant quantity of data present in DES as a result of wide adoption digital engineering techniques o Using modern DE practices enable fine-grained control of classified information o Appling open architecture techniques to enable data exchange and interoperability o Appling DE practices to enable full discovery and traceability of data lineage as it changes over time o Automating data movement leveraging deployed Cross-domain Solutions (CDSs) to support "high frequency" data analytics and DevSecOps software development across multiple classifications which fully support SAP community requirements 2) Continue to drive to an end-to-end, automated, "unified" approach to certification and fielding of ICBMs systems requiring a human in the loop, only where necessary. Certification standards can be located within AFMAN 91-118 and DAFMAN 91-119 through https://www.e-publishing.af.mil/. o Reduce staffing burden through automated body of evidence generation and integration encompassing cyber, system safety, nuclear surety, system test, and program protection teams o Automating many of the routine processes need to ensure the system is safe, secure, and effective 3) Conduct research on the feasibility with demonstration on integrating real-time supply chain illumination into a MBSE engineering digital environment using industry standard application(s) o Supply Chain Risk Management (SCRM) activities are conducted in separate, "siloed" systems that do not communicate/integrate into the DES except through manual inputs and SME recommendation o AFNWC is interested in identifying, developing and integrating an automated with human in the loop solution to incorporate SCRM data into AFNWC models The outlined use cases are not all-inclusive to AFNWC needs and a candidate is not required to cover all identified use cases. Below are some key information required to properly evaluate the applicability and feasibility of a proposed solution: • How it will solve a DE challenge? • How does the identified solution support AFNWC needs? • How it will operate in an environment across different classification systems? • How will this solution enable and/or support collaboration across multiple stakeholders (government, industry, and academia) that support different aspects of AFNWC systems? • What is the proposed plan to meet cybersecurity requirements to support AFNWC needs? • What is the intended transition plan post-PII? o The transition plan must include the proposed business model (licensing, PaaS, SaaS, etc.), any further development needed, sustainment needs for continued operations, and what would it take to support further development or capability increase as requirements change over time, etc.

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded mission capability to a broad range of potential government and civilian users and alternate mission applications. Direct access with end users and government customers will be provided with opportunities to receive Phase III awards for providing the government additional research & development, or direct procurement of products and services developed in coordination with the program.
The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. Certification standards can be located within AFMAN 91-118 and DAFMAN 91-119 through https://www.e-publishing.af.mil/ ;
2. DoD Data Strategy: https://media.defense.gov/2020/Oct/08/2002514180/-1/-1/0/DOD-DATA-STRATEGY.PDF ; DoD DE Strategy: https://ac.cto.mil/digital_engineering/

KEYWORDS: Data management; Digital Thread; Onthology; Configuration Management; Classified Systems; Certification; Cybersecurity

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AF231-D013 TITLE: Intercontinental Ballistic Missiles (ICBM) Test Technologies

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

OBJECTIVE: Reentry vehicles release parameters from bulkhead are critical to its flight dynamics and reentry performance of ICBMs. AFNWC seeks to develop a prototype that is able to be qualified for flight test and perform a successful post-flight data decryption and analysis

DESCRIPTION: AFNWC ensures the ICBM force is equipped with the safest, most reliable, most survivable Reentry Systems, and explores options for common, multi-mission capabilities. The program enables a responsive engineering infrastructure by developing modeling/simulation and ground and flight test platforms to support Reentry System qualifications. The program ensures the availability of long-lead components and materials while identifying life cycle cost reduction methods. In addition, the program matures and tests advanced Reentry System technologies and designs to meet future requirements. This includes studying and assessing technology applications relevant to current and future ICBM Reentry Systems. The program leverages investments by the Science & Technology community and reentry systems applications program. Testing may occur on a space available basis on Development Evaluation (FDE) flights.

PHASE I: This is a D2P2 topic, and as such, no Phase I awards will be made. This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a “Phase I-type” effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. The feasibility study should have: -Identified the prime potential AF end user(s) for the non-Defense commercial offering to solve the AF need, i.e., how it has been modified; -Described integration cost and feasibility with current mission-specific products; -Described if/how the demonstration can be used by other DoD or Governmental customers.

PHASE II: AFNWC seeks an instrumented payload flight prototype that provides high-fidelity release and post-release dynamics and signature data (video, radar, IR, etc.) via encrypted telemetry methods. The sensor package can be either a bolt-on or releasable solution for collecting data without interference on other payloads. Must have the capability to: • Measure release dynamics (tip-off, spin-up, velocity, acceleration rates and errors, etc.) • Measure video and signature data (HD video, SWIR/LWIR, MMW radar, etc.) o Sensor package may include sensors such as IR sensor(s), camera(s), radar(s), and/or Laser Detection And Ranging (LADAR), etc. • Encrypt and transmit using NSA-Approved cryptography methods for classified data (e.g. AES-256)

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded mission capability to a broad range of

potential government and civilian users and alternate mission applications. Direct access with end users and government customers will be provided with opportunities to receive Phase III awards for providing the government additional research & development, or direct procurement of products and services developed in coordination with the program. The information and materials provided pursuant to or resulting from this topic are restricted under the ITAR, 22 C.F.R. Parts 120 - 130 or the EAR, 15 C.F.R. Parts 710 - 774.

REFERENCES:

1. Information regarding Capabilities-Based Test and Evaluation and operations can be located within AFI 13-520 and AFI 99-103 through https://www.e-publishing.af.mil/

KEYWORDS: Reentry System technologies; telemetry; cryptography

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AF231-D015 TITLE: Thermal Flux Data Collection Instrument and Data Processing Methods for Concentrated Radiant Energy Beam Target Surface Thermal Exposure Characterizations

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

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

OBJECTIVE: This SBIR technology development request is intended to further advance thermal flux data collection methods for applications in characterizing thermal flux profiles on concentrated radiant energy beam targets.

DESCRIPTION: diverse thermal effects on thermally exposed test asset surfaces. The currently used concentrated radiant energy beam has a peak irradiance of 350 W/cm2 over an approximate 1 m diameter target area. The area of interest on target is an approximate 4 inch square test asset. Although Infrared (IR) cameras can be used to characterize concentrated radiant energy beam incident temperature distributions over the target surface, test equipment configuration can constrain IR camera positioning and consequently limit heat flux profile image quality over the area of interest. Relevant IR camera temperature range and accuracy specifications are provided below for reference. • Range –20 to 120°C (–4 to 248°F): o –20 to 100°C (–4 to 212°F), o accuracy ±2°C (±3.6°F) o 100 to 120°C (212 to 248°F), o accuracy ±2% • Range 0 to 650°C (32 to 1202°F): o 0 to 100°C (32 to 212°F), o accuracy ±2°C (±3.6°F) o 100 to 650°C (212 to 1202°F), o accuracy ±2% • Range 300 to 2000°C (572 to 3632°F): o accuracy ±2% Flux gages can also be used for collecting target area flux data. Although it is possible to recreate a flux distribution from flux gage data through the use of computational methods, the number of flux gages used, and their position relative to the test asset, do not provide sufficient data points to recreate a high resolution heat flux profile over the area of interest. Software tools for recreating detailed flux profiles from flux gage data have also not been formally developed. The development of a new technology for collecting high resolution thermal flux data over an approximate 4 inch square exposed to a maximum of 350 W/cm2 is requested. The technology must not interfere with the radiant energy beam, and should provide a resolution equivalent to, or reasonably near to, the listed relevant IR camera accuracy for the given ranges. Flux data points must be collected at a maximum spacing of 0.5 inch radius between each data collection point within and encompassing the 4 inch square area of interest. If additional data processing methods are required for obtaining a complete usable flux profile data set, the processing methods or accompanying software tools must be provided. Any processing procedures, algorithms, numerical methods applications, or related computational processes should also be included within the proposed technology documentation where applicable.

PHASE I: This is a D2P2 topic, and as such, no Phase I awards will be made. Applicants must demonstrate completion of a "Phase I-type" effort, and the proposed technology must be validated through sufficient studies and feasibility assessments. The studies will be documented in a report detailing theory behind the technology, and an analysis of alternative solutions within the scope of the presented theory. A rational for the selected concept must be Included in an analysis of applicable alternative solutions. A prototype and preliminary experimental data with included analyses are favorable and should be included as part of the feasibility assessment. A technology development plan and a detailed

technology verification plan referencing the theory and proof of concept design will be composed and reviewed as part of this phase. If the technology includes the use of computational methods and software tool developments, a software development plan should also be composed in phase I.

PHASE II: A rationale for the selected concept must be included in an analysis of applicable alternative solutions. A prototype and preliminary experimental data with included analyses are favorable and should be included in the final deliverable. The development will include procurement of test assets, instrumentation, and any accompanying software tools. Development will also include testing as necessary for verifying milestone criteria in the development plan has been reached.

PHASE III DUAL USE APPLICATIONS: Phase III will include full system testing of the technology. The technology will be tested under operational conditions. Data fidelity will be assessed under criteria agreed upon in the phase I verification plan. The collected data a system performance will also inform analyses for possible diverging application of the technology. Such application include but may not be limited to rocket engine wall heat flux data collection and analysis methods, concentrated solar renewable energy solar beam receiver flux characterizations, and laboratory applications in high capacity thermal source data collection.

REFERENCES:

1. R. D. Neumann, “Thermal Instrumentation A State-of-the-art Review,” WPAFB/AFMC Wright Laboratory Aerospace Propulsion & Power Directorate Technical Report WL-TR-96-2107, December 1993, The University of Dayton Research Institute, Dayton, OH, https://apps.dtic.mil/sti/pdfs/ADA315205.pdf

KEYWORDS: Data collection; Data processing; Instrumentation; Thermal Flux; Heat Transfer; Infrared; Concentrated Solar; Materials; Software; Computation; Sensors; Directed Energy

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AF231-D016 TITLE: Seal Bond Removal

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

OBJECTIVE: To develop a pulse hand-held laser to remove nitrile-phenolic resin from aircraft surfaces.

DESCRIPTION: Hand-held laser technology developed for aircraft skin paint removal has not been tailored for nitrile-phenolic film adhesive removal, partly because the nitrile-phenolic film adhesive is a niche application – it falls between the realm of structural bonding and sealing. The F-16 makes extensive use of nitrile-phenolic heat cured adhesives. Breaking the adhesive bonds requires cryogenic treatment to induce brittleness and leaves a significant amount of residue on parts. At present this residue is removed using 100% methyl-ethyl-ketone (MEK) and non-metallic scrapers. This method is extremely time consuming, but sanding and similar methods are not appropriate because many of the bonded components are fracture critical parts (surface must not have scratching or gouging to minimize the risk towards developing cracks). A method that would quickly and fully remove the residue without damaging the parts would represent a significant time savings and would remove 100% MEK from the work environment. To fulfill the objective of removing the residue after the cryogenic treatment, new methods are being researched and tested. PACAF depot contractor Korean Airlines uses a locally made portable water jet for removal. However, as the water jet is locally made, it is not available for Hill AFB or USAFE. This approach also generates a need to remediate the wastewater stream. Another method that has been tested but not approved is a hand-held pulse laser system. The laser system has proven to remove the adhesive, but testing has not been done with regards to structural fatigue or environmental concerns regarding decomposition.

PHASE I: FEASABILITY DOCUMENTATION. For this Direct-to-Phase II topic, applicants must demonstrate the feasibility to remove Nitrile-Phenolic heat cured adhesives (FMS-3014) in an aircraft maintenance environment.

PHASE II: Develop a working prototype to remove nitrile-phenolic adhesives from F-16 aircraft components. A complete successful nitrile-phenolic adhesive removal hand held laser prototype would be demonstrated through tests as recommended by the F-16 System Program Office.

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. Matthew Campbell, Laser System for Supplemental Coatings Removal Test Plan, ADB379774;
2. Ms. Shanna Denny, Mr. Juan Valencia, and Mr. Mark Phillippi, Mr. Jim Arthur, Optimization Of Aircraft Laser Coating Removal Processes Final Report, ADB397147;
3. Ms. Shanna Denny and Mr. James Arthur Jr., Optimization Of Aircraft Laser Coating Removal Processes Test Plan, ADB387150;
4. Shanna Denny/Matthew Campbell, Develop and Demonstrate Hand-Held Aircraft Laser Coating Removal in a Production Environment Final Report, ADB393963;
5. Mongelli, Gerard, Portable Handheld Laser Small Area Supplemental Coatings Removal System Final Report, ADA606886.

KEYWORDS: Bond seal removal; Nitrile-Phenolic

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AF231-D017 TITLE: Zero-Trust Data Fabric for Industrial Internet of Things

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

OBJECTIVE: To develop a robust zero-trust data fabric for industrial internet of things addressing Air Force sustainment and other interests

DESCRIPTION: Recent years have witnessed the rise of Industrial Internet of Things (IIoT), a newly emergent networking paradigm that connects pervasive sensors, instruments, and other devices networked together with computers' industrial applications, including manufacturing and energy management. Furthermore, powered by interconnected devices in IIoT, industrial enterprises have entered a new age of "big data", where the volume, velocity and variety of sensory data they manage are exploding at relatively high rates. Such big sensory data constitutes the largest-ever information source that covers almost every aspect of manufacturing, and this has fundamentally changed the ways that products are made and delivered. However, this big treasure trove of information has also posed great challenges on the design and development of IIoT. Currently, one major challenge confronting us is how to store and share the big sensory data in a secure and privacy-aware manner in order to facilitate complex computing and data analysis tasks. To address this challenge, there is a need to develop a zero-trust data fabric for IIoT. This environment should initialize Cloud Native Access Point technologies at the ATHENA hybrid cloud edge to fully integrate with current security advancements in our Operational Technology ecosystem. It should further functionally bring Zero Trust Architecture from outside the DOD boundary to current and future OT networks. In this infrastructure, enterprises' sensory data will need to be encrypted and stored in a peer-to-peer distributed file system. Each enterprise will need to possess full control on its own data, and only the parties who get permission from this enterprise will need to access the raw data. Additionally, the developed data fabric in this scenario would need to support privacy-aware and auditable data indexing and query, with each enterprise in this infrastructure dynamically specifying and adjusting the privacy level of its respective data.

PHASE I: FEASIBILITY DOCUMENTATION. For this Direct-to-Phase II topic, applicants must show feasibility by demonstrating the ability to i.) design data encryption and access control schemes, ii.) design an encryption scheme that enables each enterprise to encrypt its data in an efficient way, iii.) design a scheme that will support multi-key encryption so that the disclosure of a single key will not lead to any privacy leakage, which provides strong privacy protection in zero-trust environments, and iv.) design an access control scheme based upon each enterprise having full control of its own data.

PHASE II: Create an environment initializing Cloud Native Access Point technologies at the ATHENA hybrid cloud edge to fully integrate with current security advancements in our Operational Technology ecosystem. Functionally bringing Zero Trust Architecture from outside the DOD boundary to current and future OT networks. Estimated requirement is $1.8M with potential for additional funds from AFSC beginning in mid FY23.

PHASE III DUAL USE APPLICATIONS: The developed zero-trust data fabric is proliferated to multiple commercial applications. A successful infrastructure would be marketed to commercial manufacturing, aerospace industry, and other customers. Additional markets could include the smart homes, construction, and power industries.

REFERENCES:

1. Chenglin Miao, Wenjun Jiang, Lu Su, Yaliang Li, Suxin Guo, Zhan Qin, Houping Xiao, Jing Gao, and Kui Ren, "Privacy-Preserving Truth Discovery in Crowd Sensing Systems", ACM Transactions on Sensor Networks (TOSN), Vol. 15, No. 1, 2019. ;

2. Chenglin Miao, Qi Li, Houping Xiao, Wenjun Jiang, Mengdi Huai, and Lu Su, "Towards Data Poisoning Attacks in Crowd Sensing Systems", the 19th ACM Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc), Los Angeles, USA, June 2018. ;
3. Chenglin Miao, Lu Su, Wenjun Jiang, Yaliang Li, and Miaomiao Tian, "A Lightweight Privacy-Preserving Truth Discovery Framework for Mobile Crowd Sensing Systems", the 36th

KEYWORDS: DATA FABRIC; INTERNET OF THINGS

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AF231-D018 TITLE: Laser Paint Mapping System

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

OBJECTIVE: develop a robotic paint stripping system capable of measuring and mapping the varying thicknesses of paint layers on an aircraft or on aircraft components, thereby enabling the removal of paint or primer via laser projection without causing damage to substrates.

DESCRIPTION: current standard practices for aircraft "depainting" include hand-sanding, chemical stripping, media blasting, among other means. Manual sanding involves sanding of existing paint layers before application of new paint. This practice is labor intensive and increases the weight of the aircraft by not removing unnecessary paint and/or primer layers. Sanding also generates dust containing materials hazardous to workers. Chemical stripping and media blasting removes all paint, but cannot be utilized on all substrates and also generates substantial amounts of hazardous waste. One solution to these issues is the use of robotic laser depaint technology. Current robotic laser stripping systems are limited by color-based sensors, leaving the potential for imprecise paint removal and costly substrate damage, particularly when employed on composite airframes. A technology is being sought to measure the varying thicknesses of paint in real-time compliant with the width of the laser raster such that laser power can be controlled by the measured thickness and layer type. This data will be modeled in three-dimensional (3D) form for review. The mapping data should exhibit extreme precision and accuracy and the 3D model shall be capable of differentiating between paint, primer, and other common materials. This high level of detail will allow for precise dynamic adjustments in laser power to ensure thorough removal of all paint and primer layers without damage to the aircraft. Applications for this technology span both military and civilian realms. For example, the application can be used for either on-aircraft or off-aircraft depaint operations in military and private aircraft maintenance and similar operations. This technology development would prove to be new and useful among the state of the art.

PHASE I: FEASIBILITY DOCUMENTATION. For this Direct-to-Phase II topic, applicants must demonstrate feasibility by showing the ability to measure thickness of paint layers. Applicants must demonstrate accuracy of laser paint stripper to adequately respond to mapping data.

PHASE II: Develop working prototype to measure and map paint thicknesses over complex aircraft components. Complete successful robotic laser paint stripping utilizing mapped data.

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. 1. Ceballos, D., West, C., Methner, C.-S., & Gong, W. "Evaluation of Chromium, Hexavalent Chromium, Cadmium, and Isocyanate Exposures in an Aircraft Refinishing Plant." May 2017, https://www.cdc.gov/niosh/hhe/reports/pdfs/2013-0011-3278.pdf
2. Jordan, Holly. "AFRL Helps Enable Laser Paint Removal Technology." Wright-Patterson AFB, 6 Feb. 2018, www.wpafb.af.mil/News/Article-Display/Article/1433126/afrl-helps-enable-laser-paint- removal-technology/.
3. Verger, Rob. "The Best Way to Strip Paint off a Fighter Jet? Laser-Wielding Robots." Popular Science, 19 Nov. 2019, www.popsci.com/story/technology/air-force-laser-robots-depaint-f-16/.

KEYWORDS: laser; depaint; mapping;

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AF231-D019 TITLE: Bolt Hole Eddy Current (BHEC) Signal Indication Interpretation

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

OBJECTIVE: Develop advanced guidance capabilities for the interpretation and evaluation of BHEC signals.

DESCRIPTION: Sub optimal inspector performance in the interpretation and evaluation of BHEC signals is currently rated by AFSC Nondestructive Inspection (NDI) Program Managers as one of the most pressing issues. Inaccurate interpretation and evaluation is driving unnecessary maintenance which increases the risk of maintenance induced damage, excess material removal, and related deleterious effects. The intent of this solicitation is to integrate and build upon existing technologies to pull video output from the nondestructive inspection (NDI) equipment, limited augmented reality (AR)-based capability refresher and visualization tools developed by Air Force Research Laboratory (AFRL), and advanced learning methods. This integrated guidance could include reference video indications from various hole conditions (such as nicks, gouges, burrs, corrosion, layer, shims, and related damage modes), information from tutorials developed by AFRL and an equipment manufacturer to allow realistic interpretation of indications from the cited fastener hole conditions. All material will be recreated in the AR environment. The guidance would include multiple modules and examples for the inspector to interpret and evaluate, be evaluated on their performance and be provided feedback to meet anticipated levels of proficiency. Ideally the AR-based capability will be fully interactive. The developed capability will be modular and organically editable for easy modification, updates, and minimize cost to implement.

PHASE I: Ability to project eddy current instrumentation screens onto test articles Ability to overlay a virtual representation of the eddy current instrument onto an actual eddy current instrument using augmented reality Ability to use commands in augmented reality to control an actual instrument.

PHASE II: Develop an AR capability to perform diagnostics on eddy current BHEC inspection results of fastener holes with irregularities that inhibit easy interpretation or disposition. System has capability to distinguish between gouges [circumferential, helical and axial], oblong holes, out of roundness, burrs, corrosion, cracks, steel contamination, corner crack, mid-bore crack and through thickness crack. AR system should overlay representative impedance plane data over instrument response and provide feedback to inspectors to facilitate inspector interpretation of results from the actual inspection. Characterization of variance (i.e. different bolt conditions) has a threshold accuracy of 75% with an objective of 90% accuracy. The AR capability should be integrated into commercially available systems. In addition, the AR module should be agnostic to a specific hardware configuration.

PHASE III DUAL USE APPLICATIONS: Contractor shall implement, deploy and provide initial training of the final guidance platform at the aircraft NDI units at Ogden, Warner-Robins, and Oklahoma City Air Logistics Complexes. The contractor shall also include a deployment plan and cost analysis for field level implementation to be delivered to the AF NDI Program Office.

REFERENCES:

1. 1. INTERPRETATION GUIDE And TUTORIAL, Eddy Current Inspection of Boltholes, T.W. Guettinger ;
2. Bolt Hole Eddy Current Signal Interpretation, Ken LaCivita, John McClure, Dave Stubbs, Dan Laufersweiler ;
3. "Leveraging Augmented Reality - a Nondestructive Evaluation Case Study" 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 EN-SB-08-012,

Revision D, In-Service Inspection Crack Size Assumptions for Metallic Structures **"Distribution A presentation available to all who request it during pre-release discussion period. Once the solicitation is accepting proposals, it will be posted on SITIS Q&A site for this topic."**

KEYWORDS: NDI; bolt hole; eddy current; bolthole, augmented reality, AR, guidance

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AF231-D020 TITLE: Improved Weather Sensor Analysis Algorithms via Machine Learning

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

OBJECTIVE: Air Force Weather develops, tests, fields, modernizes, and sustains fixed and deployed ground-based weather sensor systems at locations around the world. Recent and near-term upgrades to tactical and fixed-base sensors include added digital sky cameras, higher resolution in-situ sensors, and data aggregation in a cloud-based platform. As an exploitation gap example, the digital sky cameras are currently only exploited by manual, human-visual processes and informally. Employing machine learning to build upon and create new weather sensor algorithms has great potential to provide additional and/or streamline local area environmental intelligence and to increase fidelity of understanding environmental impacts to operations in planning and execution. This intelligence is cumulative and adds to a global understanding of the environment, including accuracy/fidelity of regional and global weather physics and machine learning-based models.

DESCRIPTION: Describes what limitations and constraints this solution will need to operate under (ie nuclear certification): Processing and data of sensor data at the local level is limited to non-server based compute and imbedded firmware processors. Processes and tech stack will need to be established to optimally aggregate sensed data for machine learning training. What is the minimum desired Technology Readiness Level (TRL)? TRL 3 (Analytical and experimental critical function and/or characteristic proof of concept) What resources do you have? (i.e. Gov data, additional money, Gov equipment, etc): AF Weather Virtual Cloud (AFW VPC) Continuous Integration/Continuous Delivery (CI/CD) tools and processes can be utilized for software development and software deployment. The AFW VPC also hosts a MLops platform that can be utilized for data curation, experimentation, model training, and model metrics. The Weather Engineering Facility at Hanscom AFB, MA, hosts all types of AF Weather ground-based sensors and can be leveraged for systems engineering and machine learning algorithm employment evaluation processes. The government will supply additional supporting data, if available, if requested. Air Force Weather develops, tests, fields, modernizes, and sustains fixed and deployed ground-based weather sensor systems at locations around the world. Recent and near-term upgrades to tactical and fixed-base sensors include added digital sky cameras, higher resolution in-situ sensors, and data aggregation in a cloud-based platform. As an exploitation gap example, the digital sky cameras are currently only exploited by manual, human-visual processes and informally. Employing machine learning to build upon and create new weather sensor algorithms has great potential to provide additional and/or streamline local area environmental intelligence and to increase fidelity of understanding environmental impacts to operations in planning and execution. This intelligence is cumulative and adds to a global understanding of the environment, including accuracy/fidelity of regional and global weather physics and machine learning-based models.

PHASE I: This topic is slated to compete for a Direct-to-Phase-2 (D2P2) topic with no Phase I SBIR portion. Therefore, direct documentation and a feasibility demonstration of using Machine Learning to generate additional observational data based on weather sensors (such as using visual observation encoding techniques mentioned above) beyond current capabilities is paramount for consideration.

Additionally employing Machine Learning to augment collection and fidelity of gathered data is desired. Develop a conceptual design and approach for using Machine Learning to exploit newer sensing capabilities and data. Deliverables for consideration include a report or presentation demonstrating the conceptual design, Machine Learning implementation and benefit to current weather observation techniques for Phase II consideration.

PHASE II: Develop and demonstrate a proof-of-concept prototype system based on the preliminary research and designs presented for consideration.

PHASE III DUAL USE APPLICATIONS: Operationalize the prototype for existing tactical and fixed-base site sensor data.

REFERENCES:

1. Weather Machine Learning Platform (WxMLP): https://m.facebook.com/NextGenFed/photos/nextgen-was-selected-to-brief-at-the-recent-air-force-research-laboratory-afrl-a/4272594109440865/;
2. AF Weather Web Services: https://weather.af.mil/

KEYWORDS: weather; observation; observing; modeling; environment; data; generation; Machine Learning; ML; Artificial Intelligence; AI; ground-based; sensor; cloud-based; exploitation; digital; visibility; sky; camera

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AF231-D021 TITLE: Innovative Technology to Automatically Build/Update Required Acquisition Milestone Documentation

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

OBJECTIVE: This is a Department of the Air Force (DAF) Special Topic in partnership with AFLCMC/WLZ. This topic is seeking technologies for transition into the United States Air Force. Primary objectives of this topic include exploring innovative technologies applicable to both defense and non-defense markets, scaling capability, and growing the industrial base for defense. This topic is intended to reach companies capable of completing a feasibility study and prototype-validated concepts under accelerated Phase I and II schedules. This topic is aimed at applied research and development efforts rather than "front-end"; or basic R/R&D. The end state of this project would be a web-hosted/cloud database that provides users automated consolidation of program deliverables to meet DoDD 5000.01 directives for reports/plans that support milestone requirements (entrance/exit approvals) DoDD 5000.1 series provides the framework for acquiring systems. This framework includes a series of technical reviews including but not limited to System Requirements Review (SRR), System Design Review (SDR), Software Specification Review (SSR), Preliminary Design Review (PDR), and Critical Design Review (CDR) among others. Historically, documents such as MIL-STD-1521, Technical Reviews and Audits for Systems, Equipment, and Computer Software, or the United States Air Force Weapon Systems Soft and applicable required domains. This database should be cloud-deployed on relevant networks meeting DoDD cyber requirements. System will use contractor approved systems for this effort that can to be transferred to DoD/USAF standards upon completion for USG demonstration and use . This capability will provide real time dissemination of technical information supporting an acquisitions strategy plan by organizing, building and validating DoDD 5000.1 directives for milestone entrance and exit objectives. Updates will generate notification to assigned POC's and identify changes made and require linkage to updated documentation.

DESCRIPTION: The USAF acquisition process is heavy on regulatory requirements and documentation from a variety of technical expertise, functional areas, outside organizations and higher levels of leadership. AF programs have critical/technical reports and plans that have to be developed, approved and executed to produce, sustain and dispose of all acquisition assets. These regulatory documents/plans ingest numerous amount of data from a multitude of reports delivered in divergent formats and requirements. The USAF is looking for a digital system that can disseminate, organize and provide connection of data required from contractually deliveries to build reports, executed milestone activates and provide health assessment for entire programs. Additionally, this effort is to provide linkage between the reports/plans to enhance accuracy, timeliness and real-time updates to provide a true living document. Lastly, this effort should provide linkage between functional area reports/plans to minimize risk by maximizing accuracy of data from functional areas being reviewed to maintain an executable program.

PHASE I: This topic is Direct-to-Phase II for technology that is proven to be ready to meet the objectives within Phase II. As such, Phase I awards will not be made for this topic. Successful proposals will have documented detailed enough to demonstrate ability to meet objective within Phase II. The applicant is required to provide detail and documentation in the Direct to Phase II; effort, including a feasibility study, similar sample articles and customer feedback. This will include determining value and feasibility of functionality appearing to have both governmental commercial utility. It will be validated to meet the objective in Phase II between the proposed solution and a potential needs of Air Force and/or DoD stakeholder. The applicant should be able to present a feasible plan, utilizing known resources to meet and execute predetermined reports/plans as a sampling of the potential impact to meet the customer and end-users needs. The feasibility study should have; 1. Clearly identified the potential reports/plans of the adapted solution for meeting the Air Force and/or DoD need(s). 2. Described the conduit to

integrating with 5000.1 milestone required documentation, to include how the applicant plans to accomplish development, regulatory processes, and integrate with other relevant systems and/or processes to build reports/plan to meet user needs. 3. Described if and how the solution can be used by other DoD or Governmental customers.

PHASE II: Determine the possibility of a digital/technical approach and feasibility of ideas thought to have potential to process build/link required Milestone Acquisition reports/plans. Moreover, validate the probability to propose a solution to the USAF military/non-military stakeholders. This viability study should 1. Identify all stakeholders and required documentation to build identified reports/plans to meet Milestone entrance requirements. 2. Provide linkage to governing requirement, quick access linkage to documentation, organize in predetermined format and provide notification of missing/conflicting documentation missing data. 3. Store and update reports/plans as required to include notification of new or rescinded information supporting reports/plans. 4. Describe if and how the solution can be used by other DoD or Governmental customers.5. Reduce time required to build, validate, maintain and coordinate approvals. Example; Pulling data from contractual deliveries documentation to build a single report/plan for a Life Cycle Sustainment Plan that meets entrance/exit criteria as spelled out in DoDD 5000.1. Example Commercial application; System could be used to submit required documents that meet DoD formatting to minimize reformatting while meeting DODD 5000.1 required objectives.

PHASE III DUAL USE APPLICATIONS: Continue RDT&E to develop, install, integrate, demonstrate, and/or test and evaluate the prototype system(s) determined to be the most feasible solution during the Phase I feasibility study. These activities should focus specifically on; 1. Evaluating the adapted solution against the objectives and measurable key results defined in the Phase I feasibility study. 2. Describing in detail how the solution differs from the non-defense commercial offering to solve the Air Force or Space Force need and how it can be modified for scale. 3. The solution's clear transition path including consideration of all affected stakeholders' inputs. This would include, but not be limited to, end users, engineering, sustainment, contracting, finance, legal, and cyber security. 4. Providing specific details about the solution's integration with other current and future solutions. 5. Explaining the solution's sustainability, i.e., supportability. 6. Identifying other DoD or Governmental customers interested in the solution.

REFERENCES:

1. 1. LCSP Template; https;//www.dau.edu/tools/Lists/DAUTools/Attachments/12/LCSP%20Plan%20Outline%20Version%202.0%20-%2019%20Jan%202017.pdf;
2. ACQUISITION STRATEGY; Template; https;//ac.cto.mil/wp-content/uploads/2019/06/PDUSD-Approved-TDS_AS_Outline-04-20-2011.pdf;
3. Risk, Issue, and Opportunity Management; https;//www.dau.edu/tools/Lists/DAUTools/Attachments/140/RIO-Guide-January2017.pdf;
4. DoDD 5000.01; https;//www.esd.whs.mil/Directives/issuances/dodd

KEYWORDS: Acquisition; Milestone; Automation; Digital; Artificial Intelligence

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AF231-D022 TITLE: FARE - Fully Adaptive Radar Electronics (FARE)

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. Applicants 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. Applicants 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 new approaches targeting advanced radars employing Fully Adaptive and AI techniques. These counter-Fully Adaptive techniques (CFATs) must themselves employ advanced Fully Adaptive/AI techniques to counter a Fully Adaptive fully adaptive radar's (CoFAR) Observe, Orient, Decide, Act (OODA) loop, thereby degrading its performance. A complimentary set of advanced RF Digital Engineering (DE) tools must also be developed to support all phases of development, transition, and deployment.

DESCRIPTION: Fully Adaptive radar (FAR) has emerged as the next generation of highly adaptable systems for military applications. FAR uses both advanced AI techniques and full-adaptivity (transmit and receive) to "probe" the total radar environment (targets, clutter, jamming, etc.) to gain an optimal understanding of how to best prosecute its mission. This highly agile transmit probing is supported by advanced real-time adaptive waveform and MIMO techniques, high performance embedded computing (HPEC), knowledge-aided (KA) processing, model-based signal processing, and other AI techniques The goal of CFATs is to disrupt this channel learning OODA cycle thereby degrading its performance. These advanced techniques must themselves employ many if not all of the aforementioned Fully Adaptive systems techniques to: (1) Degrade a FAR's understanding of the environment to a degree sufficient to degrade its receiver-operator-characteristic (ROC) performance; and (2) Remain undetected to the victim FAR. This degree of sophisticated operation requires very high-fidelity, physics-based, modeling and simulation, and digital engineering tools for both the design phases, and subsequent transition and sustainment activities. The main deliverables will be sub-scale experiments, test, and demonstrations that advance Fully Adaptive radar capabilities.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I-like" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Relevant areas of demonstrated experience and success include M&S, cost benefit analysis, risk analysis, concept development, concept demonstration and concept evaluation, laboratory experimentation and field testing. Phase I type efforts should include the assessment of emerging Fully Adaptive capabilities and how they show a measurable value and operational impact. The result of Phase 1 type efforts is to assess and demonstrate whether algorithm can support the furtherance of counter-Fully Adaptive techniques (CFATs).

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a "Phase I-like" effort predominantly separate from the SBIR/STTR Programs. These efforts will include M&S, simulation of prototype concepts, cost benefit analysis, system-of-systems studies, experimentation

and evaluation of operational imperatives to enable future concepts. Prototypes, M&S and experimentation should explore a wide range of integrating commercial capabilities to support the operational imperatives. These capabilities should consider areas that are unique to military operations and have one or more real-world applications to serve as the pathfinder for the new CFAT approaches. Details of the new CFAT procedures shall be delineated in a manner sufficient to transition to established DoD organizations. A goal for Phase II efforts is to conduct sub-scale experiments and provide test articles for further test and demonstration. Experiments should address military-unique requirements that may not be otherwise met by commercial capabilities.

PHASE III DUAL USE APPLICATIONS: Phase III shall include upgrades to the analysis, M&S, T&E results and provide mature prototypes of system concepts. Phase III shall provide a business plan and address the ability to transition technology and system concepts to commercial applications. The adapted non-Defense commercial solutions shall provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications. Integration and other technical support to operational users may be required.

REFERENCES:

1. J. R. Guerci, Cognitive Radar, The Knowledge-Aided Fully Adaptive Approach, 2nd Ed. Norwood, MA USA; Artech House, 2020;
2. A. Farina, A. De Maio, and S. Haykin, The impact of cognition on radar technology. Scitech Publishing, 2017;
3. J. S. Bergin and J. R. Guerci, Introduction to MIMO Radar. Norwood, MA US, Artech House, 2018;
4. J. R. Guerci and E. J. Baranoski, Knowledge-aided adaptive radar at DARPA, an overview, Signal Processing Magazine, IEEE, vol. 23, no. 1, pp. 41-50, 2006

KEYWORDS: Cognitive techniques; adaptive radar; radio frequency digital engineering

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AF231-D023 TITLE: RADS - Radar Disruption Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Network Systems-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. Applicants 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. Applicants are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: This topic seeks to develop imaging radar disruption systems by using passive mechanical action for at least a portion of their functional mechanism. Mechanical motion is an alternative way to manipulate radar signals, as opposed to pure electronic means. The devices will disrupt/manipulate over a broad ground area on the order of 1km and over broad frequency ranges.

DESCRIPTION: The Department of the Air Force is exploring capability for utilizing mechanical methods for disrupting radar signals. The devices typically use rotary motion to manipulate and disrupt electromagnetic signals, although this effort is not restricted to rotary motion as the underlying mechanism. These types of systems offer certain advantages such as broadband response, simplicity, and likely cost. Other possible advantages include ease of operation and set up, which along with the design and operation simplicity which provides a smaller logistical tail. The topic is expected to deliver at least one field ready prototype. The goal of this effort is to investigate concepts for these systems, perform realistic modeling of those concepts on real world data, and provide a complete integrated system at the end of effort that meets the Air Force specifications. End of effort should also provide the Air Force with a trusted industrial partner for further development and procurement.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a “Phase I-like” effort, including a feasibility study. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Phase I type efforts include modeling of the effectiveness of the mechanical systems on known RF systems utilizing real world data. Phase I type efforts would also include exploration of solution space and consideration of the known systems that the passive systems are expected to interact with.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a “Phase I-like” effort predominantly separate from the SBIR/STTR Programs. These efforts will include development and evaluation of M&S tools, simulation of prototype concepts, and definition of the trade space. Phase II efforts shall conduct analysis, further M&S optimization and experimentation on prototype(s) to address military-unique requirements. Specific attention shall be paid to manufacturing readiness, preliminary costing, and Air Force logistical considerations.

PHASE III DUAL USE APPLICATIONS: Phase III or phase II enhancements shall include upgrades to the analysis, further M&S, test and evaluation results, and provide delivery of system concepts. Phase II E and Phase III shall provide a business and manufacturing plan including cost and further ruggedization if needed. Delivery of a field ready system for deployment at test ranges for testing purposes and blue force practice against such systems is desired, as well as a high manufacturing readiness enabling further procurement.

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1. Progress In Electromagnetics Research M, Vol. 48, 37–44, 2016 A Passive Suppressing Jamming Method for FMCW SAR Based on Micromotion Modulation Jia-Bing Yan* , Ying Liang, Yong-An Chen, Qun Zhang, and Li Su

KEYWORDS: Imaging radar; passive radar; mechanical motion of radar signals

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AF231-D024 TITLE: HiFi - Manufacturing high fidelity full-scale wind tunnel model for next-generation air vehicle development

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

OBJECTIVE: This topic seeks to develop and demonstrate design and manufacturing technology capable of building a full-scale wind tunnel model for developing next-generation aircraft using new structures and manufacturing technologies. The structural model must be light and easy to assemble/disassemble to store and transfer to the test facility. This effort will explore state-of-the-art technologies in new lightweight structure concepts, new assembly concepts, and low-cost manufacturing technologies to build large wind tunnel models for full-size testing.

DESCRIPTION: The Department of the Air Force is exploring designing and manufacturing full-scale wind tunnel models to test next-generation air vehicles. Air Force Research Laboratory (AFRL) is currently assessing emerging air vehicle concepts to address warfighter needs and their use for quickly testing full-scale vehicles eliminating the uncertainty associated with testing scaled models in a small wind tunnel. Developing a scaled model is often another challenge since the other components, such as the actuator, test rig, material, etc, are not scaled as structures. The process for obtaining accurate aerodynamic data from a scaled model may require a similar workload as designing and fabricating a full-scale model, and most importantly, the analysis and test result may not agree well due to the uncertainty of the scaled model and test environment. This effort aims to explore new structural concepts and low-cost manufacturing technology to build a high fidelity lightweight, and compact full-scale wind tunnel model. Among new structural ideas, lattice structures, origami structures, compliant mechanisms, Lego-like structures, or topology-optimized structures are concepts that might satisfy the weight, rigidity, assembly time, and volume requirements critical for the success of this program. It is unlikely that a simple foam construction will meet volume requirements unless there is a novel concept that satisfies stiffness and compaction requirements. The outer mold line (OML) of the assembled model should match the design within a yet to be determined tolerance and the skin should be stiff enough to maintain the OML under aerodynamic loads and smooth enough to meet the surface roughness requirements. The model should not deform under the aero loads expected in the wind tunnel and its components should be robust enough to endure 25 assembly/disassembly cycles. The disassembled part should be compact enough to fit in a standard 20 foot ISO dry storage shipping container for easy transfer to the wind tunnel facility. The focus of this topic is on evaluating new structural concepts and low-cost manufacturing technologies and selecting feasible concepts considering the wind tunnel model's weight, rigidity, assembly time, and volume requirements. In a future project, the design and manufacturing concepts demonstrated through this topic will be used to design and fabricate a full-size air vehicle model (F-16 equivalent size). The main deliverables for this topic are a full-size section of wind tunnel model for a relevant vehicle. The contractor should perform analysis to validate a full vehicle can be transported within the 20 foot ISO shipping container. The applicant should demonstrate through analysis and testing that the fabricated structure will meet anticipated wind tunnel loads. The applicant also should demonstrate the capability that one to four people can assemble and disassemble within a couple of hours.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I-like" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution. Relevant areas of demonstrated experience and success include: modeling and simulation, concept development, concept demonstration, concept evaluation, and field testing. Phase I type efforts include the assessment of the structural concept and the potential for fast assembly/disassembly.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a "Phase I-like" effort predominantly separate from the SBIR/STTR Programs. These efforts will include modeling and simulation of prototype concepts, concept development, concept demonstration, concept evaluation, and field testing. Phase II efforts shall conduct analysis, experimentation, and fabrication of prototype systems to address unique requirements that may not be otherwise met by conventional wind tunnel models.

PHASE III DUAL USE APPLICATIONS: Phase III shall include fabrication of more complex prototypes such as full sections of a wind tunnel model.

REFERENCES:

1. Mobile augmented reality to support fuselage assembly, Luís Fernando de Souza Cardoso, Flávia Cristina Martins Queiroz Mariano, E. R. Zorzal, 1 Oct2020, Business Comput. Ind. En.

KEYWORDS: Quick assembly; quick disassembly; full scale wind tunnel models

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AF231-D025 TITLE: MagDie - Magneto-dielectric Antennas for Broadband HF Sensing

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

OBJECTIVE: This topics seeks to demonstrate a wide-band and compact magneto-dielectric antenna operating in the 2MHz to 30MHz receiver range with a large bandwidth compared with current capabilities. The end state is to demonstrate an improved range of communication links between an airborne UAV and its airborne controlling host using these novel permeable antenna designs. The application is to address an emerging priority need from the Global Integrated ISR community to sense high-frequency signals (HF, nominally 2-30 MHz) at standoff ranges from compact antenna structures, enabling future applications.

DESCRIPTION: Traditional electrical antenna designs to meet such needs revert to very large structures—often towed lines or long loop-wires—which are long, bulky, and while they can provide SIGINT capabilities, exceptional care must be taken for employment for direction-finding activity, as the body of the platform they are on perturbs the very signals being collected. Another approach is to attempt structurally integrated antennas--meaning use of the air-structure itself, usually with additional protrusions and alterations—in order to amplify and collect these lower band signals. The structurally integrated approach requires a complex and intricate electromagnetic model of the platform, and any subsequent alteration to the structure will alter the response to incoming signals of interest, making the technique highly platform and configuration specific. The opportunity is to build upon proven prior demonstration in permeable antennas and tailor both the materials selection choice, deposition method, and magneto-dielectric antenna design to demonstrate affordable, high-performance receivers in the HF band that are ~10x more compact, have wideband performance (cover the entire 2-30 MHz range), and just as importantly has a path to platform-independent design and implementation. This includes the use of UAS systems for potential distributed sensing and geolocation applications, previously thought untenable.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a “Phase I-like” effort, including a feasibility study. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Phase I type efforts include modeling of the effectiveness of the mechanical systems on known RF systems utilizing real world data. Phase I type efforts would also include exploration of a solution space and consideration of the known parameters for magneto-dielectric antennas.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a “Phase I-like” effort predominantly separate from the SBIR/STTR Programs. These efforts will include development and evaluation of M& tools, simulation of prototype concepts, and definition of the trade space. Phase II efforts shall conduct analysis, further M&S optimization and experimentation on

prototype(s) to address military-unique requirements. Specific attention shall be paid to manufacturing readiness, preliminary costing, and Air Force logistical considerations.

PHASE III DUAL USE APPLICATIONS: Phase III shall include upgrades to the analysis, further M&S, test and evaluation results, and provide delivery of system concepts. Phase III shall provide a business and manufacturing plan including cost and further ruggedization if needed. Delivery of a field ready system for deployment at test ranges for testing purposes and blue force practice against such systems is desired, as well as a high manufacturing readiness enabling further procurement.

REFERENCES:

1. Magneto-dielectric characterization and antenna design, 2014 IEEE 64th Electronic Components and Technology Conference (ECTC), ISBN:978-1-4799-2407-3.

KEYWORDS: magneto-dielectric antennas

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AF231-D026 TITLE: FOCUS – Future Operational Capabilities for the US

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

OBJECTIVE: This topic seeks to perform system-of-system concept exploration, sub-scale experiments, test, and evaluation of future operational capabilities resulting from developments focused on the operational imperatives of the Air and Space Force.

DESCRIPTION: The Air and Space Force must dominate time, space, and complexity in future conflicts across all operating domains to project power and defend the homeland. This means the Air and Space Force must operate at an unrivaled speed. In order to achieve these objectives, the Air and Space Force must have unparalleled global awareness, execute from resilient and "flash" / pop-up bases with robust and guaranteed logistic supply trains while maintain un-denied communications to support warfighter management systems - all the while being able to transition to a heightened level of execution in a rapid and seamless manner. These objectives have been clearly stated as the operational imperatives for the Air and Space Force and are aimed at modernizing management systems (2), defining next generation system-of-system concepts (3), maintaining custody of a very large number of moving targets (4), utilizing flexible basing that can operate from numerous locations with robust logistic and sustainment – all the while being able to transition to a heightened level of execution in a rapid and seamless manor (7). Underpinning all of the operational imperatives is resilient communications (5). The Department of the Air Force is exploring these operational imperatives and the Air Force Research Laboratory (AFRL) is currently assessing how the commercial vendor base can support bringing the operational imperatives to fruition. Technology developments are paving the way where situational awareness and target tracking do not have to rely on the sensor that is integrated into a platform, such as a tactical fighter or unmanned system, even in challenging operational environments. Commercial sensing capabilities, coupled with national capacities are beginning to demonstrate the capability to aggregate sensing data from multiple sources and maintain track custody. In addition, current and planned commercial communications systems are developing and fielding the technology for space-based communications and the reliance on direct line-of sight may no longer be needed – truly enabling a distributed, network centric warfighting capability. AFRL is supporting the operational imperatives and seeks to perform maturation of system-of-systems concepts to support the future operation capabilities. The goal of this effort is to conduct experiments that shorten the kill chain in contested environments by decoupling command from control while aggregating sensing data from platforms and systems via distributed communications, including the use of a space-based data transport layer. A focus of the experiments should be on emerging commercial capabilities that can meet the challenge where targets are reported every couple of minutes over a 24 hour or greater time span. Experimentation should demonstrate that modernization of command and control systems with increased speed of decision-making to support Joint operations. The need for speed is not just in decision-making but also in the ability to mobilize forces, and then supporting those forces with information systems and logistical and industrial infrastructure. All experiments must show a measurable value and operational impact. The main deliverables will be sub-scale experiments, tests, and demonstrations that advance the operational imperatives.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I-like" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Relevant areas of demonstrated experience and success include: M&;S, cost benefit analysis, risk analysis, concept development, concept demonstration and concept evaluation, laboratory experimentation and field testing. Phase I type efforts should include the assessment of emerging operational imperatives and how they show a measurable value and operational impact. The result of Phase I type efforts is to assess and demonstrate whether commercial systems can support the furtherance of the operational imperatives.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a "Phase I-like" effort predominantly separate from the SBIR/STTR Programs. These efforts will include M&S, simulation of prototype concepts, cost benefit analysis, system-of-systems studies, experimentation and evaluation of operational imperatives to enable future concepts. Prototypes, M&S and experimentation should explore a wide range of integrating commercial capabilities to support the operational imperatives. These capabilities should consider areas that are unique to military operations, logistics, mission planning, mission execution, base sustainment and logistics. A goal is for Phase II efforts to conduct sub-scale experiments and provide test articles for further test and demonstration. Experiments should address military-unique requirements that may not be otherwise met by commercial capabilities.

PHASE III DUAL USE APPLICATIONS: Phase III shall include upgrades to the analysis, M&S, T&E results and provide mature prototypes of system concepts. Phase III shall provide a business plan and address the ability to transition technology and system concepts to commercial applications. The adapted non-Defense commercial solutions shall provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications. Integration and other technical support to operational users may be required.

REFERENCES:

1. Kendall details 'Seven Operational Imperatives' & how they forge the Future Force, https://www.af.mil/News/Article-Display/Article/2953552/kendall-details-seven-operational-imperatives-how-they-forge-the-future-force/

KEYWORDS: Operational Imperatives

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AF231-D027 TITLE: RESINATE - REmoste Sensing IN A TEu

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

OBJECTIVE: This topic seeks to perform concept exploration, prototype development, sub-scale experiments, test and evaluation of intermodal cargo containers that can be used for sensing applications that are minimally manned or not manned at all, and in extreme weather conditions. The containers may be air dropped to the remote locations and must contain all the necessary set-up, power generation, communications, sensors and antenna equipment for a self-sustaining capability. It is possible that the remote sensing in a TEU (Twenty-Foot Equivalent Unit) could be transported and air dropped via rocket and not just by an air platform or ship.

DESCRIPTION: There is a growing need within the Department of Defense (DoD) for increased surveillance and situational awareness in remote locations such as the Arctic. These locations are often un-accessible for many months during the year and experience extreme weather conditions. An approach to providing increased surveillance capacity is to house the sensing systems within a TEU that is "self-sufficient". The system can begin operations with minimal crew set-up and continue to operate for many months with no human interaction or maintenance due to weather extremes or austere location inaccessibility. The "sensing in a TEU box" may also be air-dropped to their intended location but remain "dormant" for an extended period of time until crews can access the site. Another mission scenario under consideration is where the air-dropped sensing system would begin operations autonomously without crew setup deploying sensors, antennas and other systems required for operation. The goal of this effort is to investigate and develop concepts for inter-modal containers that can provide sensing capabilities that are self-sufficient and are suited for air drop of cargo from a rocket. Existing ISU-90 and TEU type cargo containers will need to be adopted to allow for a complete sensing system that can withstand air-drop conditions and environments, including airdrop in the atmosphere post-reentry. Some sensors and supporting sub-systems/electronics are fragile in nature and additional packaging will need to be taken into consideration. The objective of this effort is to enable the commercial market to develop and manufacture RESINATE systems utilizing inter-modal shipping containers that meet the needs of the DoD for increased surveillance and situational awareness. This topic is intended to reach companies capable of completing a prototype or sub-scale experiment to validate concepts under accelerated Phase I and II type schedules. This topic is aimed at later stage research and development efforts rather than "front-end" or basic research/research and development. The focus is on emerging commercial capabilities in sensing and utilization of cargo containers to minimize cost and enable agile logistics through the entire span of responsive mission planning to rapid logistics. The main deliverables will be test and evaluation of concepts that advance the viability and utility of using commercial inter-modal container for remote sensing systems.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, a Phase I award is not required. The applicant is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I-like" effort, including a feasibility study. This includes determining, insofar as possible, the scientific and technical merit and feasibility of

ideas appearing to have commercial potential. It must have validated the product-market fit between the proposed solution and a potential AF stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Relevant areas of demonstrated experience and success include: M&S, cost benefit analysis, risk analysis, concept development, concept demonstration and concept evaluation, laboratory experimentation and field testing. Phase I type efforts include the assessment of emerging sensing capabilities integrated into commercial container systems that enable rapid transport of capabilities to ports across the globe. Phase I type efforts would also include how the data generated from the sensors can improve surveillance and overall domain awareness.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the applicant having performed a "Phase I-like" effort predominantly separate from the SBIR/STTR Programs. These efforts will include simulation of prototype concepts, experimentation and evaluation of sensing systems in commercial shipping containers that can be air- dropped. Prototypes and experimentation should explore a wide range of sensing capabilities and the extreme environments these systems must operate in. The sensing-in-a-box should consider areas that are unique to military logistics such as mission planning and execution, ground operations, precision delivery to remote locations and maintenance.

PHASE III DUAL USE APPLICATIONS: Phase III shall include upgrades to the analysis, M&S, T&E results and provide mature prototypes of system concepts. Dual Use aspects include the surveillance capacity for scientific use, environmental monitoring and even search and rescue operations. Phase III shall provide a business plan and address the ability to transition technology and system concepts to commercial applications. The adapted non-Defense commercial solutions shall provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications. Integration and other technical support to operational users may be required.

REFERENCES:

1. B. Johnson, "Sensing the Arctic: Situational Awareness and the Future of Northern Security", International Journal, 2021; 76(3):404-426.

KEYWORDS: Remote sensing; surveillance

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AF231-D028 TITLE: Next-Generation Neural Interface for Real-World Performance Monitoring and Augmentation

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Human-Machine Interfaces; Space Technology; Trusted AI and Autonomy

OBJECTIVE: Develop a next-generation wearable neural and/or physiological interface and corresponding algorithms, hardware, and software that provide a real-time/semi-real time link between a human being and a secondary technology (e.g. augmented reality, intervention) in a manner that augments Air Force-relevant cognitive performance (e.g. training-related, decision making) in able-bodied nonclinical populations.

DESCRIPTION: Mechanisms to enhance cognitive performance are important for future success (AF 2030 Strategy). Over the years, researchers have successfully used technology to enhance cognitive performance (Cinel et al., 2019). These cognitive augmentation technologies are often dependent on the underlying cognitive state and unique biological profile of the individual at the time of use. However, most commercial cognitive augmentation technologies do not take into account the cognitive state of the individual and instead deliver augmentation under fixed predetermined schedules and/or protocols (i.e. open-loop augmentation). Neural interfaces (e.g. brain machine/computer interfaces) can serve as a real-time bridge between an individual's cognitive state and cognitive augmentation technologies (Chaudhary et al., 2016; Miranda et al., 2014). Researchers have shown that these "brain-in-loop" augmentations outperform open-loop augmentation (Basu et al., 2021; DeBettencourt et al., 2015; Raphael et al., 2009; Zrenner et al., 2016). These systems, however, often do not have the necessary spatial and/or temporal resolution, usability, and/or algorithm maturity to be useful for Air Force applications (e.g. personalized training, cognitive interventions). Further, most cognitive augmentation technologies either emphasize the sensing element (e.g. electroencephalography, functional near infrared spectroscopy, eye tracking, behavioral measures), the software to interpret these signals (e.g. signal processing, machine learning algorithm library) or the cognitive augmentation technology elements (e.g. augmented reality system, neuromoduation device, artificial intelligence-inspired training software, advanced visualizations, external stimuli) and fail to link these elements to quantifiable cognitive performance measures (e.g. accelerated learning, improved working memory, reduced reaction time and accuracy). Therefore, this SBIR seeks to develop a system that integrates the physiological and behavioral/biological sensing, software, and augmentation technology elements into an easy to setup usable form factor that is designed for use outside of laboratory. The developed system must also have a demonstrable positive impact on cognitive performance.

PHASE I: This topic is only soliciting Direct to Phase II (D2P2) level proposals. Proposers must provide data demonstrating the appropriate function of an existing neural interface prototype, sensing elements, and preliminary software for processing neural interface prototype outputs. While proposers are not required to have the cognitive augmentation technology already integrated into the neural interface, they should have identified the cognitive augmentation technology that will be integrated in phase II. Additionally, the existing neural interface prototype must either already have the relevant software and hardware input/output architecture in place, which will form the basis for integration between the neural interface and augmentation technology, or provide sufficient documentation to substantiate a path towards this architecture within the period of performance of Phase II.

PHASE II: Performers will need to demonstrate: 1) the performance enhancement benefit and 2) the usability of a wearable neural interface combined with augmentation technology. The performance enhancement benefit will depend on the quality (e.g. signal to noise ratio, number of sensors) of physiological and behavioral signals (e.g. brain, eye tracking, behavioral) extracted from the human being, the ability of algorithms to extract useful information from these signals (e.g. bits of

entropy/mutual information, algorithm goodness-of-fit or classification accuracy, receive operator characteristic curve performance) the role the cognitive augmentation technology(ies) has on performance, and the interaction between algorithm outputs and the secondary technology/intervention. The performance enhancement benefit must be Air Force relevant (e.g. improve learning, decision making) and target able-bodied nonclinical populations. The cognitive performance enhancement benefit of the combined neural interface and cognitive augmentation technology system components must outperform what each system component contributes to cognitive performance individually. The usability of the neural interface will depend on comfort levels derived from wearing the device, robustness to motion artifacts, portability, and ease and duration to setup and cleanup. Schedule/Milestones/Deliverables: • Month 1: Report on product development project plan that adapts existing technology as much as possible or develops a new platform if necessary. IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 3: Report on: Progress toward month 6 goals; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 6: Report on: Month 6 demonstration; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 9: Report on: Progress toward month 12 goals; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 12: Report on: Month 12 demonstration; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 15: Report on: Progress toward month 18 goals; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 18: Report on: Month 18 demonstration; Performers must show performance enhancement benefit using prototype neural interface; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 21: Report on: Progress towards month 24 goals enrollment; IRB and HRPO approvals or data collection effort enrollment when approvals obtained. • Month 24: Report on: Month 24 demonstration: Performers must show usability and performance benefit in finalized form factor.

PHASE III DUAL USE APPLICATIONS: While this SBIR application focuses on a capability benefit designed to enhance cognitive performance in able-bodied nonclinical populations, a similar benefit might translate to non-cognitive performance domains within able-bodied nonclinical populations. Similarly, cognitive and/or non-cognitive benefits seen in able-bodied nonclinical populations could translate to clinical populations.

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2. Chaudhary, U., Birbaumer, N., & Ramos-Murguialday, A. (2016). Brain-computer interfaces for communication and rehabilitation. Nature Reviews Neurology, 12(9), 513–525. https://doi.org/10.1038/nrneurol.2016.113
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5. Miranda, R. A., Casebeer, W. D., Hein, A. M., Judy, J. W., Krotkov, E. P., Laabs, T. L., Manzo, J. E., Pankratz, K. G., Pratt, G. A., Sanchez, J. C., Weber, D. J., Wheeler, T. L., & Ling, G. S. F. (2014). DARPA-funded efforts in the development of novel brain-computer interface technologies. Journal of Neuroscience Methods, 244, 52–67. https://doi.org/10.1016/j.jneumeth.2014.07.019

6. Raphael, G., Berka, C., Popovic, D., Chung, G. K. W. K., Nagashima, S. O., Behneman, A., Davis, G., & Johnson, R. (2009). I-NET®: Interactive neuro-educational technology to accelerate skill learning. Proceedings of the 31st Annual International Conference of the IEEE Engineering in Medicine and Biology Society: Engineering the Future of Biomedicine, EMBC 2009, September, 4803–4807. https://doi.org/10.1109/IEMBS.2009.5332638
7. Zrenner, C., Belardinelli, P., Müller-Dahlhaus, F., & Ziemann, U. (2016). Closed-Loop Neuroscience and Non-Invasive Brain Stimulation: A Tale of Two Loops. Frontiers in Cellular Neuroscience, 10(April), 1–7. https://doi.org/10.3389/fncel.2016.00092

KEYWORDS: Brain Machine Interface; Brain Computer Interface; Training, Learning; Cognitive Enhancement; Closed loop systems; Extended Reality; Neuromodulation; Cognitive Interventions; Cognitive State

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AF231-D029 TITLE: Battle Damage Assessment Manager

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

OBJECTIVE: Improve BDA timelines by automating processes, while including human on the loop interaction and developing toolsets with necessary background and real-time data for analysts to make functional assessments and for leaders to make restrike recommendations.

DESCRIPTION: Management system that provides a platform to advance the automation of key components required for the assessment of both kinetic and non-kinetic strikes. Leverages and integrates disparate but corresponding maturing technologies in key areas of focus under this topic to provide a comprehensive platform that decreases BDA timelines by automating processes and developing toolsets with necessary background and real-time data for analysts to make functional assessments and restrike recommendations.

PHASE I: This topic is only soliciting Direct to Phase II (D2P2) level proposals. Proposers must provide data and documentation demonstrating appropriate function of an existing prototype and preliminary development for automated data aggregation of relevant intel sources, framework for decision tables and critical elements. Additionally, the existing prototype must either already have the relevant software input/output architecture in place, or provide sufficient documentation to substantiate a path toward this architecture within the period of performance of Phase II.

PHASE II: The BDAM proof of concept developed separate from the SBIR program, and requires full engineering development to mature and scale up these functions with test/validation on an operational testing platform to enable scalable, accurate bomb hit assessments at the speed of need. The government will provide current classified BDAM Datasets. No other government furnished materials, equipment, data, or facilities will be provided. BDAM requires temporal and geospatial queries with existing common operational/intelligence pictures.

PHASE III DUAL USE APPLICATIONS: Adapt, refine, and optimize the existing prototype into a mature product directly integrated with operational tools currently in limited use at one of ACC's Air Operation Centers. Additionally, pursue integration of BDAM with National Reconnaissance Office and National Geospatial Agency projects and programs of record to expand the software into other intelligence applications and DoD branches, and future space-based battle management command and control satellite systems.

REFERENCES:

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2. National Defense Strategy of the United States of America (2018). Washington D.C., pg.6.;
3. Global Integrated Intelligence, Surveillance, and Reconnaissance Core Function Support Plan;
4. AFRL S&T 2030 Strategy, Objective #1: Strategic Capability #3, pg. 7;

5. CJCSI 3162.02 6. SecAF Operational Imperatives 2 & 4. 7. Lockheed Martin to Launch 3 Satellites in 2023 to Advance Joint All-Domain Operations - Via Satellite - (satellitetoday.com)

KEYWORDS: Multi-Domain Command and Control; Integrated ISR; Battle Damage Assessment; Bomb Hit Indicator

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