DEPARTMENT OF DEFENSE
Small Business Innovation Research (SBIR) Program

SBIR 25.4 Annual Program Broad Agency Announcement (BAA)

Amendment 1 (December 4, 2024)

The purpose of amendment 1 is to clarify section 2.5 Due Diligence Program to Assess Security Risks.

IMPORTANT DATES

	Pre-Release	Open	Close
Release 1	Oct 02, 2024	Oct 23, 2024	Nov 20, 2024
Release 2	Nov 06, 2024	Dec 04, 2024	Jan 08, 2025
Release 3	Dec 04, 2024	Jan 08, 2025	Feb 05, 2025
Release 4	Jan 08, 2025	Jan 29, 2025	Feb 26, 2025
Release 5	Feb 05, 2025	Feb 26, 2025	Mar 26, 2025
Release 6	Mar 05, 2025	Mar 26, 2025	Apr 23, 2025
Release 7	Apr 02, 2025	Apr 23, 2025	May 21, 2025
Release 8	May 07, 2025	May 28, 2025	Jun 25, 2025
Release 9	Jun 04, 2025	Jun 25, 2025	Jul 23, 2025
Release 10	Jul 02, 2025	Jul 23, 2025	Aug 20, 2025
Release 11	Aug 06, 2025	Aug 27, 2025	Sep 24, 2025
Release 12	Sep 03, 2025	Sep 24, 2025	Oct 22, 2025

NOTE: DoD Services and Components may elect to release topics under this BAA once a month throughout fiscal year 2025. New research topics will pre-release on the first Wednesday of each month, based on the schedule above. Each release will have corresponding open and close dates applicable only to those topics within the release. If a topic in a release deviates from the open and close dates listed above, it will be noted within the Component-specific instructions and on DSIP.

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1.0 PROGRAM DESCRIPTION

1.1 Objectives and Context

The Defense Small Business Innovation Research (SBIR) Program's objectives include stimulating technological innovation, strengthening the role of small business to meet DoD research and development (R&D) needs, fostering and encouraging minority and disadvantaged persons' participation in technological innovation, and increasing the commercial application of DoD-supported research or R&D results. DoD invites proposing SBCs with the capability to conduct R&D and commercialize the results in any of the defense-related topic areas described in this SBIR Program BAA to submit proposals.

The Small Business Administration (SBA), through its SBIR/STTR Policy Directive, purposely departs from normal government solicitation formats and requirements, which simplifies the SBIR/STTR award process and minimizes the regulatory burden on small business. Consistent with the SBA SBIR/STTR Policy Directive, DoD is soliciting proposals as a broad agency announcement (BAA). The guidelines in this BAA incorporate and make use of the SBA SBIR/STTR Policy Directive's flexibility to encourage scientific and technical approaches proposals most likely to yield significant results for DoD and the private sector.

This BAA is for research topics accepting Phase I or Direct to Phase II proposals. A separate BAA will not be issued requesting Phase II proposals, and unsolicited proposals will not be accepted. All proposing SBCs that receive a Phase I award from this BAA will be eligible to participate in Phase II competitions and potential Phase III awards. DoD Services/Components will notify Phase I awardees of the Phase II proposal submission requirements.

DoD is not obligated to make any awards under Phase I, Phase II, or Phase III, and all awards are subject to both a risk-based due diligence security review and funds availability. DoD is not responsible for any monies the proposing small business concern (SBC) spends before any award issuance. Proposals must conform to this announcement's terms. DoD is under no obligation to fund any proposal or any specific number of proposals in each topic. It also may elect to fund several or none of the proposed approaches to the same topic.

1.2 A Three Phased Program

The SBIR Program has three phases, Phases I, II, and III. Phase I determines, to the extent possible, an idea's scientific, technical, and commercial merit and feasibility within the SBIR program. Phase I and II awards are made adhering to current SBA Policy Directive guidelines.

The Phase I period of performance is generally between six to twelve months. Proposals should focus on Research or Research & Development (R/R&D)to prove the proposed effort's scientific and technical feasibility, and commercialization potential, the successful completion of which is a prerequisite for further DoD support in Phase II. Proposing SBCs are encouraged to consider whether the research or R&D being proposed to DoD Services/Components also has private sector potential, either for the proposed application or as a base for other applications.

Phase II awards will be made to proposing SBCs based on results of Phase I awards and the Phase II proposal's scientific merit, technical merit, and commercialization potential. The period of performance is generally 24 months. The objective of Phase II is to continue and further develop the R/R&D effort from the completed Phase I award.

Phase III refers to work that derives from, extends, or completes an effort made under prior SBIR funding agreements, but is funded by sources other than the SBIR Program. Under Phase III, the SBC should focus on commercializing previously SBIR-funded technology and is required to obtain funding from either the private sector, a non-SBIR federal source, or both, to develop the prototype into a viable product or non-R&D service for sale in military or private sector markets.

1.3 OUSD(R&E) Critical Technology Areas

Although each DoD Service/Component develops SBIR and STTR topics tailored to their mission needs, topics generally align with the Office of the Under Secretary of Defense, Research & Engineering (OUSD(R&E)) critical technology areas. While many technologies may cross between these categories, these areas represent the broad and different approaches required to advance technologies crucial to the Department, with a focus on accelerating key capabilities' transitions to the Military Services and Combatant Commands.

OUSD(R&E) critical technology areas include:

- FutureG
- Trusted AI and Autonomy
- Biotechnology
- Advanced Computing and Software
- Integrated Sensing and Cyber
- Directed Energy (DE)
- Hypersonics
- Microelectronics
- Integrated Network Systems-of-Systems
- Quantum Science
- Space Technology
- Renewable Energy Generation and Storage
- Advanced Materials
- Human-Machine Interfaces

Below are additional technology areas supporting DoD Services/Component-specific mission-critical areas:

- Advanced Infrastructure & Advanced Manufacturing
- Combat Casualty Care
- Emerging Threat Reduction
- Military Infectious Diseases
- Military Operational Medicine
- Mission Readiness & Disaster Preparedness
- Nuclear
- Sustainment & Logistics

Full descriptions of the above technology areas can be reviewed here.

1.4 Eligibility and Performance Requirements

Each proposing SBC must qualify as an SBC as defined in 13 C.F.R §§ 701-705 at time of award and certify to this in the proposal's cover sheet. The eligibility requirements for the SBIR/STTR programs are unique and do not correspond to those of other small business programs.

a. Proposing SBC must meet eligibility requirements for Small Business Ownership and Control (see 13 CFR § 121.702).
b. The proposing SBC must conduct a minimum of two-thirds of the Phase I research and/or analytical work. For Phase II, the proposing SBC must perform no less than 50 percent of the research and/or analytical work. The work percentage is measured via direct and indirect costs. Occasionally, deviations from these SBIR requirements may occur with the Funding Agreement officer's written approval after consultation with the agency SBIR/STTR program manager/coordinator. For more information on the percentage of work calculation during proposal submission, refer to section 3.7.
c. For both Phase I and II, the principal investigator's primary employment must be with the proposing SBC at the time of the award and during the conduct of the proposed effort. Primary employment means that more than one-half of the principal investigator's time is spent with the

small business (based on a 40-hour work week). Primary employment with an SBC precludes full-time employment at another organization. Deviations from this requirement or changes to the principal investigator are subject to the Funding Agreement officer approval.

d. For both Phase I and Phase II, the SBC and its subcontractors must perform all research or R&D work in the United States.
e. Joint ventures and limited partnerships are permitted, provided that the entity qualifies as small business in accordance with the ownership requirements in 13 CFR 121.702(a)(1)(iii) and the size requirements in 13 CFR 121.702(c)(6). Proposing SBC must disclose joint ventures with existing (or planned) relationships/partnerships with any foreign entity or any foreign government-controlled companies. See sections 2.6 and 3.7 for more detail.

1.5 Majority Ownership in Part by Multiple Venture Capital, Hedge Fund, and Private Equity Firms

Unless otherwise noted in the participating Service/Component instructions, proposing SBCs that are multiple venture capital operating companies (VCOCs), hedge funds, or private equity funds majority owned are **ineligible** to submit applications to or receive awards under this BAA. If a Service/Component authorizes such participation, any proposing VCOC, hedge fund, and/or private equity fund-owned SBC, whether in part or in whole, must identify each foreign national, foreign entity, or foreign government holding or controlling greater than a 5 percent, either directly or indirectly held, equity stake in the proposing SBC. The proposing SBC must also identify any ultimate parent owner(s) and other entities and/or individuals owning more than a 5 percent equity stake in its ownership chain.

In accordance with the requirements of 13 CFR 121.702(a)(2), no single venture capital operating company, hedge fund, or private equity firm may own more than 50 percent of the concern unless that single venture capital operating company, hedge fund, or private equity firm qualifies as a small business concern that is more than 50 percent directly owned and controlled by individuals who are citizens or permanent resident aliens of the United States.

1.6 Performance Benchmark Requirements/Increased Minimum Performance Standards for Experienced Firms

Proposing SBCs with multiple prior SBIR/STTR awards must meet minimum performance requirements to be eligible to apply for a new Phase I or Direct-to-Phase II award. The Phase I to Phase II Transition Rate addresses the extent to which an awardee progresses a project from Phase I to Phase II. The Commercialization Benchmark addresses the extent to which an awardee has moved past Phase II work towards commercialization.

The SBIR and STTR Extension Act of 2022 (Pub. L. 117-183) amended the benchmarks' application for more experienced firms. Find detailed information on benchmark calculations, increased performance standards for more experienced firms and consequence of failure to meet benchmarks here. SBA will notify companies failing either benchmark and the relevant officials at the participating agencies.

The SBIR/STTR Policy Directive defines the Departments of the Army, Navy, and Air Force each as its own federal agency, and the remaining DoD Components as an executive agency of the Department of Defense. Therefore, companies that fail to meet either of the benchmarks under the Increased Performance Standards for More Experienced Firms may not receive more than an overall total of 80 awards from DoD, as detailed in the breakdown below:

Army – 20 total Phase I and Direct to Phase II awards
Navy – 20 total Phase I and Direct to Phase II awards

Air Force – 20 total Phase I and Direct to Phase II awards
All other DoD Components combined – 20 total Phase I and Direct to Phase II awards

1.7 Direct to Phase II Program

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 an SBC with respect to a project, without regard to whether the SBC was provided a SBIR program Phase I award with respect to such project. DoD does not guarantee Direct to Phase II opportunities will be offered in future BAAs.

Each eligible topic requires proposing SBCs provide documentation to demonstrate feasibility described in the Phase I section of the topic has been met. **Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.** The proposing SBC and/or the principal investigator must have substantially performed the work submitted in the feasibility documentation. If technology in the feasibility documentation is subject to intellectual property (IP), the proposing SBC must demonstrate ownership or licensure of the IP associated with such technology prior to proposal submission to enable it and its subcontractors to legally carry out the proposed work.

If the proposing SBC fails to demonstrate technical merit and feasibility equivalent to the Phase I level as described in the associated topic, the related Phase II proposal will not be accepted or evaluated, in accordance with the Service/Component-specific Direct to Phase II instructions.

Please refer to the Service/Component-specific Direct to Phase II instructions for full details regarding Service/Component Direct to Phase II processes and proposal preparation requirements.

1.8 Program on Innovation Open Topics

15 U.S.C. §638 (ww) requires DoD establish innovation open topic activities to:

a. increase the transition of commercial technology to the DoD;
b. expand the small business nontraditional industrial base;
c. increase commercialization derived from DoD investments; and
d. expand the ability for qualifying SBCs to propose technology solutions to meet DoD needs.

Unlike conventional topics, which specify the desired technical objective and output, open topics use generalized mission requirements or specific technology areas to adapt commercial products or solutions to close capability gaps, improve performance, or provide technological advancements in existing capabilities.

Open topics released under this BAA will be clearly identified as such in the title and topic objective. Proposal preparation instructions for open topics may vary significantly across DoD Services/Components. Proposing SBCs must carefully read and follow all instructions from the DoD Service/Component for the open topic of interest. Unless specifically noted in the Service/Component instructions, all requirements outlined in this BAA remain in effect for open topics.

An SBC may only submit one proposal to each open topic. If an SBC submits more than one proposal for a single open topic, only the most recent certified proposal submitted prior to the submission deadline will receive an evaluation. All previously submitted proposals for the same open topic will be marked nonresponsive and will not receive an evaluation.

1.9 Discretionary Technical and Business Assistance (TABA)

DoD has not mandated the use of discretionary technical and business assistance (TABA). The proposing SBCs should review individual Service/Component-specific instructions to determine if TABA is offered by the Service/Component and follow instructions for requesting TABA funding.

1.10 Phase II Enhancement Policy

To further encourage the transition of SBIR research into both DoD acquisition programs and the private sector, certain DoD Services/Components developed their own Phase II Enhancement policies. Under this policy, the Service/Component will provide a Phase II awardee with additional Phase II SBIR funding if the proposing SBC can match the additional SBIR funds with non-SBIR funds from DoD acquisition programs or the private sector.

See Service/Component instructions for more details on Phase II Enhancement opportunities.

1.11 Commercialization Readiness Program (CRP)

The SBIR/STTR Reauthorization Act of 2011 established the Commercialization Pilot Program (CPP) as a long-term program called the Commercialization Readiness Program (CRP). Each Military Department (Army, Navy, and Air Force) has a CRP; please check the Service/Component instructions for further information.

The Defense SBIR/STTR Program also established the OSD Transitions SBIR Technology (OTST) Pilot Program as an interim technology maturity phase (Phase II) inserted into the SBIR development. For more information contact osd.ncr.ousd-r-e.mbx.sbir-sttr-tech-transition@mail.mil.

1.12 State and Other Available Assistance

Many states have established programs to provide services to those proposing SBCs and individuals wishing to participate in the Federal SBIR Program. These services vary from state to state, but may include:

a. Information and technical assistance;
b. Matching funds to SBIR recipients;
c. Assistance in obtaining Phase III funding.

Contact your State SBIR/STTR Support office for further information. SBCs may seek general administrative guidance from small and disadvantaged business utilization specialists located in various defense contract management activities throughout the continental United States.

1.13 Fraud and Fraud Reporting

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

The DoD Office of Inspector General Hotline ("Defense Hotline") is an important avenue for reporting fraud, waste, abuse, and mismanagement within the DoD. The Office of Inspector General operates this hotline to receive and investigate complaints or information from contractor employees, DoD civilians, Service members, and the public. Individuals who wish to report fraud, waste or abuse may contact the Defense Hotline at (800) 424-9098 between 8:00 a.m. and 5:00 p.m. Eastern Time or visit their website to submit a complaint. Mailed correspondence should be addressed to the Defense Hotline, The Pentagon, Washington, DC 20301-1900, or email addressed to hotline@dodig.mil.

2.0 CERTIFICATIONS AND REGISTRATIONS

2.1 System for Award Management (SAM) Registration

The System for Award Management (SAM) allows proposing SBCs to provide basic information on business structure, capabilities, and financial and payment information with the Federal Government. Proposing SBCs must register in SAM here. Registration in SAM will generate the Unique Entity ID (UEI) number and the Commercial and Government Entry (CAGE) code. The UEI is required for registration in the U.S. Small Business Administration's (SBA) Company Registry. A proposing SBC that is already registered in SAM should verify the registration is active, and its representations and certifications are current to avoid award delay.

2.2 SBA Company Registry

Proposing SBCs must be registered in the SBA Company Registry. SBCs will be required to verify registration by providing the SBC Control ID and Proof of Registration/Certification during proposal submission.

2.3 Defense SBIR/STTR Innovation Portal (DSIP) Registration

Individuals from proposing SBCs must be registered in the DSIP to prepare and submit proposals. Proposing SBCs submitting through this site for the first time will be asked to register. All users are required to have an individual user account to access DSIP. It is recommended proposing SBCs register as soon as possible upon identification of a proposal opportunity to avoid delays in the proposal submission process.

DSIP user accounts are authenticated by Login.gov. Users who do not already have a Login.gov account will be required to create one. Users who already have a Login.gov account can link their existing Login.gov account with their DSIP account. Job Aids and Help Videos to walk you through the process are in the Learning & Support section of DSIP.

Be advised the sharing of accounts and passwords is a violation of the Terms of Use for Login.gov and DoD policy.

Registered SBCs will have a designated DSIP Firm Admin responsible for creating the Firm PIN, controlling access for other users in the SBC and completing and maintaining the Firm-level forms, which must be completed before any proposals can be submitted.

Users should complete their account registrations as soon as possible to avoid any delays in proposal submissions.

NOTE: The DSIP application is only accessible from within the United States, which is defined as the fifty states, the territories and possessions of the Federal Government, the Commonwealth of Puerto Rico, the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the District of Columbia.

2.3.1 DSIP Assistance and Support

For assistance with the DSIP application, please visit the Learning & Support section of DSIP. Email DSIP Support at DoDSBIRSupport@reisystems.com only for further assistance with issues pertaining directly to the DSIP application. Questions submitted to DSIP Support will be addressed in the order received during normal operating hours (Monday through Friday, 9:00 a.m. to 5:00 p.m. ET). Please include information on your SBC, a proposal number (if applicable), and screenshots of any pertinent errors or issues encountered.

DSIP Support cannot provide updates to proposal status after submission, such as proposal selection/non-selection status or contract award status. Contact the DoD Service/Component that originated the topic following the Service/Component-specific instructions given at the beginning of that Service/Component-specific instructions.

2.4 Required Certifications

At the time of proposal submission, each SBC must certify via the Cover Sheet of the proposal that it meets the size, ownership, and other requirements of the SBIR Program. In addition, the Policy Directive includes certification requirements set forth in the SBIR and STTR Extension Act of 2022 (Public Law 117-183). SBCs are required to certify that they are meeting the Program's requirements during the life cycle of the funding agreement: at the time of the Phase I and Phase II award, prior to final payment on the Phase I award, prior to receiving 50 percent of the total Phase II award amount, and prior to final payment on the Phase II award.

2.5 Due Diligence Program to Assess Security Risks

15 U.S.C. §638 (vv) requires the DoD, in coordination with the SBA, to establish and implement a due diligence program to assess and, when possible, mitigate national security risks from SBCs seeking a federally funded award. The Department will use the proposal and information in response to the "Disclosures of Foreign Affiliations or Relationships to Foreign Countries" (proposal submission Volume 7) to conduct a risk-based due diligence review of the following areas: cybersecurity practices; patent analysis; employee analysis and foreign ownership, including the SBC's financial ties and obligations (which shall include surety, equity, and debt obligations); and SBC employees' ties to a foreign country, foreign person, or foreign entity. The Department will also assess proposals utilizing open-source analysis and analytical tools, for the purpose of confirming the accuracy of the information provided as well as determining if the proposing SBC failed to disclose the information set forth in 15 U.S.C. 638(g)(13).

After reviewing the proposing SBC's responses to the Disclosures of Foreign Affiliations or Relationships to Foreign Countries, if DoD determines it appropriate the Department may ask the SBC to provide true copies of any contractual or financial obligation or other agreement specific to a business arrangement or joint-venture like arrangement with an enterprise owned by a foreign state or any foreign entity in effect during the five-year period preceding the SBC's proposal submission.

The DoD may not make awards that pose an unacceptable risk to national security. If the risk-based due diligence review concludes that an SBC should not be eligible for the specific SBIR or STTR award due to a national security risk that cannot be adequately mitigated, the proposal will not receive consideration for possible award regardless of the results of the technical review of the proposal. Attachment 2: Defense SBIR and STTR Due Diligence Program Common Risk Matrix of the memo titled "Defense Small Business Innovation Research and Small Business Technology Transfer Due Diligence Program", dated 13 May 2024, provides details on the factors for assessing SBC risk during the due diligence review.

2.5.1 Training for Understanding FOCI

DoD has partnered with Project Spectrum to provide an online course on Understanding Foreign Ownership, Control, or Influence (FOCI). This course defines FOCI, explains what it means to be under FOCI, and details FOCI's effect on a company seeking initial or continued eligibility for access to a federally funded award. Small business concerns can register and access this course by following the instructions below:

1. Go to projectspectrum.io

2. Click “Profile/Dashboard” in the top right and then click “Sign Up” from the dropdown menu.
3. Follow the instructions to sign up for an account. Descriptions of the account types are provided below each option.
4. Verify your email by entering the code sent to the email address you provided when signing up.
5. Log in to Project Spectrum by clicking “Profile/Dashboard > Login” in the top right.
6. Hover over “Courses” in the Navigation Bar, and then select “FOCI” from the dropdown listing.
7. Copy the provided password.
8. Click on the “Understanding Foreign Ownership, Control, or Influence (FOCI)” course, which will open a new browser tab.
9. From the new tab, log in to Encite.io using your email address and the copied password.
10. Enroll in the course and click “Enter” to begin.

For Project Spectrum registration or access assistance, please email support@projectspectrum.io.

2.6 Joint Ventures

A small business joint venture entity must submit, with its proposal, the representation required in paragraph (c) of FAR solicitation provision 52.212-3, Offeror Representations and Certifications-Commercial Products and Commercial Services, and paragraph (c) of FAR provision 52.219-1, Small Business Program Representations, in accordance with 52.204-8(d) and 52.212-3(b) for the following categories:

a. Small business;
b. Service-disabled veteran-owned small business;
c. Women-owned small business (WOSB) under the WOSB Program;
d. Economically disadvantaged women-owned small business under the WOSB Program; or
e. Historically underutilized business zone small business.

These representations can be found here and must be uploaded to Volume 5, Supporting Documents of the proposal submission in DSIP, if applicable.

2.7 Conflicts of Interest

Contract awards to an SBC owned by or employing current, or previous, Federal Government employees could create conflicts of interest for those employees, which may be a violation of federal law.

2.8 Organizational Conflicts of Interest (OCI)

FAR 9.5 Requirements

In accordance with FAR 9.5, proposing SBCs are required to identify and disclose all facts relevant to potential organizational conflicts of interest (OCIs) involving the proposing SBC’s organization and any proposed team member (sub-awardee, consultant). The proposing SBC is responsible for providing this disclosure with each submitted proposal. The disclosure must include the proposing SBC’s, and as applicable, proposed team member’s OCI mitigation plan. The OCI mitigation plan must include a description of the actions the proposing SBC has taken, or intends to take, to prevent the existence of conflicting roles that might bias the proposing SBC’s judgment, and to prevent the proposing SBC from having unfair competitive advantage. The OCI mitigation plan will specifically discuss the disclosed OCI in the context of each of the OCI limitations outlined in FAR 9.505-1 through FAR 9.505-4.

Agency Supplemental OCI Policy

DoD Services/Components also may have a supplemental OCI policy prohibiting contractors/performers from concurrently providing scientific engineering technical assistance (SETA), advisory and assistance services (A&AS), or similar support services, and being a technical performer. As part of the FAR 9.5 disclosure requirement, a proposing SBC must affirm whether the proposing SBC or any proposed team member (sub-awardee, consultant) is providing SETA, A&AS, or similar support to any DoD Service/Component office(s) under: (a) a current award or sub-award; or (b) a past award or sub-award that ended within one calendar year prior to the proposal's submission date. If SETA, A&AS, or similar support is or was provided to any DoD Service/Component office(s), the proposal must include:

a. The name of the DoD Service/Component office receiving the support;
b. The prime contract number;
c. Identification of proposed team member (sub-awardee, consultant) providing the support; and
d. An OCI mitigation plan in accordance with FAR 9.5.

Government Procedures

In accordance with FAR 9.503, 9.504 and 9.506, the Government will evaluate OCI mitigation plans to avoid, neutralize, or mitigate potential OCI issues before award and determine whether it is in the government's interest to grant a waiver. The U.S. Government will only evaluate OCI mitigation plans for proposals determined selectable under the BAA evaluation criteria and funding availability.

The government may require proposing SBCs provide additional information to support evaluation of the proposing SBC's OCI mitigation plan.

If the government determines a proposer failed to fully disclose an OCI; or failed to provide a government waiver as described above; or failed to reasonably provide additional information the government requested when evaluating the proposer's OCI mitigation plan, the government may reject the proposal and withdraw it from consideration for award.

2.9 Research Involving Human Subjects/Human Subject Research (RIHS/HSR)

All research involving human subjects, to include use of human biological specimens and human data, shall comply with the applicable federal and state laws, and agency policy/guidelines for human subject protection (see Section 5.2 and Appendix B).

Institutions receiving funding for research involving human subjects must provide documentation of a current federal assurance of compliance with federal regulations for human subject protection; for example a Department of Health and Human Services, Office for Human Research Protections federal-wide assurance (http://www.hhs.gov/ohrp). The awarding DoD Service/Component may also request additional federal assurance documentation. All institutions engaged in human subject research, to include subcontractors, must also have a valid assurance. In addition, personnel involved in human subjects research must provide documentation of completed appropriate training for the protection of human subjects. Institutions proposing to conduct human subject research that meets one of the exemption criteria in 32 CFR 219.101 are not required to have a federal assurance of compliance. Proposing SBCs should clearly segregate research activities involving human subjects from other R&D activities in their proposal.

If selected, institutions must also provide documentation of institutional review board (IRB) approval, or a determination from an appropriate official in the institution, that the work meets one of the exemption criteria with 32 CFR 219. As part of the IRB review process, evidence that all investigators are appropriately trained should accompany the protocol. The protocol, separate from the proposal, must include a detailed description of the research plan, study population, risks and benefits of study participation, recruitment and consent process, and data collection and analysis.

The amount of time required for the IRB to review and approve the protocol will vary based on the IRB's procedures, the complexity of the research, the level of risk to study participants and the responsiveness of the investigator. The average IRB approval process can last between one and three months. Once the IRB has approved the research, the awarding DoD Service/Component will review the protocol and the IRB's determination to ensure that the research will be conducted in compliance with both DoD and Service/Component policies. The DoD review process can last between three to six months. Ample time should be allotted to complete both the IRB and DoD approval processes prior to recruiting subjects. **No funding can be used towards human subject research until ALL approvals are granted. Submitters proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal to avoid potential contract award delays.**

2.10 Research Involving Animal Subjects

All research, development, testing, experimentation, education, or training involving the use of animals shall comply with the applicable federal and agency rules on animal acquisition, transport, care, handling, and use (see Section 5.2 and Appendix B).

For submissions containing animal use, proposals should briefly describe plans for their institutional animal care and use committee (IACUC) review and approval.

All recipients must receive their IACUC's approval, as well as secondary or headquarters-level approval from a DoD veterinarian trained or experienced in laboratory animal medicine and science. **No animal research may be conducted using DoD funding until all appropriate DoD office(s) grant approval. Submitters proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal to avoid potential contract award delays.**

2.11 Research Involving Recombinant DNA Molecules

All research involving recombinant DNA molecules shall comply with the applicable federal and state law, regulation, and additional agency guidance. An institutional biosafety committee must approve the research.

In addition to the standard federal and DoD procurement certifications, the SBA SBIR Policy Directive requires the proposing business concerns provide certain information at time of award and during the award life cycle. Each proposing SBC must provide this additional information at the time of the Phase I and Phase II award, prior to final payment on the Phase I award, prior to receiving 50 percent of the Phase II total award amount, and prior to final payment on the Phase II award.

2.12 Federal Acquisition Supply Chain Security Act Orders

FAR 52.204-29 Federal Acquisition Supply Chain Security Act (FASCA) Orders—Representation and Disclosures and FAR 52.204-30 FASCA Orders—Prohibition are included in this solicitation. In accordance with FAR 52.204-29 and FAR 52.204-30, proposing SBCs must review FASCSA orders here for covered articles, or any products or services produced or provided by a source, that an applicable FASCSA order prohibits.

During contract performance, the contractor shall review SAM.gov at least once every three months, or as the contracting officer advises, to check for covered articles, or products or services produced subject as part of any new FASCSA order(s) that could impact their supply chain, and report to the contracting officer any covered article, or product or service produced or provided by a source provided to the government or used during the contract performance.

The proposing SBC represents that, via proposal submission under this BAA, it conducted a reasonable inquiry, and it does not propose to provide or use any covered article, or any products or services produced or provided by a source, if an applicable FASCSA prohibited the covered article or the source effective this BAA's issue date.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.1 Introduction

The proposal must provide sufficient information to demonstrate to the evaluator(s) that the proposed work represents an innovative approach to an important scientific or engineering problem and is worthy of support under the stated criteria. The proposed research or R&D must be responsive to the chosen topic, although it does not need to use the exact approach specified in the topic. SBCs should consider the following:

a. Does the technical approach have a reasonable chance of meeting the topic objective?
b. Is this approach innovative, not routine, with potential for commercialization?
c. Does the proposing SBC have the capability to implement the technical approach or can it obtain the appropriate people and equipment for the task?

DSIP provides a structure for providing the following proposal volumes:

a. Volume 1: Proposal Cover Sheet
b. Volume 2: Technical Volume
c. Volume 3: Cost Volume
d. Volume 4: Company Commercialization Report
e. Volume 5: Supporting Documents
f. Volume 6: Fraud, Waste and Abuse Training
g. Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

Each Service/Component guidance on allowable proposal content may vary. A completed proposal submission in DSIP does NOT indicate that each proposal volume has been completed in accordance with the Service/Component-specific instructions. Accordingly, it is the proposing SBC's responsibility to consult the Service/Component-specific instructions for detailed guidance, including required proposal documentation and structure, cost and duration limitations, budget structure, TABA allowance and proposal page limits.

3.2 Export-Controlled Topic Requirements

For proposals submitted under export-controlled topics, either International Traffic in Arms or Export Administration Regulations (ITAR/EAR), a copy of the certified DD Form 2345, Militarily Critical Technical Data Agreement, or evidence of application submission must be included. The form, instructions and FAQs may be found at the United States/Canada Joint Certification Program website, https://www.dla.mil/Logistics-Operations/Services/JCP/DD23%2045Instructions/.

DD Form 2345 approval will be required if a proposal submitted to an ITAR/EAR-marked topic receives an SBIR award.

3.3 Classified Proposals

Classified proposals will not be accepted under the DoD SBIR Program. If topics require classified work during Phase II, the proposing SBC must have a facility clearance to perform the work. For more information on facility and personnel clearance procedures and requirements, please visit the Defense Counterintelligence and Security Agency (DCSA) website at: https://www.dcsa.mil/mc/ctp/fc/.

3.4 Promotional Materials

Promotional and non-project related discussion is discouraged, and additional information provided via website links or on computer disks, CDs, DVDs, video tapes or any other medium will not be accepted or considered in the proposal evaluation.

3.5 Prior, Current, or Pending Support of Similar Proposals or Awards

While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program BAAs or solicitations, it is unlawful to enter negotiation for contracts requiring essentially equivalent effort. If there is any question concerning prior, current, or pending support of similar proposals or awards, it must be disclosed to the soliciting agency or agencies as early as possible and declared on the proposal cover sheet.

3.6 Marking Proprietary Proposal Information

Proposing SBCs that include data in their proposals they do not want disclosed to the public for any purpose, or only used for government evaluation purposes, shall:

a. Mark the first page of each volume of the proposal submission with the following legend:

> "This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed-in whole or in part-for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this proposing SBC as a result of-or in connection with-the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in pages [insert numbers or other identification of sheets]"; and

b. Mark each sheet of data it wishes to restrict with the following legend:

> "Use or disclosure of data contained on this page is subject to the restriction on the first page of this volume."

The DoD assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

Restrictive notices notwithstanding, support contractors may handle proposals and final reports submitted through DSIP for administrative purposes only; they are required to adhere to appropriate non-disclosure agreements.

3.7 Phase I Proposal Instructions

a. Proposal Cover Sheet (Volume 1)

The proposal cover sheet is prepared on DSIP. The cover sheet must include a brief technical abstract that describes the proposed R&D project and an anticipated benefits and potential commercial applications discussion. Each section should be no more than 3,000 characters.

Do not include proprietary or classified information in the proposal cover sheet. If your proposal is selected for negotiation and possible award, the technical abstract and anticipated benefits discussion may be publicly released online. DSIP will assign a proposal number once the cover sheet is saved. You may modify the cover sheet as needed until the BAA closes.

NOTE: the amounts listed in the percentage of work (POW) certification question on the proposal cover sheet are derived from SBC-entered information in the cost volume (Volume 3). Details on the calculation can be viewed in DSIP during proposal submission.

If the POW calculations fall below eligibility requirements, the funding agreement officer must upload either an explanatory letter or approval to the certification question to complete the submission. Some DoD Services/Components will not accept any deviations from the POW minimum requirements. Please refer to the Service/Component instructions regarding deviations acceptance to the POW requirements.

b. **Technical Volume Format (Volume 2)**

1. **File Type.** The Technical Volume must be a single PDF file, including graphics. Perform a virus check before uploading the technical volume file. If a virus is detected, the proposal may be rejected. **Do not lock, password protect or encrypt the uploaded file. Do not include or embed active graphics, such as videos, moving pictures, or other similar media, in the document.**

2. **Length.** It is the proposing SBC's responsibility to verify that the technical volume does not exceed the page limit after upload to DSIP. Please refer to Service/Component-specific instructions for how a technical volume is handled if the stated page count is exceeded. Some Services/Components will reject the entire technical proposal if the proposal exceeds the stated page count.

3. **Layout.** Number all proposal pages consecutively. Submit a direct, concise, and informative research or R&D proposal (no type smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins, including the header). Each header on each page in the technical volume should contain the proposing SBC's name, topic number, and the DSIP-assigned proposal number from the cover sheet.

c. **Technical Volume Content (Volume 2)**

The Technical Volume should cover the following items <u>in the order given below</u>:

1. Identification and Significance of the Problem or Opportunity
2. Phase I Technical Objectives
3. Phase I Statement of Work
4. Related Work
5. Relationship with Future Research or Research and Development
6. Commercialization Strategy
7. Key Personnel
8. Foreign Citizens
9. Facilities/Equipment
10. Subcontractors/Consultants
11. Prior, Current, or Pending Support of Similar Proposals or Awards
12. Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software

A Phase I technical volume template is available in Appendix A to provide details and helpful guidelines for completing each section of your Phase I technical proposal.

Refer to the Service/Component-specific Direct to Phase II instructions for details on proposal preparation and technical volume content requirements.

d. **Cost Volume Content (Volume 3)**

Complete the cost volume using the DSIP cost volume form. Some items in the cost breakdown may not apply to the proposed project. There is no need to provide information on each individual item; make sure to provide enough information for evaluators to understand the requested funds' planned use if a contract is awarded.

1. List all key personnels' names and include their individual hours dedicated to the project as direct labor.
2. While special tooling and test equipment and material cost may be included under Phase I, equipment and material inclusion will be carefully reviewed relative to need and appropriateness for the work proposed. Special tooling and test equipment purchases must, in the Service/Component contracting officer's opinion, be advantageous to the U.S. Government and should relate directly to the specific topic. These may include such items as innovative instrumentation or automatic test equipment. Title to property the U.S. Government furnished or acquired with government funds will be vested with the DoD Service/Component, unless it is determined that title transfer to the contractor would be more cost effective than the DoD Service/Component equipment recovery.
3. Cost for travel funds must be justified and related to the project needs.
4. Cost sharing is permitted for proposals under this BAA; cost sharing is not required, nor will it be an evaluation factor in the Phase I proposal consideration.
5. A Phase I option (if applicable) should be fully costed separately from the Phase I (base) approach.
6. All subcontractor costs and consultant costs, such as labor, travel, equipment, materials, must be detailed at the same level as prime contractor costs. Provide detailed subcontractor costs substantiation in your cost proposal. Supporting Documents (Volume 5) may be used if additional space is needed.

If a proposal is selected for negotiation and possible award, you must be prepared to submit further documentation to the Service/Component contracting officer to substantiate costs (e.g., a cost estimates explanation for equipment, materials, and consultants or subcontractors). For more information about cost proposals and accounting standards, see visit DCAA's website.

e. **Company Commercialization Report (Volume 4)**

The company commercialization report (CCR) allows companies to report funding outcomes resulting from prior SBIR and STTR awards. SBA requires SBIR and STTR awardees to update and maintain their organization's CCR on SBIR.gov. Commercialization information is required upon the last deliverable's completion under the funding agreement. Thereafter, SBIR and STTR awardees are requested to voluntarily update the information in the database annually for a minimum 5-year period.

If the proposing SBC has prior DoD and/or non-DoD Phase I and/or Phase II SBIR/STTR awards, regardless of whether the project has any commercialization to date, the firm admin must download the CCR's PDF copy from SBIR.gov and upload it to DSIP's "Firm Forms" section. The DSIP firm admin completes the firm forms are completed and are applies them to all proposals the proposing SBC submits. To fulfill the DSIP CCR requirement complete the following:

1. Log into the firm account at https://www.sbir.gov/.
2. Navigate to My Dashboard > My Documents to view or print the information currently contained in the "Company Registry Commercialization Report."
3. Create or update the commercialization record, from the company dashboard, scroll to the "My Commercialization" section and click the "Create/Update Commercialization" tab under "Current Report Version." Please refer to the "Instructions" and "Guide" documents contained on dashboard for more detail on completing and updating the CCR. **Ensure the report is certified and submitted.**
4. Click the "Company Commercialization Report" PDF under the dashboard's "My Documents" section to download the CCR PDF.
5. Upload the CCR PDF (downloaded from SBIR.gov in previous step) to the "Company Commercialization Report" in DSIP's "Firm Forms" section. The firm admin must complete this upload action.

In Volume 4 of the DSIP proposal submission, the proposing SBC will be prompted to answer: "Do you have a new or revised Company Commercialization Report to upload?" There are three possible courses of action:

a. If the proposing SBC has prior DoD and/or non-DoD Phase I and/or Phase II SBIR/STTR awards and **has a new or revised CCR from SBIR.gov to upload to DSIP**, select YES.
   1. If the user is the firm admin, they can upload the CCR PDF from SBIR.gov directly on this page. It will also be updated in the "Firm Forms" and be associated with all new or in-progress proposals the proposing SBC submitted. If the user is not the firm admin, they will receive a message that they do not have access and must contact the firm admin to complete this action.
   2. **WARNING:** Uploading a new CCR under the DSIP "Firm Forms" section or clicking "Save" or "Submit" in one proposal's Volume 4 is considered a change for ALL proposals under any open BAAs or CSOs. If a proposing SBC has previously certified and submitted any Phase I or Direct to Phase II proposals under ***any*** BAA or CSO ***still open***, those proposals will be automatically reopened. Proposing SBCs will have to recertify and resubmit affected proposals. If a proposing SBC does not recertify or resubmit affected proposals, they will not be considered fully submitted and will not be evaluated.

b. If the proposing SBC has prior DoD and/or non-DoD Phase I and/or Phase II SBIR/STTR awards, and **no new or revised CCR from SBIR.gov to upload to DSIP**, select NO.
   1. If a prior CCR was uploaded to the "Firm Forms", the proposing SBC will see a file dialog box at the bottom of the page and can view the previously uploaded CCR. This read-only access allows the proposing SBC to confirm the firm admin uploaded the CCR.
   2. If no file dialog box appears at the bottom of the page **there is no previously uploaded CCR in the DSIP "Firm Forms**." To fulfill the DSIP CCR requirement the firm admin must follow steps 1-5 listed above to download a CCR PDF from

SBIR.gov and upload it to the DSIP "Firm Forms" to be included with all proposal submissions.

c. If the proposing SBC has **NO** prior DoD and/or non-DoD Phase I and/or Phase II SBIR/STTR awards, the CCR upload from SBIR.gov is not required and SBC will select NO. The proposal's CCR section will be marked complete.

Please refer to the Service/Component-specific instructions for details on how the CCR information will be considered during proposal evaluations.

f. **Supporting Documents (Volume 5)**

Volume 5 is provided for proposing SBCs to submit additional documentation to support the Coversheet (Volume 1), Technical Volume (Volume 2), and the Cost Volume (Volume 3).

The following documents may be included in Volume 5, if applicable to the proposal. Refer to Service/Component-specific instructions for additional Volume 5 requirements. **Reminder: A completed proposal submission in DSIP does NOT indicate the mandatory supporting documents have been uploaded in accordance with the Service/Component-specific instructions.**

1. Letters of support
2. Additional cost information
3. Funding agreement certification
4. Technical data rights (assertions)
5. Lifecycle certification
6. Allocation of rights
7. Verification of Eligibility of Small Business Joint Ventures, if applicable
8. DD Form 2345, Militarily Critical Technical Data Agreement, if applicable (see section 3.2)

g. **Fraud, Waste, and Abuse Training (Volume 6)**

The fraud, waste, and abuse (FWA) training is **required** for DoD SBIR/STTR proposals. FWA training provides information on what represents FWA in the SBIR/STTR program, the most common mistakes that lead to FWA, as well as the penalties and ways to prevent FWA. The training currently consists of a 3-page PDF, consistent with the tutorial provided by the SBA. This training material must be thoroughly reviewed once per year and can be found here and in the DSIP proposal submission module for Volume 6. Plan time to review the tutorial during completion of Volume 6, prior to the proposal submission deadline. The individual designated as the Proposal Owner must complete this training on behalf of the proposing small business.

h. **Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7)**

In accordance with 15 U.S.C. §638 (vv) and the SBA SBIR/STTR Policy Directive, the DoD will review all proposals submitted in response to this BAA to assess security risks of SBCs seeking a federally funded award. SBCs must complete the DSIP Volume 7 webform "Disclosures of Foreign Affiliations or Relationships to Foreign Countries" (NOTE: PDF uploads are no longer accepted). The corporate official cannot certify and submit the full proposal until the Volume 7 webform is fully completed and submitted.

Please be aware that the “Disclosures of Foreign Affiliations or Relationships to Foreign Countries” form WILL NOT be accepted as a supporting document in DSIP’s Volume 5 proposal submission. Do not upload any previous versions of this form to Volume 5.

For additional details, please refer to Section 2.5. The disclosure questions are below:

1. Is any owner or covered individual of the applicant or awardee party to any malign foreign talent recruitment program? If yes, disclose the first and last name of each owner or covered individual, identify their role (i.e., owner or covered individual), and the malign foreign talent recruitment program.
2. Is there a parent company, joint venture, or subsidiary, of the applicant or awardee that is based in or receives funding from, any foreign country of concern? If yes, disclose the name, full address, applicant or awardee relationships (i.e., parent company, joint venture, or subsidiary) of each entity based in, or funded by, any foreign country of concern.
3. Does the applicant or awardee have any current or pending contractual or financial obligation or other agreement specific to a business arrangement, or joint venture-like arrangement with an enterprise owned by a foreign state or any foreign entity? If yes, disclose the name of each enterprise or foreign entity, type of obligation, agreement, or arrangement (*i.e.,* contractual, financial, or other), description of obligation, agreement, or arrangement, and the foreign state(s) and/or the country of the foreign entity (or entities).
4. Is the applicant or awardee wholly owned in a foreign country? If yes, disclose the foreign country.
5. Does the applicant or awardee have any venture capital or institutional investment? If yes, proceed to question 5a. If no, proceed to question 6.

   5a. Does the investing entity have a general partner or any other individual holding a leadership role who has a foreign affiliation with any foreign country of concern? If yes or unable to determine, disclose the venture capital or institutional investing entity's name, the percentage of ownership obtained by the investing entity, and the type of investment (i.e., equity, debt, or combination of equity and debt).
6. During the previous 5-year period, did the applicant or awardee have any technology licensing or intellectual property sales or transfers, to a foreign country of concern? If yes, disclose the name, address, and country, of the institution or entity that licensed, purchased, or received the technology or intellectual property.
7. Is there any foreign business entity, offshore entity, or entity outside the United States related to the applicant or awardee? If yes, disclose the entity name, relationship type (i.e., foreign business entity, offshore entity, entity outside the United States), description of the relationship to the applicant or awardee, and entity address and country.
8. Does the applicant or awardee have an owner, officer, or covered individual that has a foreign affiliation with a research institution located in a foreign country of concern? If yes, disclose the first and last name of each owner, officer, or covered individual that has a foreign affiliation with a foreign country of concern, identify their role (i.e., owner, officer, or covered individual), and the name of the foreign research institution and the foreign country of concern where it is located.

3.8 Phase II Proposal Information

Only Phase I awardees may submit Phase II proposals. Phase II proposals submission must follow individual Service/Component instructions. Awarding DoD Services/Component, either in the Phase I award or via subsequent notification, will provide details on Phase II proposal due date, content, and submission requirements. If a proposing SBC submits their Phase II proposal prior to the individual Service/Component's dates, it may be rejected without evaluation.

Due to specific limitations on the amount of funding and number of awards awarded to a particular proposing SBC per topic using SBIR/STTR program funds, head of agency determinations are now required before a different agency may make an award using another agency's topic. This limitation does not apply to Phase III funding. Please contact your original sponsoring agency before submitting a Phase II proposal to an agency other than the one who sponsored the original topic.

SBIR/STTR Policy Directive Section 4(b)(1)(i) allows that, at the agency's discretion, projects awarded a Phase I under a solicitation for SBIR may transition in Phase II to STTR and vice versa. A proposing SBC wishing to transfer from one program to another must contact their designated technical monitor to discuss the reasons for the request and the agency's ability to it. The transition may be proposed prior to award or during the Phase II effort performance. Agency disapproval of a request to change programs shall not be grounds for granting relief from any contractual performance requirement. All approved transitions between programs must be noted in the contracting officer-signed Phase II award or award modification that indicates the removal or addition of the research institution and the revised percentage of work requirements.

3.8.1 Phase II Commercialization Strategy

At a minimum, the commercialization strategy must address the following five questions:

a. What will be the first product to use this technology?
b. Who will be the customers, and what is the estimated market size?
c. How much money is needed to bring the technology to market, and how will that money be raised?
d. Does the proposing SBC contain marketing expertise and, if not, how will the SBC acquire that expertise?
e. Who are the proposing SBC's competitors, and what is the price and/or quality advantage over those competitors?

The commercialization strategy must also include a schedule showing the anticipated quantitative commercialization results at 1) one year after the Phase II project starts, 2) at Phase II completion, and 3) after Phase II completion (i.e., additional investment amount, sales revenue, etc.). After Phase II award, the proposing SBC is required to report actual sales and investment data in its SBA company commercialization report via SBIR.gov's "My Dashboard" on a minimum annual basis. Please refer to the Service/Component-specific instructions for guidance on formatting, page count and other details.

3.8.2 Phase II Adequate Accounting System

To reduce the small business's risk and avoid potential contracting delays, companies interested in pursuing Phase II SBIR contracts and other contracts of similar size with the DoD, must have an adequate accounting system in place per General Accepted Accounting Principles, Generally Accepted Government Auditing Standards, Federal Acquisition Regulation (FAR) and Cost Accounting Standards. The Defense Contract Audit Agency (DCAA) will audit the accounting system. See DCAA's website for requirements and standards, the audit process overview, and a pre-award system adequacy checklist.

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Evaluation Process

All proposals will be evaluated and judged on a competitive basis in terms of technical capability and technical value. Proposals will be initially screened to determine responsiveness to the topic objective. Proposals passing this initial screening will be technically evaluated by engineers, scientists, or subject matter experts to determine the most promising technical and scientific approaches. As a common statement of work does not exist, each proposal will be assessed on the merit of the approach in achieving the technical objectives established in the topic.

4.2 Evaluation Criteria

Proposals will be evaluated based on the criteria outlined below, unless otherwise specified in the Service/Component-specific instructions. Selections will be based on a determination of the overall technical value of each proposal and an evaluation of the cost volume, with the appropriate method of analysis given the contract type to be awarded, for selection of the proposal(s) most advantageous to the Government, considering the following factors which are listed in descending order of importance:

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the R&D but also the ability to commercialize the results.
c. The potential for commercial (government or private sector) application and the benefits expected to accrue from this commercialization.

Cost or budget data submitted with the proposals will be considered during evaluation.

Technical reviewers will base their conclusions only on information contained in the proposal. Do not assume reviewers are acquainted with the proposing SBC, key individuals, or any referenced experiments. Relevant supporting data such as journal articles, literature, including Government publications, etc., should be included based on requirements listed in Service/Component-specific instructions.

4.3 Proposal Status & Feedback

Proposing SBCs will be notified of selection or non-selection status for an award by the DoD Service/Component that originated the topic <u>no later than 90 days</u> of the closing date for this BAA. Please refer to the Service/Component-specific instructions for details.

After final selection decisions have been announced, the SBC may be provided proposal feedback in the form of a written debrief. This debriefing process varies across the DoD Services/Components. Please refer to the Service/Component-specific instructions for details on the debriefing processes.

4.4 Award Denials

The DoD will not make an award under the SBIR program if it determines:

a. The SBC submitting the proposal
    i. has an owner or covered individual that is party to a malign foreign talent recruitment program;
    ii. has a business entity, parent company, or subsidiary located in the People's Republic of China or another foreign country of concern; or
    iii. has an owner or covered individual that has a foreign affiliation with a foreign entity located in the People's Republic of China or another foreign country of concern; and

b. The relationships and commitments described in clauses (i) through (iii) of subparagraph (A)
   i. interfere with the capacity for DoD-supported activities to be carried out;
   ii. create duplication with DoD-supported activities;
   iii. present concerns about conflicts of interest;
   iv. were not appropriately disclosed to the DoD;
   v. violate Federal law or terms and conditions of DoD-awarded contracts or other agreements; or
   vi. pose a risk to national security.

4.5 Pre-Award and Post Award BAA Protests

Interested parties have the right to protest via procedures in FAR Subpart 33.1; protests exclusively related to this BAA's terms must be served to: osd.ncr.ousd-r-e.mbx.SBIR-STTR-Protest@mail.mil

For protests filed with the Government Accountability Office (GAO), a copy of the protest shall be submitted to the email address listed above (pre-award ONLY) or DoD Service/Component POC (post-selection/award decision ONLY) within one day of filing with the GAO. Protests of small business status of a selected proposing SBC may also be made to the SBA via the procedures in FAR § 19.302.

For the purposes of a protest related to a particular topic selection, non-selection or award decision, protests should be served to the point-of-contact (POC) listed in the instructions of the DoD Component that authored the topic.

5.0 ADDITIONAL CONSIDERATIONS

5.1 Award Information

The number of awards will be consistent with the Component's RDT&E budget. No contracts will be awarded until evaluation of all qualified proposals for a specific topic is completed.

Each proposal selected for negotiation and possible award will be funded under negotiated contracts, purchase orders, or Other Transactions and will include a reasonable fee or profit consistent with normal profit margins provided to profit-making proposing SBCs for R/R&D work. Firm-Fixed-Price, Firm-Fixed-Price Level of Effort, Labor Hour, Time & Material, or Cost-Plus-Fixed-Fee type contracts can be negotiated and are at the discretion of the Component Contracting Officer.

Contract value varies among the DoD Services/Components; it is important for proposing SBCs to review Service/Component-specific instructions regarding award size.

The SBA SBIR/STTR Policy Directive, Section 7(c)(1)(ii), states agencies should issue the award no more than 180 days after the closing date of the BAA.

5.2 Contract Requirements

Upon contract award, the contractor will be required to make certain legal commitments through acceptance of U.S. Government contract clauses in the Phase I contract. The examples below are illustrative of the types of provisions the Federal Acquisition Regulation requires in the Phase I contract. This is not an exhaustive provisions list that could be included in Phase I contracts, nor does it contain specific clause wording. Appendix C of this BAA contains additional potential required Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) clauses. Copies of complete general provisions will be made available prior to award.

Examples of general provisions:

a. **Standards of Work**. Work performed under the Funding Agreement must conform to high professional standards.
b. **Inspection**. Work performed under the Funding Agreement is subject to Government inspection and evaluation at all times.
c. **Examination of Records**. The Comptroller General (or a duly authorized representative) must have the right to examine any pertinent records of the Awardee involving transactions related to this Funding Agreement.
d. **Default**. The Federal Government may terminate the Funding Agreement if the contractor fails to perform the work contracted.
e. **Termination for Convenience**. The Funding Agreement may be terminated at any time by the Federal Government if it deems termination to be in its best interest, in which case the Awardee will be compensated for work performed and for reasonable termination costs.
f. **Disputes.** Any dispute concerning the Funding Agreement that cannot be resolved by agreement must be decided by the contracting officer with right of appeal.
g. **Contract Work Hours**. The Awardee may not require an employee to work more than 8 hours a day or 40 hours a week unless the employee is compensated accordingly (for example, overtime pay).
h. **Equal Opportunity**. The Awardee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.
i. **Equal Opportunity for Veterans**. The Awardee will not discriminate against any employee or application for employment because he or she is a disabled veteran or veteran of the Vietnam era.
j. **Equal Opportunity for People with Disabilities**. The Awardee will not discriminate against any employee or applicant for employment because he or she is physically or intellectually disabled.
k. **Officials Not to Benefit**. No Federal Government official may benefit personally from the SBIR/STTR Funding Agreement.
l. **Covenant Against Contingent Fees**. No person or agency has been employed to solicit or secure the Funding Agreement upon an understanding for compensation except bona fide employees or commercial agencies maintained by the Awardee for the purpose of securing business.
m. **Gratuities**. The Funding Agreement may be terminated by the Federal Government if any gratuities have been offered to any representative of the Government to secure the award.
n. **Patent Infringement**. The Awardee must report each notice or claim of patent infringement based on the performance of the Funding Agreement.
o. **American Made Equipment and Products**. When purchasing equipment or a product under the SBIR/STTR Funding Agreement, purchase only American-made items whenever possible.

5.3 Agency Recovery Authority and Ongoing Reporting

In accordance with Section 5 of the SBIR and STTR Extension Act of 2022, the DoD will:

a. require an SBC receiving an award under its SBIR program to repay all amounts received from the federal agency under the award if,
   1. the SBC makes a material misstatement that the federal agency determines poses a risk to national security; or
   2. there is a change in the SBC’s ownership, entity structure, or other substantial change in circumstances that the federal agency determines poses a risk to national security; and

b. require an SBC receiving an award under its SBIR program to regularly report to the federal agency and the administration throughout the duration of the award on

1. any change to a disclosure required under the Disclosures of Foreign Affiliations or Relationships to Foreign Countries form;
2. any material misstatement made under paragraph (A) above; and
3. any change described in paragraph (B) above.

5.4 Copyrights

With prior written permission of the contracting officer, the awardee may copyright (consistent with any appropriate national security considerations) material developed with DoD support. DoD receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgment and disclaimer statement.

5.5 Patents

SBCs normally may retain the principal worldwide patent rights to any invention developed with U.S. Government support. The government receives a royalty-free license for its use, reserves the right to require the patent holder to license others in certain limited circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. 35 U.S.C. § 205 authorizes that the government will not make public any information disclosing a government-supported invention for a period of five years to allow the awardee to pursue a patent. See also Section 6.8, Invention Reporting.

5.6 Invention Reporting

SBIR awardees must report inventions to the Service/Component within two months of the inventor's report to the awardee, via either paper documentation submission, including fax, or through the Edison Invention Reporting System at www.iedison.gov for participating agencies.

5.7 Technical Data Rights

Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this BAA generally remain with the contractor, except that the U.S. Government obtains a royalty-free license to use such technical data only for government purposes during the period commencing with contract award and ending not less than twenty years after that date. This data should be marked with the restrictive legend specified in DFARS 252.227-7018 Class Deviation 2020-O0007. Upon expiration of the twenty-year restrictive license, the government has government purpose rights in the SBIR data. During the license period, the U.S. Government may not release or disclose SBIR data to any person other than its support services contractors except: (1) for evaluation purposes; (2) as expressly permitted by the contractor; or (3) a use, release, or disclosure that is necessary for emergency repair or overhaul government-operated items. See DFARS clause 252.227-7018 Class Deviation 2020-O0007 "Rights in Noncommercial Technical Data and Computer Software – Small Business Innovation Research (SBIR) Program."

If a proposing SBC plans to submit assertions in accordance with DFARS 252.227-7017 Class Deviation 2020-O0007, those assertions must be identified and assertion of use, release, or disclosure restriction must be included with your proposal submission, at the end of the technical volume. The contract cannot be awarded until assertions are approved.

5.8 Final Technical Reports - Phase I through Phase III

a. **Content**: A final report is required for each project phase. The reports must contain in detail the project objectives, work performed, results obtained, and estimates of technical feasibility. A completed SF 298, "Report Documentation Page," will be used as the first page of the report. The DoD Service/Component also may require monthly status and progress reports.

b. **SF 298 Form "Report Documentation Page" Preparation**:

a. If desirable, the proposing SBC may also use language from its Phase II proposal to cover Phase I progress in the final report.

b. For each unclassified report, the proposing SBC submitting the report should fill in Block 12 (Distribution/Availability Statement) of the SF 298, "Report Documentation Page," with the following statement: "Distribution authorized to U.S. Government only; Proprietary Information, (Date of Determination). Other requests for this document shall be referred to the Service/Component SBIR Program Office."

   Note: Data developed under a SBIR contract is subject to SBIR Data Rights, under which DFARS 252.227-7018 Class Deviation 2020-O0007 (see Section 5.7, Technical Data Rights) provides protection. The sponsoring DoD activity, after reviewing the proposing SBC's entry in Block 12, has final responsibility for assigning a distribution statement.

   For additional information on distribution statements see the following Defense Technical Information Center (DTIC) website.

c. Block 14 (Abstract) of the SF 298, "Report Documentation Page" must include as the first sentence, "Report developed under SBIR contract for topic [insert BAA topic number. [Follow with the topic title, if possible.]" The abstract must identify the work's purpose and briefly describe the work conducted, the findings or results, and the effort's potential applications. **Since DoD will publish the abstract, it must not contain any proprietary or classified data, and type "UU" in Block 17.**

d. Block 15 (Subject Terms) of the SF 298 must include the term "SBIR Report".

c. **Submission**: In accordance with DFARS 252.235-7011, submit an electronic copy of the approved final scientific or technical report, not a summary, delivered under the contract to the Defense Technical Information Center (DTIC) through the web-based input system at https://discover.dtic.mil/submit-documents/ as required by DoD Instruction 3200.12, DoD Scientific and Technical Information Program (STIP). Include a completed Standard Form (SF) 298, Report Documentation Page, in the document, or complete the web-based SF 298. Additional submission resources are available here.

   Delivery will normally be within 30 days after completion of the Phase I technical effort.

   Other requirements regarding reports and/or other deliverables submission will be defined in each contract's contract data requirements list (CDRL). Special instructions for submitting CLASSIFIED reports will be defined in the contract's delivery schedule.

   DO NOT email classified or controlled unclassified reports, or reports containing SBIR Data Rights protected under DFARS 252.227-7018 Class Deviation 2020-O0007.

6.0 PROPOSAL SUBMISSION

6.1 Submission Details

DSIP is the official portal for DoD SBIR/STTR proposal submission. Proposers are required to submit proposals via DSIP; proposals submitted by any other means will be disregarded. Detailed guidance on DSIP proposal submission is found here.

Deadline for Receipt: Complete proposals must be certified and submitted in DSIP no later than the close date of the release listed on the cover page of this BAA. Proposals cannot be submitted in DSIP after the deadline is reached and will not be accepted or evaluated.

The final proposal submission includes successful completion of all firm level forms, all required proposal volumes, and electronic corporate official certification. Although signatures are not required on the electronic forms at the time of submission, the proposal must be certified electronically by the corporate official for it to be considered submitted. If the proposal is selected for negotiation and possible award, the DoD Component program will contact the proposing SBC for signatures prior to award. **Please plan to submit proposals as early as possible to allow time for troubleshooting any possible issues before the BAA close. DSIP Support is unable to assist with submission issues once a deadline has passed and cannot provide submission extensions. DoD is not responsible for missed proposal submission due to system latency.**

If the proposal status is "In Progress" or "Ready to Certify" it will NOT be considered submitted, even if all volumes are added prior to the BAA close date. The proposing SBC may modify all proposal volumes prior to the BAA close date.

6.2 Technical Questions

a. **Direct Contact with Topic Authors**. During the pre-release period, the names of the topic authors, their phone numbers and/or email addresses are published with the topic on the DSIP Topics and Topic Q&A page. During this time, proposing SBCs can contact topic authors via telephone or email to ask technical questions about specific BAA topics. Questions must be limited to specific information related to understanding a particular topic's requirements. Proposing SBCs may not ask for advice or guidance on solution approach and may not submit additional material to the topic author.

   If information provided during an exchange with the topic author is deemed necessary for proposal preparation, that information will be made available to all parties through DSIP Topic Q&A.

   After the pre-release period, questions must be asked through DSIP Topic Q&A as described below. No further direct contact is allowed between proposing SBCs and topic authors, unless the topic author is responding to a question submitted during the pre-release period.

b. **DSIP Topic Q&A.** Proposing SBCs may submit written questions through DSIP Topic Q&A here, where all questions and answers are posted on a non-attribution basis for public viewing. DSIP Topic Q&A opens on the pre-release date and closes two weeks prior to the topic close date.

   Proposing SBCs may use the topic search feature on DSIP to locate a topic of interest. Use the form at the bottom of the topic description, enter and submit the question. Answers are generally posted within seven business days of question submission and also e-mailed directly to the inquirer.

   Questions submitted through the DSIP Topic Q&A are limited to technical information focused on understanding a topic's requirements. Any other questions, such as asking for advice or guidance on solution approach, or administrative questions, such as SBIR or STTR program eligibility, technical proposal/cost proposal structure and page count, budget and duration limitations, or proposal due date are not appropriate and will not receive a response; for administrative questions, refer to a topic's Service/Component-specific instructions.

Once the BAA proposal submission closes, no communication of any kind is allowed either with the topic author or through topic Q&A regarding submitted proposals.

Throughout the BAA period, proposing SBCs should frequently monitor DSIP for updates and amendments to the topics and DSIP Topic Q&A for questions and answers.

7.0 Participating Component Instructions & Research Topics

The following section contains all Component-specific proposal preparation instructions and research topics this BAA.

DoD SBIR 25.4 BAA
Release 8

May 7, 2025: Topics Pre-Release
May 28, 2025: Topics Open; DoD begins accepting proposals in DSIP
June 11, 2025: DSIP Topic Q&A closes to new questions at **12:00 p.m. ET**
June 25, 2025: Topics Close; Deadline for receipt of proposals is **12:00 p.m. ET**

Participating Services/Components:

- Department of the Army (Army)
- Department of the Air Force (Air Force)
- Defense Advanced Research Projects Agency (DARPA)
- Missile Defense Agency (MDA)

Version 4

DEPARTMENT OF THE ARMY
DoD 25.4 Small Business Innovation Research (SBIR)
Annual Broad Agency Announcement (BAA)
Component-Specific Proposal Instructions
Release 8

IMPORTANT

The following topic number in this release is part of a prize competition, xTechSearch 9: A254-P039

xTechSearch 9 will be used to identify small business concerns that meet the criteria for award. Winners selected from the xTechSearch 9 prize competition will be the only firms eligible to submit an SBIR proposal under the topic listed above. Proposals submitted to the topic listed above by non-winners of the xTechSearch 9 competition will not be evaluated. See the full xTech competition RFI here: https://www.xtech.army.mil/competitions

NOTE: White papers are NOT submitted to DSIP. Small business concerns that do not submit a concept white paper to the xTechSearch 9 competition before the June 4, 2025 deadline will be ineligible to compete or submit a full SBIR proposal to DSIP.

The white paper submission deadline for xTechSearch 9 is June 4, 2025 at 5pm ET. White papers must be submitted by following instructions provided at the xTechSearch 9 link above. NOTE: white papers are NOT submitted to DSIP. Small business concerns that do not submit a concept white paper to the xTechSearch 9 competition before the June 4, 2025 deadline will be ineligible to compete or submit a full SBIR proposal to DSIP.

The following topic numbers are NOT part of the prize competition and are subject to submission deadlines as published in the DoD SBIR 25.4 Program BAA, Release 8.

A254-031	**A254-032**	**A254-033**	**A254-034**	**A254-035**	**A254-036**
A254-037	**A254-038**				

To the extent possible, all Department of the Army component specific text follows the same numbering as the related sections in the Department of Defense (DoD) SBIR 25.4 Program BAA. Supplemental numbering is used only when the text cannot be integrated intelligibly with the DoD SBIR 25.4 Program BAA counterpart.

Each Small Business Concern (SBC) (also referred to herein as "proposer", "offeror", and/or "firm") is encouraged to thoroughly review the DoD SBIR 25.4 Program BAA, to include any amendments/revisions, and the Army component-specific proposal instructions herein.

Please note that these instructions contain active hyperlinks. Offerors are encouraged to utilize these hyperlinks for additional information and resources. Ensure your browser or Portable Document Format viewer settings permit hyperlink access to take full advantage of these resources.

The following resources are provided to assist SBCs with SBIR Program Opportunities:

- The DoD SBIR 25.4 Program BAA is located at: https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations.

- To remain apprised of important programmatic and solicitation changes, SBCs should register for the Defense SBIR / Small Business Technology Transfer (STTR) Innovation Portal (DSIP) Listserv at: https://www.dodsbirsttr.mil/submissions/login.

- Department of the Army's SBIR|STTR Website: https://www.armysbir.army.mil/.

Version 4

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1.0 PROGRAM DESCRIPTION

1.1 Objectives and Context

The future Army must be capable of conducting Multi-Domain Operations (MDO) as part of an integrated Joint Force across an array of situations in multiple theaters by 2035. The MDO concept describes how the Army will support the Joint Force in the rapid and continuous integration of all domains of warfare – land, sea, air, and cyberspace – to deter and prevail as we compete short of conflict, and fight and win if deterrence fails. The Army must provide game-changing capabilities to our Soldiers. To capitalize on small business innovation and reduce the time from solicitation to award, the Army leverages an approach that advertises SBIR funding opportunities through the DoD Annual BAA process, with monthly topic releases. Additionally, the Army has established a SBIR|STTR Contracting Center of Excellence dedicated to executing all SBIR|STTR Phase I and Phase II awards for Army customers.

1.4 Eligibility and Performance Requirements

Proposing SBCs may refer the DoD SBIR 25.4 Program BAA, to include any amendments/revisions, for full eligibility requirements.

Furthermore, firms must not be debarred, suspended, proposed for debarment, or excluded from Government contracting within the System for Award Management (SAM) –

- Contractors debarred, suspended, or proposed for debarment are excluded from receiving an award. Contractors that are debarred, suspended, or proposed for debarment are also excluded from conducting business with the Government as agents or representatives of other contractors.
- Contractors and other entities that have an active exclusion record in SAM because they have been declared ineligible on the basis of statutory or other regulatory procedures are excluded from receiving an award under the conditions and for the period set forth in the statute or regulation.
- The Army SBIR|STTR Program will not consent to subcontracts with these contractors.

1.5 Majority Ownership in Part by Multiple Venture Capital, Hedge Fund, and Private Equity Firms

Under the Department of the Army's SBIR Program, proposing SBCs that are owned in majority part by multiple venture capital operating companies (VCOCs), hedge funds (HF), or private equity funds (PEF) are eligible to submit applications or receive awards. Reference may be made to the DoD SBIR 25.4 Program BAA, including revisions/amendments, as well as 13 CFR 121.702, regarding eligibility standards, to include ownership and control requirements, applicable to the SBIR program.

All applicants that are majority-owned by multiple VCOC, HF or PEF, and are submitting a proposal to an Army Topic, shall complete the certification at Verification of Eligibility of Small Business Joint Ventures, prior to submitting an application/proposal and must include the certification with their submission.

1.7 Direct to Phase II (DP2) Program

Implementing the authority granted by 15 U.S.C. §638 (cc), as amended, the U.S. Army will be conducting 'Direct to Phase II' contract awards for eligible SBIR topics. For eligible topics, please refer to Section 3.9, Direct to Phase II (DP2) Proposal Instructions, below.

1.8 Program on Innovation Open Topics

This release may contain an open topic. Proposing SBCs shall refer to the DoD SBIR 25.4 Program BAA, to include any amendments/revisions, for additional information regarding open topic submissions.

1.9 Discretionary Technical and Business Assistance (TABA)

The Army's SBIR and STTR Policy Directive, Section 9(b), authorizes the provision of Technical Assistance and Business Assistance (TABA) to awardees. TABA aims to support awardees in several key areas, including making informed technical decisions, overcoming technical challenges, mitigating technical risks, and facilitating the commercialization of their SBIR|STTR projects. While participation in the Army SBIR|STTR TABA program is voluntary, the Army encourages awardees to utilize its preferred vendor, FedTech, for these services. Instructions to complete the Army's preferred vendor application will be provided upon contract award.

Alternatively, proposing SBCs may choose to contract TABA services themselves through one or more providers. To do so, the SBC must explicitly state in its Army SBIR|STTR proposal its intention to use a different TABA provider. The cost of TABA services, not exceeding the resource limitations specified below, must be included in the Cost Volume (Volume 3) of the proposal. This amount cannot include any profit/fee for the proposing SBC. Additionally, TABA costs cannot be factored into the calculation of general and administrative expenses (G&A) for the proposing SBC. **The required justification for using a firm-selected TABA vendor must be provided in Supporting Documentation (Volume 5), following the instructions outlined in that section.**

The Army SBIR program sponsors participation in the TABA program. The resource limitations for each firm is as follows:

Phase I Firms:

- Army-Preferred Vendor: If approved, the contractor may receive up to $6,500 for assistance services per project (in addition to the maximum award funding guideline limitation specified in the respective SBIR|STTR Topic). The Army's preferred provider currently offers the following TABA services for Phase I awardees:
  - Commercial Pitch Deck Review
  - Commercialization Strategy Review
- Firm-Selected Vendor: If approved, the contractor may receive up to $6,500 in contract obligations per project (this amount must be included as part of the maximum award funding guideline limitation specified in the respective SBIR|STTR Topic). **Firm-Selected Vendor TABA funding will be denied if the offeror fails to include the cost in the Phase I proposal.**

Phase II Firms:

- Army-Preferred Vendor: If approved, the contractor may receive up to $50,000 for assistance services per project (in addition to the maximum award funding guideline limitation specified in the respective SBIR|STTR Topic). The Army's preferred provider currently offers the following TABA services for Phase II awardees:
  - Customized market research and strategy
  - IP support
  - Cybersecurity Maturity Model Certification (CMMC) compliance
  - Defense Contract Audit Agency (DCAA) compliance
  - Communications and Marketing
- Firm-Selected Vendor: If approved, the contractor may receive up to $50,000 in contract obligations per project (this amount must be included as part of the maximum award funding

guideline limitation specified in the respective SBIR|STTR Topic). **Firm-Selected Vendor TABA funding will be denied if the offeror fails to include the cost in the Phase II proposal.**

For additional resources regarding the Army SBIR Program's TABA, please refer the following link: https://www.armysbir.army.mil/taba/

1.10.1 Department of the Army Phase II Enhancement Policy

1.10.1 Overview

To further encourage the transition of SBIR|STTR research into DoD acquisition programs as well as the private sector, the Department of the Army may provide a Phase II awardee with up to $500,000.00 in matching SBIR funding (on a dollar-for-dollar basis) if the performer obtains commitment of non-SBIR|STTR funding from a DoD component(s), Federal Agency(ies), and/or a commercial investor(s).

Enhancement funding is typically applied to an active Phase II award via a contract modification and will result in an additional period of performance that is commensurate with the total funding received, typically 6 to 18 months (18 months being the maximum). On a case-by-case basis, however, a new Phase II contract may be awarded if appropriate. The proposed Enhancement effort must develop, deliver, and integrate a technology or product into a program within a DoD component(s), Federal Agency(ies), and/or the commercial sector.

1.10.2 Application Process

Enhancement requests should be submitted at least 6 months prior to the end of the Phase II period of performance to allow adequate time to complete the contracting process. Applications to the Enhancement Program will be reviewed for overall merit, transition potential, commercialization strategy, and value to the Army mission and are typically initiated through the Contracting Officer Representative (COR), Technical Point(s) of Contact (TPOC), SBIR|STTR Coordinator, and/or the Army SBIR|STTR Program Office, with oversight and input from the Contracting Officer.

Upon Army SBIR|STTR Program's Source Selection Authority (SSA) approval to proceed, assigned contracting personnel will prepare and issue a letter request for proposal (RFP), soliciting the firm's Enhancement proposal.

1.10.3 Limitations

All Enhancement requests are subject to the approval of the Army SBIR|STTR Program's SSA, successful completion of negotiations, and the availability of funding.

In order to be considered for matching SBIR funds under a Phase II Enhancement, the Contracting Officer must receive certified proof of the non-SBIR|STTR funding transfer. Certification consists of a notarized letter, stating that "$ in cash has been transferred to [company name] from [investor name] in accordance with the DA Enhancement Program procedures" that is signed by both the awardee and its investor. The letter must be sent to the Contracting Officer along with a copy of the SBIR awardees bank statement showing the funds were deposited. This certification should be received by the Contracting Officer within 45 days of the Enhancement approval notification. Failure of the awardee to certify and provide proof of the Investor's total cash contribution may significantly delay the Phase II enhancement or result in the awardee becoming ineligible for the Phase II Enhancement.

"Outside investment" must meet DoD Guidelines to qualify for Phase II Enhancement matching funds.

Eligible third-party investors include:

- Non-SBIR|STTR Department of Defense funds
- Any other non-SBIR|STTR federal agency funds
- An SBC other than the eligible/performing SBC
- Venture capital firms
- Individual investors
- A non-SBIR|STTR federal, state, or local government; or
- Any combination thereof

Ineligible sources include:

- The eligible SBC's internal research and development funds
- Funding in forms other than cash (such as in-kind or other tangible assets)
- Funding from the owners of the eligible SBC, or the family members or affiliates of such owners; or
- Funding attained through loans or other forms of debt obligations

2.0 CERTIFICATIONS AND REGISTRATIONS

2.1 System for Award Management (SAM) Registration

Interested SBCs are required to be registered and active in SAM in accordance with FAR Provision 52.204-7, System for Award Management, when submitting an offer or quotation and at time of award. Proposals or offers submitted by firms failing to meet this requirement may deemed unresponsive. For the requirement to maintain SAM registration during performance, and through final payment, interested SBCs may refer to FAR Clause 52.204-13, System for Award Management Maintenance.

SBCs may only submit offers using their legal business name or 'Doing Business As' (DBA) name, as indicated in the SAM registration for the provided Unique Entity Identifier (UEI). A firm submitting an offer using a DBA name shall have the DBA registered and linked to their current, active, SAM registration. Further, a firm may NOT submit an offer on behalf of another entity. Please refer to section 2.3 below for instructions regarding the correlation between your firm's DSIP account profile, and the SAM.

Refer to the Eligibility section above, for information regarding firms (proposing SBC and its subcontractor(s)) who are listed as debarred, suspended, proposed for debarment, or possessing an active exclusion within the SAM.

2.3 Defense SBIR|STTR Innovation Portal (DSIP) Registration

It is the SBCs responsibility to ensure that the firm's DSIP account profile information correlates to the data found within the firm's SAM registration. This includes, but is not limited to the following:

- 5-Digit Commercial and Government Entity Code
- 12-Digit UEI
- Legal Business Name
- "Doing Business As" Name
- Physical Address

Failure to correlate the SBCs entity information between the DSIP application and SAM and/or submit required certifications may significantly delay funding agreement award, become grounds

for cancellation of the funding agreement, or become grounds for termination of an existing funding agreement.

2.4 Required Certifications

- Under a SBIR Phase I contract, the contractor shall submit a SBIR Funding Agreement Certification – Life Cycle Certification, certifying as to whether it follows specific SBIR program requirements at the time of final payment or disbursement. This form shall be submitted as an attachment in Wide Area Workflow (WAWF), when submitting an invoice for final payment or disbursement on the Phase I contract.

- Under a SBIR Phase II contract, the contractor shall submit a SBIR Funding Agreement Certification – Life Cycle Certification, certifying as to whether it follows specific SBIR program requirements prior to receiving more than 50% of the total award amount and prior to final payment or disbursement. This form shall be submitted as an attachment in WAWF when submitting invoices for each of the aforementioned milestones.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.2 Export-Controlled Topic Requirements

Export of all unclassified technical data with military or space application in the possession of, or under the control of, a DoD Component information, which includes, in some circumstances, release to foreign nationals within the United States, without first obtaining approval, authorization, or license from the Department of State for items controlled by the International Traffic in Arms Regulations (ITAR), or the Department of Commerce for items controlled by the Export Administration Regulations (EAR), may constitute a violation of law.

Pursuant to Defense Federal Acquisition Regulation Supplement (DFARS) Procedures Guidance and Information 225.7901-2, your firm should direct its attention to the clause at DFARS 252.225-7048, Export-Controlled Items for questions concerning compliance with ITAR/EAR.

Further, in accordance with Department of Defense Directive 5230.25, Withholding of Unclassified Technical Data from Public Disclosure, contractors, or subcontractors that will handle technical data that might have military or space applications, must certify that they will comply with all applicable U.S. laws that control the export of sensitive data, as follows:

> If any portion of the proposed SBIR effort is subject to ITAR your firm must complete a fully certified DD Form 2345, Military Critical Technical Data Agreement. The DD Form 2345, Military Critical Technical Data Agreement, instructions, and Frequently Asked Questions (FAQs) may be found at the United States/Canada Joint Certification Program (JCP) website, JCP Portal. Failure to complete the DD From 2345 in a timely manner will significantly delay contract award, become grounds for cancellation of the contract action, or become grounds for termination of an existing contract.
>
> If any portion of the proposed SBIR effort is subject to EAR, your firm must submit for and obtain the proper export licenses through the Department of Commerce's Bureau of Industry and Security on-line system, SNAP-R. Failure to obtain the proper export licenses in a timely manner will significantly delay contract award, become grounds for cancellation of the contract action, or

become grounds for termination of an existing contract.

Topics under this announcement may be subject to ITAR/EAR and may be identified as such. However, export control compliance statements found in this document are not meant to be all inclusive. They do not remove any liability from the applicant to comply with applicable ITAR or EAR export control restrictions.

3.7 Phase I Proposal Instructions

The following proposal instructions supplement, and in some cases, supersede, those found within the DoD SBIR 25.4 Program BAA, including any amendments/revisions/appendices.

a. Proposal Cover Sheet (Volume 1)

The proposal cover sheet shall follow the instructions and requirements provided in the DoD SBIR 25.4 Program BAA. The offeror shall certify that to the best of its knowledge and belief, its eligibility information under the SBIR Program is accurate, complete, and current as of the date of the offer.

b. Technical Volume Format (Volume 2)

Proposals shall adhere to the formatting instructions provided in the DoD SBIR Program 25.4 BAA, including any amendments/revisions, as supplemented by the technical volume formatting requirements described herein. Information provided in these Service/Component-specific proposal instructions take precedence over any instructions listed in the DoD SBIR Program BAA. **Submissions that fail to conform to the technical volume formatting requirements shall be deemed unresponsive.**

1. **File Type**: The Technical Volume shall be a single Adobe Acrobat (supporting Windows 10-11) Portable Document Format (.pdf) searchable text format file, including graphics. PDF files that cannot be opened using Adobe Acrobat products may be rejected by the Government. Perform a virus check before uploading the technical volume file. If a virus is detected, the proposal may be rejected. Do not lock, password protect or encrypt the uploaded file. Do not include or embed active graphics, such as videos, moving pictures, or other similar media, in the document.

2. **Length**: The Technical Volume shall not exceed seven (7) pages including all key sections described in Section 3.7(c), Technical Volume Content, below. SBCs may allocate any portion of the seven (7) page technical volume limit to each of the key sections as desired. It is the proposing SBC's responsibility to verify that the Technical Volume does not exceed the page limit after upload to DSIP. **Any proposals exceeding the page count limit may be deemed unresponsive.**

3. **Layout**: Number all proposal pages consecutively. Submit a direct, concise, and informative research or R&D proposal (no type smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins, including the header). The header on each page of the technical volume, which may be included in the one-inch margin, should contain the proposing SBC's name, topic number, and the DSIP assigned proposal number from the cover sheet.

4. **General**:
   - Technical volume MUST be a single Adobe Acrobat PDF file

- Graphics are strongly encouraged to be included throughout the white paper as you see fit. Ensure they are logical and easy to read. Supporting images should be thoughtful and visually attractive.
- For plots and charts: Include title, caption, axes labels, and be sure to include scale.
- Avoid jargon and define all technical terms
- Use the "Compress Pictures" feature to reduce file size when possible.

c. Technical Volume Content (Volume 2)

The following technical volume content instructions supersede those stated in the DoD SBIR 25.4 Program BAA, including any amendments/revisions/appendices.

Offerors must address the requirements outlined for the Non-Proprietary Work Plan in Supporting Documents (Volume 5). This overview should directly reflect the key elements of the technical approach detailed in this volume, ensuring consistency between both documents.

The Technical Volume shall be structured in the following order:

i. **Introduction;**
ii. **Army Benefits;**
iii. **Technical Approach;**
iv. **Programmatic Potential; and**
v. **Commercial Potential**

Each of the key sections align directly with the evaluation rubric, Phase I Evaluation Criteria (Appendix A), ensuring clarity in how proposals will be assessed. The following outlines the specific content expectations for each section of the Technical Volume, as guided by the evaluation criteria in Appendix A. Offerors should ensure their proposals clearly address the key elements identified in the rubric to maximize the proposal's competitiveness.

i. **Introduction**: Write a clear, concise description of what your innovation does or will do, and where you are in your evolution. Make clear its intended impact on the Army. Evaluators should "get it" after reading this.

ii. **Army Benefits**: Briefly describe any identified Army use cases, the solutions' advantages and potential level of impact and scale of impact the solution would have for the Army. If you are unsure how an Army end-user might benefit from this technology or the scale of impact it could have, please provide an analogous use case to allow the Army evaluators a way to connect the dots using their knowledge of potential Army use cases when evaluating this section. The rubric prompts below are provided to guide you in preparing this section:
   - **Alignment.** Argue your technology innovation is aligned with this Army topic's priorities as defined in the solicitation.
   - **Solution's Advantages.** Prove your prospective customers will choose you given limited resources and myriad choices. Have you accounted for indirect substitute products as well as direct competitors?
   - **Solution's Impact.** The Army seeks higher-risk, high-impact solutions through SBIR - not engineering changes or incremental improvements. Use this section to describe your technology's impact and improvement upon the state of the art.

iii. **Technical Approach**: Provide details and supporting data on how the proposer is going to solve the problem. It shall detail key elements of the firm's approach, the technical team, and any risks and mitigation plans identified. Use data to substantiate your claims that your technical risk mitigation plans are credible. Show us quality data attributed to reliable, credible sources. The rubric prompts below are provided to guide you in preparing this section:

- **Scientific Feasibility.** Convince readers that your innovation is built atop sound scientific and/or engineering principles. Ensure that your feasibility argument adequately responds to the requirements this Army topic.
- **Enabling Technologies.** Do the required enabling technologies introduce added risk?
- **Technical Team.** Briefly list and describe your core scientific and technical team with an emphasis on their past accomplishments and experiences that would relate to this Army SBIR topic.
- **Technical Risk and Mitigation Plans.** Describe any technical risks that still exist between you and a fully mature solution and your plans to mitigate those risks.

iv. **Programmatic Potential**: Outline where your company is today, what will be accomplished under this SBIR effort with Army customer discovery and in identifying the risks and mitigation plans for successfully transitioning beyond SBIR funding into a contract with an Army or integration with an Army system. The rubric prompts below are provided to guide you in preparing this section:

- **Project Milestone Schedule.** Outline your execution plan. What milestones do you hope to accomplish, and what deliverables if any do you hope to produce during this phase and subsequent phases of the effort.
- **Army Customer Discovery and Validation.** Argue you are "getting out of the building" to engage in productive customer-discovery with Army stakeholders and describe any customer validation you may have received formally or informally to date on this proposed technology.
- **Army Transition Pathways.** Describe the next type of deal you aim to make with the Army following this award. Briefly outline your current plan to unlock that next opportunity and/or share the biggest risks you see post this SBIR award to transition this technology to the Army.

v. **Commercialization Potential**: Highlight any commercial market for this solution that the DoD can build upon. Describe your past success and future potential in commercial applications. The rubric prompts below are provided to guide you in preparing this section:

- **R&D to Product Revenue.** Argue that your team members have transitioned research and development efforts into products successfully, as evidenced by product revenue. (Product revenue is realized by directly selling a solution to solve a problem vs. selling consulting, services, or research activities.)
- **Competitive Edge.** Why will you win? A small company needs to have a competitive edge in the marketplace: Something your team does very well that is difficult to match. Some examples may include: well protected intellectual property; unmatched relevant experience; a novel business model; network effects; etc.
- **Other People's Money.** Make the case for the commercial market (non-DoD) potential of your technology from which the Army will benefit.

d. Cost Volume Content (Volume 3)
Cost and duration limits are detailed within each topic. With the exception of the instructions provided below, Offerors must comply with all Cost Volume (Volume 3) requirements outlined in the DoD SBIR 25.4 Program BAA. Note: Options are not anticipated at this time. If an option is identified in the topic posting, costs for the Base and Option shall be separated and clearly identified.

In anticipation of a possible contract award, all proposed costs shall be accompanied by documentation to substantiate how the cost was derived. Failure to include supporting documentation with the proposal may delay any potential contract award, as the proposer will be asked to submit the necessary documentation to the Contracting Officer to substantiate costs. It is important to respond as quickly as possible to the Contracting Officer's request for documentation. Failure or refusal to provide documentation may result in dissolution of the contract action.

- DIRECT LABOR:

    - List all key personnel by name as well as by number of hours dedicated to the project as direct labor.

    - Provide a task-level, time-phased (e.g., annual) breakdown of labor hours, rates, and cost by appropriate Direct Labor category, and explain the basis of estimates. Include substantiating documentation to support the costs (e.g., payroll reports)

- MATERIAL/TOOLING/EQUIPMENT:

    - Provide a consolidated priced summary of individual raw materials, parts, components, assemblies, and services to be produced or performed by others. For all items proposed, include the item nomenclature, description, part number, quantity, unit price, extended amount, vendor name, basis of estimate, and whether the item is commercial in accordance with the definition in FAR 2.101, based on adequate price competition or non-competitive.

    - Proposing firms shall provide substantiating documentation for the cost of all material, tooling, and equipment (e.g. vendor quotes, invoice prices, competitive bids, catalog price lists, etc.). If your choice isn't the lowest cost available, explain the decision to choose one item or supplier over another.

    - Ensure all materials are American made to the maximum extent practicable. Offerors who propose to use a foreign-made product in its technology may be required to find an American-made equivalent.

    - While special tooling and test equipment and material cost may be included, it will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment shall, in the opinion of the Procurement/Government Component Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with the DoD Component, unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DoD Component.

- SUBCONTRACTS:
    - Provide data showing the degree of Subcontractor competition and the basis for establishing the source and reasonableness of price through price analysis.
    - Provide detailed substantiation of subcontractor costs in your cost proposal.
    - Subcontracts with Federal Laboratories - As defined in 15 United States Code (U.S.C.) 3703, Federal Laboratory means any laboratory, any federally funded research and development center, or any center established under 15 U.S.C. 3705 and 3707 that is owned, leased, or otherwise used by a Federal Agency and funded by the Federal Government, whether operated by the Government or by a contractor. A waiver is no longer required for the use of federal laboratories and FFRDCs; however, Offerors must certify their use of such facilities on the Cover Sheet of the proposal. A list of eligible FFRDCs is available at: https://www.nsf.gov/statistics/ffrdclist/
    - Offerors shall not propose to subcontract to any prohibited sources, as prescribed at FAR 25.7 – Prohibited Sources, and its supplements. **Proposals identifying a subcontractor/vendor arrangement with a prohibited source will be deemed unresponsive**.
    - Considering the goals of the SBIR|STTR Programs, Offerors shall ensure subcontracts (as defined in Appendix B of the overarching DoD SBIR 25.4 Program BAA) are with United States SBCs to the maximum extent practicable. Offerors proposing a subcontractor arrangement with other than a United States SBC (such as, a large business, foreign firm, foreign government, educational institution, FFRDC, unit of Federal Government, etc.) may be required to submit further explanation.
- TRAVEL:
    - **Virtual meetings shall be utilized to the maximum extent practicable.**
    - Explain the basis of proposed travel, including to/from locations, number of trips, number of travelers per trip, and number of days/nights per trip. Include substantiating documentation for the costs (e.g. screenshots of flight cost comparison, rental car quotes, etc.).
    - In accordance with FAR 31.205-46 Travel costs incurred shall not exceed the maximum per diem rates set forth in Federal Travel Regulation, Joint Travel Regulation, or standard regulations, unless the travel is special or considered unusual. Any special or unusual travel costs shall be supported with substantiating documentation for review and consideration. Per diem rate lookup can be located at GSA Per Diem.

- INDIRECT COSTS:

  - Indicate how you have computed and applied your indirect costs (e.g., overhead, general & administrative, material handling, fringe, etc.), including cost breakdowns. Indicate the rates used and provide an appropriate explanation.

  - If a DCAA Audit has been conducted within the last five (5) years, include the audit compliance documentation in the cost proposal documents. The documentation should also include the offeror's DCAA Point of Contact (if applicable). Further, if applicable Offerors shall provide any current Forward Pricing Rate Agreements in effect at time of proposal submission.

e. Company Commercialization Report (Volume 4)

Completion of the Company Commercialization Report (CCR) as Volume 4 of the proposal submission in DSIP is required for prior SBIR|STTR awardees. Please refer to the DoD SBIR 25.4 Program BAA for full details on this requirement.

f. Supporting Documents (Volume 5)

Volume 5 is provided for proposers to submit additional documentation to support the Cover Sheet (Volume 1) and the Technical Volume (Volume 2), and the Cost Volume (Volume 3). A completed proposal submission in DSIP does NOT indicate that the mandatory supporting documents have been uploaded. It is the responsibility of the proposing small business concern to ensure that the mandatory documents listed above have been uploaded and included with the proposal submission.

All proposing SBCs are REQUIRED to submit the following documents to Volume 5:

1. Non-Proprietary Work Plan: This summary, which should be based upon the technical approach discussed in your Technical Volume (Volume 2), is subject to a two (2) page limit and should provide a clear and concise overview of the proposed project's technical objectives, key milestones and their target completion dates, associated key deliverables, and the anticipated project duration. This information will serve as the basis for publicly releasable information about the project and will serve as the basis for establishing performance requirements within the contract. Therefore, the summary should be written in a manner understandable to a technically literate audience without disclosing sensitive or proprietary information.

2. Key Personnel Table. This table must identify all key personnel expected to execute work on the project, including individuals from the prime, subcontractors, or Research Institution (as applicable). Failure to provide this information may significantly delay selection, and/or any potential contract award. The table must include the following information for each individual:

   a. Employee Name
   b. Labor Category
   c. Description of Work to be Performed on the Project
   d. Employee (Prime, Subcontractor, Consultant, Research Institution)
   e. Country of Origin

All proposing SBCs are required to submit the following documents to Volume 5, *if applicable*:

3. Verification of Eligibility of Small Business Joint Ventures
4. Assertion of use, release, or disclosure restriction (in accordance with DFARS 252.227-7017)
5. DD Form 2345, Military Critical Technical Data Agreement – Applicable to actions subject to ITAR
6. Foreign National/Persons Information
   Identify any foreign citizens or individuals expected to be involved on your project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. **Note**: You may be asked to provide additional information during proposal evaluation and/or negotiations in order to verify the foreign citizen's eligibility to participate on a SBIR contract.
7. Justification for SBC-selected TABA vendor
   In two (2) pages or less, clearly demonstrate the firm-selected TABA provider's unique qualifications and suitability for your project. Provide the TABA vendor's firm name and the point of contact's name, email address, and phone number. Detail the specific reasons this TABA provider is uniquely qualified to address your project's needs, focusing on their relevant expertise, experience, and specialized capabilities. Clearly outline the tasks they will perform, including the purpose and objectives of their assistance in relation to your project goals. Include a cost breakdown with the total cost of TABA services, the number of support hours, and labor rates (an average/blended rate is acceptable). Remember, the TABA provider cannot be your firm or any affiliated entity, and TABA costs must be directly related to their services, excluding indirect costs, profit, or fees passed through by your company.
8. Place of Performance - Ammunition and Explosives - refer to section 3.11 – Arms, Ammunitions and Explosives, Paragraph (f) below.

In addition to the Volume 5 requirements, the Department of the Army may accept the following documents in Volume 5:

9. Cost/Pricing Information
10. SBIR|STTR Funding Agreement Certification
11. Other (only as specified in the topic)

Please only submit documents that are identified immediately above, and as required by the DoD SBIR 25.4 Program BAA. All other documents submitted will be disregarded, including but not limited to promotional and non-project related information.

g. Fraud, Waste and Abuse Training (Volume 6)
Follow instructions provided in the DoD Program BAA for completion of the Fraud, Waste and Abuse training in DSIP.

h. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7)
SBCs must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission.

Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a PDF Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5. For additional details, please refer to the DoD SBIR 25.4 Program BAA.

3.8 Phase II Proposal Information

Unless a Topic posting specifies that the DA will be accepting Direct to Phase II proposal submissions, Phase II proposals may only be submitted by Phase I awardees. Submission of Phase II proposals is not permitted at this time, and if submitted, will be rejected without evaluation. Phase II proposal preparation and submission instructions will be provided via subsequent notification.

3.9 Direct to Phase II (DP2) Proposal Instructions

Offerors may submit DP2 proposals only if allowed pursuant to the topic posting. With the exception of the DP2 component specific proposal instructions for the Technical Volume (Volume 2), identified below, DP2 Proposals shall follow the Phase I Proposal Instructions described above.

b. Technical Volume Format (Volume 2)

2. **Length**: The Technical Volume shall not exceed 15 pages including all key sections described in section 3.9(c), Technical Volume Content, below. SBCs may allocate any portion of the 15-page technical volume limit to each of the key sections as desired. It is the proposing SBC's responsibility to verify that the Technical Volume does not exceed the page limit after upload to DSIP. **Any proposals exceeding the page count limit may be deemed unresponsive**.

c. Technical Volume Content (Volume 2)

The following instructions supersede those stated in the DoD SBIR 25.4 Program BAA, including any amendments/revisions/appendices.

Offerors must address the requirements outlined for the Non-Proprietary Work Plan in Supporting Documents (Volume 5). This overview should directly reflect the key elements of the technical approach detailed in this volume, ensuring consistency between both documents.

The Technical Volume shall be structured in the following order:

i. **Introduction;**
ii. **Army Benefits;**
iii. **Feasibility for Direct to Phase II;**
iv. **Technical Approach;**
v. **Programmatic Potential; and**
vi. **Commercial Potential**

Each of the key sections align directly with the evaluation rubric, Direct to Phase II Evaluation Criteria (Appendix B), ensuring clarity in how proposals will be assessed. The following outlines the specific content expectations for each section of the Technical Volume, as guided by the evaluation criteria in Appendix B. Offerors should ensure their proposals clearly address the key elements identified in the rubric to maximize the proposal's competitiveness.

i. **Introduction**: Write a clear, concise description of what your innovation does or will do, and where you are in your evolution. Make clear its intended impact on the Army. Evaluators should "get it" after reading this.

ii. **Army Benefits**: Briefly describe any identified Army use cases, the solutions' advantages and potential level of impact and scale of impact the solution would have for the Army. If you are unsure how an Army end-user might benefit from this technology or the scale of impact it could have, please provide an analogous use case to allow the Army evaluators a way to connect the dots using their knowledge of potential Army use cases when evaluating this section. The rubric prompts below are provided to guide you in preparing this section:
- **Alignment.** Argue your technology innovation is aligned with this Army topic's priorities as defined in the solicitation.
- **Solution's Advantages.** Prove your prospective customers will choose you given limited resources and myriad choices. Have you accounted for indirect substitute products as well as direct competitors?
- **Solution's Impact.** The Army seeks higher-risk, high-impact solutions through SBIR - not engineering changes or incremental improvements. Use this section to describe your technology's impact and improvement upon the state of the art.

iii. **Feasibility for Direct to Phase II:** Provide documentation that demonstrates the scientific and technical merit, feasibility, and commercialization potential of ideas that would otherwise have been accomplished in a SBIR Phase I feasibility study. Use data to substantiate your claims. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within this section must have been substantially performed by the proposer and/or the Principal Investigator. Feasibility documentation cannot be based upon any prior or ongoing federally funded SBIR or STTR work and DP2 proposals MUST NOT logically extend from any prior or ongoing federally funded SBIR or STTR work. The rubric prompts below are provided to guide you in preparing this section:
- **Proof of Feasibility.** Provide documentation to substantiate the scientific and technical merit and feasibility has been met.
- **Work Ownership.** Document the people, organizations, and any intellectual property (IP) ownership responsible for the work products in this section. The work must have been at least "substantially" performed by your organization and/or the proposed principal investigator for this research, and your firm must either own any IP discussed outright or have appropriate and sufficient licenses thereto.
- **New Research.** Prove that the proposed DP2 research is not in any way a logical extension of previous or ongoing federally funded SBIR or STTR research.
- **Prototype Delivery.** Demonstrate that the research will result in appropriately mature Prototype at the conclusion of the DP2 SBIR contract.

iv. **Technical Approach**: Provide details and supporting data on how the proposer is going to solve the problem. It shall detail key elements of the firm's approach, the technical team, and any risks and mitigation plans identified. Use data to substantiate your claims that your technical risk mitigation plans are credible. Show us quality data attributed to reliable, credible sources. The rubric prompts below are provided to guide you in preparing this section:
- **Scientific Feasibility.** Convince readers that your innovation is built atop sound

scientific and/or engineering principles. Ensure that your feasibility argument adequately responds to the requirements this Army topic.

- **Enabling Technologies.** Do the required enabling technologies introduce added risk?
- **Technical Team.** Briefly list and describe your core scientific and technical team with an emphasis on their past accomplishments and experiences that would relate to this Army SBIR topic.
- **Technical Risk and Mitigation Plans.** Describe any technical risks that still exist between you and a fully mature solution and your plans to mitigate those risks.

v. **Programmatic Potential**: Outline where your company is today, what will be accomplished under this SBIR effort with Army customer discovery and in identifying the risks and mitigation plans for successfully transitioning beyond SBIR funding into a contract with an Army or integration with an Army system. The rubric prompts below are provided to guide you in preparing this section:

- **Project Milestone Schedule.** Outline your execution plan. What milestones do you hope to accomplish, and what deliverables if any do you hope to produce during this phase and subsequent phases of the effort.
- **Army Customer Discovery and Validation.** Argue you are "getting out of the building" to engage in productive customer-discovery with Army stakeholders and describe any customer validation you may have received formally or informally to date on this proposed technology.
- **Army Transition Pathways.** Describe the next type of deal you aim to make with the Army following this award. Briefly outline your current plan to unlock that next opportunity and/or share the biggest risks you see post this SBIR award to transition this technology to the Army.

vi. **Commercialization Potential**: Highlight any commercial market for this solution that the DoD can build upon. Describe your past success and future potential in commercial applications. The rubric prompts below are provided to guide you in preparing this section:

- **R&D to Product Revenue.** Argue that your team members have transitioned research and development efforts into products successfully, as evidenced by product revenue. (Product revenue is realized by directly selling a solution to solve a problem vs. selling consulting, services, or research activities.)
- **Competitive Edge.** Why will you win? A small company needs to have a competitive edge in the marketplace: Something your team does very well that is difficult to match. Some examples may include: well protected intellectual property; unmatched relevant experience; a novel business model; network effects; etc.
- **Other People's Money.** Make the case for the commercial market (non-DoD) potential of your technology from which the Army will benefit.

3.10 Expeditionary Technologies (xTech) Prize Competition Selectees

This section applies exclusively to companies selected as winners in Part 2 of the respective Expeditionary Technologies (xTech) Prize Competition. These companies, having successfully pitched their solutions to Army and DoD experts, are the only SBCs eligible to submit Army SBIR proposals under the corresponding topic area.

xTech Prize Competition selectees must follow the Army Phase I Proposal Submission Instructions, with one important exception regarding the Technical Volume (Volume 2). **In lieu of submitting a full Technical Volume (Volume 2), xTech selectees shall submit the following as a single Adobe PDF document**:

- Non-Proprietary Work Plan: This document should adhere to the guidelines outlined in Section f. Supporting Documents (Volume 5) of the Army Phase I Proposal Submission Instructions, including the two (2) page limitation. This waives the requirement to include the Non-Proprietary Work Plan in Volume 5 – Supporting Documents.
- Pitch Deck Slides from Part 2 Finals of the xTech Prize Competition: This should be the final version of the slides used during your in-person (or virtual) pitch.

All remaining proposal volumes, including any applicable and/or optional documents discussed in Section f. Supporting Documentation (Volume 5) must be completed according to the standard Army Phase I Proposal Submission Instructions.

NOTE: The Technical Evaluation (Section 4.1.2) and Selection (Section 4.1.3) guidance defined below do not apply to xTech Prize Competition selectees. Your proposals have already undergone a comprehensive evaluation as part of the xTech competition.

3.11 Controlled Unclassified Information (CUI)

Successful firms will be required to comply with CUI DoDI 5200.48. Firms must monitor CUI for aggregation and compilation based on the potential to generate classified information pursuant to security classification guidance addressing the accumulation of unclassified data or information. Firms shall report the potential of classification of aggregated or compiled CUI to ASA(ALT) Security Manager. Firms, pursuant to mandatory DoD contract provisions, will submit unclassified DoD information for review and approval for release and approval for release in accordance with the standard DoDI 5230.09. All CUI records must follow the approved mandatory disposition authorities whenever the DoD provides CUI to, or CUI is generated by, non-DoD entities in accordance with Section 1220-1236 of Title 36, CFR, Section 3301a of Title 44, U.S.C., DoDI 5200.48.

3.12 Arms, Ammunition, and Explosives (AA&E)

If the proposed statement of work requires the use, development, production, manufacture, purchase, or delivery of Arms, Ammunition and Explosives (AA&E) data and/or hardware, the offeror shall follow the following instructions:

a. References:

1. MIL-STD-1168 - Ammunition Lot Numbering and Ammunition Data Cards
2. DODM 5100.76 - Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives (AA&E)
3. AR 190-11 - Physical Security of Arms, Ammunition, and Explosives
4. Defense Transportation Regulation 4500.9-R
5. Technical Bulletin (TB) 700-2

b. The offeror, in its proposal, and resulting contractor, in performance of the work, shall comply with the requirements of the following DFARS provisions/clauses:

1. 252.223-7002, Safety Precautions for Ammunition and Explosives (NOV 2023);

2. 252.223-7003, Change in Place of Performance-Ammunition and Explosives (DEC 1991); and
3. 252.223-7007, Safeguarding Sensitive Conventional Arms, Ammunition, and Explosives (NOV 2023).

c. The offeror, in its proposal, and resulting contractor, in performance of the work, shall provide proper storage and accountability. These standards are set forth in Department of Defense (DOD) 5100.76-M, entitled "Physical Security of Sensitive Conventional Arms, Ammunition and Explosives".

d. Prior to any contract award, the offeror must first pass a pre-award physical security inspection of its and its subcontractor's facilities, conducted by Defense Security Service (DSS). See DOD 5100.76-M, Appendix 2, Attachment 1, for a listing of DSS regions. Facilities, including any subcontractor facilities, that do not meet all of the security requirements of DOD 5100.76-M will not be awarded a contract.

e. If the proposed statement of work requires transportation of Sensitive Conventional AA&E, the standards set forth in Defense Transportation Regulation 4500.9-R., Defense Traffic Management, shall be followed.

f. Place of Performance: In accordance with Federal Acquisition Regulation (FAR) provision/clause 52.215-6, Place of Performance (OCT 1997), and DFARS provision/clause 252.223-7003, Change in Place of Performance—Ammunition and Explosives (DEC 1991), the offeror shall include the following information in Volume 5 of its proposal. Failure to include this information in proposals involving AA&E may result in the proposal being deemed unresponsive.

1. The offeror, in the performance of any contract resulting from this solicitation, □ intends, □ does not intend [check applicable block] to use one or more plants or facilities located at a different address from the address of the offeror as indicated in its proposal.
2. If the offeror or respondent checks "intends" in paragraph (a), it shall include the following required information for each and every plant or facility (including subcontractor plants or facilities) located at a different address from the address of the offeror as indicated in its proposal.
   i. Firm Name
   ii. Place of Performance (Street Address, City, State, County, ZIP Code)
   iii. Name and Address of Owner and Operator of the Plant or Facility

g. In accordance with local procedures and DFARS provision/clause 252.223-7007, Safeguarding Sensitive Conventional Arms, Ammunition, and Explosives (NOV 2023), the offeror shall include the following information in Volume 5 of its proposal for itself and for each plant or facility (including subcontractor plants or facilities) that the offeror listed as a "Place of Performance". The offeror shall include the information to the best of its ability in order to avoid delay in contract award. Do not include locations that will not use, develop, produce, manufacture, purchase, or deliver AA&E in performance of the work.

1. Firm Name
2. Identify if the firm is the prime-contractor or sub-contractor
3. Place of Performance (Street Address, City, State, County, ZIP Code)
4. Unique Entity Identification (UEI) and Cage Code

5. Confirm that address and cage code match the information in SAM.gov (“unknown” is an acceptable response if unable to look up sub-contractors)
6. Full name, phone number, and email address for a point of contact at this location
7. Description of the AA&E and/or work involving AA&E
8. National Stock Number (NSN) of the AA&E (if none exist, indicate “N/A”)
9. Identify the Security Risk Classification (SRC) of the AA&E (Instructions for determining the SRC are found in Enclosure 7 (p. 40 - p.46) of DODM 5100.76) (The SRC can be either I, II, III, IV or U) (“unknown” is an acceptable response if Government input is required to make this determination)
10. Identify the hazard classification (HC) of the AA&E (Instructions for determining the HC are found in Chapter 2 (p.2) of TB 700-2) (“unknown” is an acceptable answer if Government input is required to make this determination)
11. Identify whether the AA&E will be furnished by the Government as Government Furnished Property (GFP) or if it will be developed, produced, manufactured, or purchased by the prime or sub-contractor

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Evaluation Process

4.1.1 Initial Screening

Proposals will only be evaluated in response to an active, corresponding Army topic. Proposals will be initially screened to determine responsiveness, timeliness, and SBC eligibility. Assessment of responsiveness and eligibility may continue during technical evaluation, and after selection. For purposes of this solicitation, these terms are defined as:

Responsiveness: When a proposal fails to meet a material requirement of the solicitation, to include compulsory terms and conditions, the proposal shall be deemed unresponsive.

Timeliness: A Timely Proposal is one that is received by the Government on or before the due date and prior to the established set time.

SBC Eligibility: To be eligible, SBCs must meet all requirements listed in the "Eligibility" section, Title 13 of the Code of Federal Regulations, Section 121.702, and the SBA SBIR|STTR Policy Directive.

4.1.2 Technical Evaluation (Not Applicable to xTech Prize Competition Selectees)

Proposals passing the initial screening will receive a technical evaluation using ‘Valid Evaluation,’ a software as a service analytics tool. Each proposal undergoes review by a cadre of evaluators (typically engineers, scientists, and/or program managers). These experts assess proposals against the criteria outlined in the DoD SBIR|STTR Program BAA, with further guidance provided by the Army’s Phase I and Direct to Phase II Valid Evaluation Criteria (Appendix A and B respectively). These supplemental criteria offer a more detailed breakdown, outlining specific sub-dimensions and elements for consideration.

It is the policy of the Army to ensure equitable and comprehensive proposal evaluations based on the evaluation criteria and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals. Selections for further consideration of possible contract award will be based on a determination of the overall technical merit of each proposal. As a common statement of work does not exist, each proposal is assessed on their own individual merit to determine how well the proposal meets the criteria stated in this BAA and the corresponding opportunity. Proposals will not be evaluated against each other during the evaluation process.

Note: Designated support contractors may review submissions for the purposes of technical evaluation. All support contractors are bound by appropriate non-disclosure agreements.

4.1.3 Selection (Not Applicable to xTech Prize Competition Selectees)

Proposing firms will be notified via email of selection or non-selection status of its Phase I or DP2 proposal within 90 days of the closing date of the Topic. The notification will be sent to the Corporate Official listed on the proposal cover sheet, from the Army SBIR|STTR Program Office mailbox.

Selected proposals are not guaranteed a contract award. Proposers shall not regard the notification email (selection decision notice) as an authorization to commit or expend funds. Upon selection, proposals are forwarded to a Government Contracting Officer for further evaluation and contract negotiation. A Government Contracting Officer may contact the proposer to discuss and request additional information required for award. This may include representations and certifications, certified or other than certified cost data, and/or other information as applicable to the proposed award. Proposers shall not regard these communications as an authorization to commence work or commit or expend funds.

4.1.4 Other Assessment Considerations

a. Contractor Responsibility: SBCs will be evaluated for responsibility, meaning the prospective SBC meets the standards set forth in FAR 9.104. A prospective contractor must affirmatively demonstrate its responsibility, including, when necessary, the responsibility of its proposed subcontractors.

b. Use of Foreign Nationals/Persons: In considering an SBC's utilization of foreign national personnel, the Government may withdraw from negotiations based on deleterious findings associated with a firm's Foreign Disclosure (Volume 7) or matters of national security not limited to: persons tied to foreign countries of concern; foreign influence or ownership; inability to clear the firm or personnel for security clearances; risk associated with Military Critical Technologies; or other related issues.

c. Fair and Reasonable Price: In accordance with FAR 15.402(a), Contracting officers shall purchase supplies and services from responsible sources at fair and reasonable prices. As a result, Contracting Officials will conduct proposal analysis in accordance with the techniques identified at FAR 13.106-3 and/or 15.404-1. Proposals lacking a fair and reasonable price will be deemed unsuccessful.

4.1.5 Potential Contract Award

If at any point the proposal is deemed untimely, unresponsive, or the SBC (or its subcontractors) is deemed ineligible or non-responsible, the proposal will be unsuccessful, meaning the proposal is not one that will result in an award (it is un-awardable). Successful proposals, therefore, are those that have met all stated requirements and qualifications and will receive an award.

Upon an affirmative determination of proposal timeliness, responsiveness, compliance, and price reasonableness, as well as prospective contractor eligibility and responsibility, the Contracting Officer may proceed with an award, subject to the availability of funds. Unless a Government Contracting Officer signs an award document (e.g., contract), no obligations to provide funding are made. The Government may cancel award of the contract action at any time.

If signed by the Government Contracting Officer, the award document is the official and authorizing instrument, thereafter, referred to as the “contract”. The period of performance will begin upon the effective date of the contract. The Contracting Officer will email the signed contract to the principal investigator and/or an authorized organization representative.

4.3 Proposal Status and Feedback

The Army promotes transparency regarding the technical evaluation for all Army SBIR proposals. The Army will provide feedback to offerors in accordance with the SBA SBIR|STTR Policy Directive. The selection decision notice contains instructions for obtaining feedback in the form of a ValidEval Report. The Army shall not provide any additional feedback beyond the ValidEval report. Offerors are entitled to no more than one feedback per proposal.

NOTE: Feedback is not the same as a FAR Part 15 debriefing. The competitive procedures for this solicitation are governed by the SBA SBIR|STTR Policy Directive. Therefore, offerors are neither entitled to, nor will they be provided FAR Part 15 debriefs.

4.5 Pre-Award and Post Award BAA Protests

Pre-award agency protests related to the terms of the BAA must be served to the point of contact listed in the DoD SBIR 25.4 Program BAA.

Post award agency protests related to a selection or award decision must be served to the following address:

Email: usarmy.SBIRSTTR@army.mil
Mailing Address:
U.S. Army SBIR|STTR Office
2530 Crystal Drive; Suite 11192
Arlington, Virginia 22202

Firms shall follow the DoD SBIR 25.4 Program BAA for protests filed with the Government Accountability Office (GAO) and size protests regarding the small business status of a selected proposing small business concern.

5.0 ADDITIONAL CONSIDERATIONS

5.1 Award Information

a. Number of Awards. The number of awards will depend upon funds availability. The Army reserves the right to award none, one, or more than one contract under any topic. No awards will be made until evaluation of all qualified proposals for a specific topic have been made. The Army is not responsible for costs incurred before award receipt.

b. Type of Funding Agreement. The Army plans to execute funding agreements as FAR-based, firm-fixed-price contracts. Fixed price payments shall be tied to measurable milestones or deliverables, as agreed to by the Government. Milestone schedules are used as a means to monitor technical progress, to mitigate technical and cost risk, and to address the cashflow needs of awardees. The Government Contracting Officer retains the right to negotiate a contract type and price (or estimated cost and fee) that will promote the Government's interest, result in reasonable contractor risk, and provide the contractor with the greatest incentive for efficient and economical performance (FAR Subpart 16.1 – Selecting Contract Types).

c. Dollar Value and Period of Performance. Award funding guideline and associative period of performance limitations have been established for each SBIR|STTR Topic. **Proposals exceeding these limitations will be deemed unresponsive**.

5.2 Contract Requirements

In addition to the contractual requirements specified in the DoD 25.4 SBIR Program BAA, awards under the Army SBIR|STTR Program are also subject to the following:

5.2.1 Deliverable Requirements

a. Hardware (Prototype) Deliverables (if applicable): See topic for information to determine if development and delivery of prototypes is required. If your proposal identifies hardware that will be delivered to the government, be aware of the possible requirement for unique item identification in accordance with DFARS Clause 252.211- 7003, Item Unique Identification and Valuation. More information regarding item identification and valuation requirements may be found at DFARS Section 211.274.

b. Data Deliverables (Contract Data Requirements Lists – CDRLS):
Data can be in the form of test data, computer software, algorithms, design details, progress reports, technical data, financial or management reports, or any information required by contract to be delivered. Data is ordered using single or multiple DD Form 1423, Contract Data Requirements Lists (CDRLS), which will be located in the contract at Section J, Exhibits. A CDRL is the "data delivery" vehicle providing the what, when, who, and how of the delivery. CDRLS require the contractor to formally deliver the data (contractual obligation) to the Government. Each CDRL will reference a Data Item Description (DID) that describes data content, format, media, and intended use of a single data product. Each DID is uniquely numbered to identify the data deliverables in terms of purpose, description, requirements, and preparation instructions. DIDs may be viewed using the Acquisition Streamlining and Standardization Information System (ASSIST).

All funding agreements executed under the Army SBIR|STTR Program shall include the following CDRL requirements:

1. Status Reports: Under the authority of DID number DI-MGMT-80368A, status reports are due at a specified time after contract award and periodically (e.g., Monthly, Bi-monthly, Quarterly) thereafter in accordance with the prepared DD Form 1423 that will be incorporated via Section J, Exhibits of any resultant contracts.

2. Scientific and Technical Report: Under the authority of DID number DI-MISC-80711A, a final report shall be delivered in accordance with the prepared DD Form 1423 that will be incorporated via Section J, Exhibits of any resultant contract (see section 12.9 below for additional information regarding the Final Technical Report).

The Army end-user or customer may require additional deliverables or documentation including Software documentation and user manuals; Engineering drawings; Operation and Maintenance documentation; Safety hazard analysis when the project will result in partial or total development/ delivery of hardware; and/or updated commercialization results.

5.2.2 Meeting Requirements:

a. Start of Work Meeting: The contractor shall hold a start of work meeting at its facility, unless some other location is designated in the contract, within 30 calendar days after contract award. The Start of Work Meeting is to assure a clear and mutual understanding of the contract terms, conditions, line items, technical requirements and sequence of events needed for successful execution of the contracted effort. The contractor shall coordinate with the Government to arrange a schedule and agenda for the meeting.

b. Periodic (e.g., Monthly, Bi-Monthly, Quarterly) Review Meetings: Periodic review meetings shall be conducted to monitor and report on status of contractor effort towards achieving contract objectives, identify accomplishments to date and difficulties encountered, and compare the status achieved to planned goals and the resources expended.

5.6 Invention Reporting

In accordance with FAR clause 52.227-11, “Patent Rights-Ownership by the Contractor”, and DFARS clause 252.227-7039, “Patents – Reporting of Subject Inventions”, the contractor shall execute the following:

a. Interim Report of Inventions and Subcontracts: Under all Phase II SBIR contracts, the contractor shall deliver an Interim Report of Inventions and Subcontracts, DD Form 882,12-months from the date of initial contract award, listing subject inventions during that period and stating that all subject inventions have been disclosed or that there are no such inventions.

b. Final Report of Inventions and Subcontracts: Under all Phase I and Phase II SBIR contracts, the contractor shall deliver a Final Report of Inventions and Subcontracts, DD Form 882, within three (3) months after completion of the contracted work, listing all subject inventions or stating that there were no such inventions.

c. SBIR awardees must report inventions within two months of the inventor’s report to the awardee. The reporting of inventions may be accomplished by submitting paper documentation, including fax, or through the Edison Invention Reporting System at www.iedison.gov.

6.0 PROPOSAL SUBMISSION

6.3 Contact Information

SBC's may direct questions to the following Points of Contact, as described below:

a. Army Component Specific Proposal Instructions: General questions regarding the administration of the Army SBIR Program, and the Army Component-Specific Proposal Instructions should be submitted as soon as possible, but not later than 15 days prior to solicitation closing, and can be directed to the following:
Email: usarmy.SBIRSTTR@army.mil
Website: https://www.armysbir.army.mil/
Mailing Address: U.S. Army SBIR|STTR Office
2530 Crystal Drive, Suite 11192
Arlington, Virginia 22202

Appendix A
Army Phase I Evaluation Criteria

Version 4

Army SBIR STTR Phase I Evaluation Criteria v4-0

U.S. ARMY SBIR|STTR

		DEFINITION
INTRODUCTION	*weight 3%*	Write a clear, concise description of what your innovation does or will do, and where you are in your evolution. Make clear its intended impact on the Army. Evaluators should "get it" after reading this.
ARMY BENEFITS	ALIGNMENT	Argue your technology innovation is aligned with this Army topic's priorities as defined in the solicitation.
	SOLUTION'S ADVANTAGES	Prove your prospective customers will choose you given limited resources and myriad choices. Have you accounted for indirect substitute products as well as direct competitors?
weight 15%	SOLUTION'S IMPACT	The Army seeks higher-risk, high-impact solutions through SBIR/STTR not engineering changes or incremental improvements. Use this section to describe your technology's impact and improvement upon the state of the art.
TECHNICAL APPROACH	SCIENTIFIC FEASIBILITY	Convince readers that your innovation is built atop sound scientific and/or engineering principles. Ensure that your feasibility argument adequately responds to the requirements this Army topic.
	ENABLING TECHNOLOGIES	Do the required enabling technologies introduce added risk?
	TECHNICAL TEAM	Briefly list and describe your core scientific and technical team with an emphasis on their past accomplishments and experiences that would relate to this Army SBIR/STTR topic.
	TECHNICAL RISKS AND MITIGATION PLANS	Describe any technical risks that still exist between you and a fully mature solution. What are your plans to mitigate those risks?
weight 35%	DATA QUALITY, TECHNICAL	Use data to substantiate your claims that your Technical Approach (this section of your proposal) is credible. Provide quality data attributed to reliable, credible sources.
PROGRAMMATIC POTENTIAL	PROJECT MILESTONE SCHEDULE	Outline your execution plan. What milestones do you hope to accomplish, and what deliverables (if any) do you hope to produce during this phase and subsequent phases of the effort?
	ARMY CUSTOMER DISCOVERY & VALIDATION	Argue you are "getting out of the building" to engage in productive customer-discovery with Army stakeholders. Describe any customer validation you may have received formally or informally to date on this proposed technology.
weight 20%	ARMY TRANSITION PATHWAY	Describe the next type of deal you aim to make with the Army following this award. Briefly outline your current plan to unlock that next opportunity and/or share the biggest risks you see post this SBIR/STTR award to transition this technology to the Army.
COMMERCIAL POTENTIAL	R&D TO PRODUCT REVENUE	Argue that your team members have transitioned research and development efforts into products successfully, as evidenced by product revenue. (Product revenue is realized by directly selling a solution to solve a problem vs. selling consulting, services or research activities.)
	COMPETITIVE EDGE	Why will you win? A small company needs to have a competitive edge in the marketplace: Something your team does very well that's difficult to match. Some examples include: well protected intellectual property, unmatched relevant expertise, a novel business model, or network effects.
weight 25%	OTHER PEOPLE'S MONEY	Make the case for the commercial market (non-DOD) potential of your technology from which the Army will benefit.
PROPOSAL QUALITY	QUALITY OF PROSE	Provide a clear, well written, and convincing proposal. Avoid jargon and define technical terms.
weight 2%	IMAGES, CHARTS, GRAPHICS	Graphics are encouraged throughout. Ensure they are logical and easy to read. Supporting images should be thoughtful and visually attractive. For plots and charts include: title, axis labels and captions. For technical images include appropriate scales or legends.

Version 4

Army SBIR STTR Phase I Evaluation Criteria v4-0

U.S. ARMY SBIR | STTR

		UNSATISFACTORY	MARGINAL	SATISFACTORY	SUPERIOR
INTRODUCTION	weight 3%	Ineffective introduction. Failed to provide concise innovation proposition.	Adequate introduction. Gradually conveyed innovation's purpose and value. Should be more crisp.	Effective introduction. Systematically conveys innovation's purpose and value.	Exceptional introduction. Immediately conveys innovation's purpose and value.
ARMY BENEFITS	ALIGNMENT	Not aligned with this Army topic's priorities.	Somewhat aligned with this Army topic's priorities.	Aligned with this Army topic's priorities.	Perfectly aligned with this Army topic's priorities.
	SOLUTION'S ADVANTAGES	No evidence of competitive analysis. Undifferentiated product.	Incomplete or too narrow competitive analysis. Weak product differentiation.	Thorough competitive analysis. Strongly differentiated product. Accounted for most substitutes.	Persuasive competitive analysis. Highly differentiated, accounted for all substitutes, provides novel solution.
weight 15%	SOLUTION'S IMPACT	If successful, no improvement vs. the state of the art.	If successful, incremental improvement vs. the state of the art.	If successful, significant improvement vs. the state of the art.	If successful, radical improvement vs. the state of the art.
TECHNICAL APPROACH	SCIENTIFIC FEASIBILITY	No scientific basis for presented approach.	Incomplete scientific basis for presented approach.	Credible scientific basis for presented approach.	Convincing scientific basis for presented approach.
	ENABLING TECHNOLOGIES	Requires nonexistent or unavailable technology.	Requires emerging, cutting edge technology.	Requires proven technologies.	Requires Army-fielded technologies.
	TECHNICAL TEAM	Technical people lack qualifications OR have no experience.	Technical people are somewhat qualified and have some experience.	Technical people are highly qualified OR have significant experience.	Technical people are highly qualified AND have significant experience.
	TECHNICAL RISKS AND MITIGATION PLANS	Failed to present challenges and risks.	Inadequate risk analysis. Mitigation marginally addressed.	Credible risk analysis. Mitigation effectively addressed.	Highly credible risk analysis. Mitigation convincingly addressed.
weight 35%	DATA QUALITY, TECHNICAL	Poorly supported by data. Little to no data attribution.	Partially supported by data. Some data attribution.	Credibly supported by data. Adequate data attribution.	Persuasively supported by meaningful data. Comprehensive data attribution.
PROGRAMMATIC POTENTIAL	PROJECT MILESTONE SCHEDULE	Unclear or non-credible project milestones, or timing.	Mostly clear, credible project milestones and timing. Mostly appropriate level of detail.	Mostly clear, credible project milestones and timing. Appropriate level of detail.	Completely clear, credible project milestones and timing. Appropriate level of detail.
	ARMY CUSTOMER DISCOVERY & VALIDATION	No customer interviews completed. No validation.	A handful customer interviews completed. No validation.	Extensive interviews completed. Early validation beginning to inform transition strategy.	Exhaustive interviews completed. Validation informs credible transition strategy.
weight 20%	ARMY TRANSITION PATHWAY	Fails to identify next contract goal and/or fails to present a plan for near-term execution.	Identifies next contract goal. Has a plan for near-term execution.	Identifies stage-appropriate next contract goal. Credible plan for near-term execution.	Identifies ideal next contract goal. Convincing plan for near-term execution.
COMMERCIAL POTENTIAL	R&D TO PRODUCT REVENUE	No evidence of creating product revenue from R&D efforts.	Evidence of R&D yielding product revenue at previous company(ies).	Evidence of R&D yielding product revenue at this company.	Evidence of R&D yielding product revenue sufficient to fuel this company's growth.
	COMPETITIVE EDGE	Undifferentiated firm. Fails to argue it has an advantage.	Weakly differentiated firm. Some evidence of an advantage.	Strongly differentiated firm. Credibly argues it has durable advantage.	Highly differentiated firm. Convincingly argues it has durable advantage.
weight 25%	OTHER PEOPLE'S MONEY	Fails to present non-DoD sources for future R&D funding.	Evolving non-DoD sources of future R&D funding.	Secure non-DoD source(s) of future R&D funding.	Diverse and robust non-DoD sources of future R&D funding.
PROPOSAL QUALITY	QUALITY OF PROSE	Poorly written. Very difficult to impossible to follow argument. Several spelling or grammar errors.	Moderately written. Sometimes difficult to follow argument. A few spelling / grammar errors.	Effectively written. Convincing, easy to follow argument. No spelling or grammar errors.	Clearly and persuasively written. Compelling arguments. No spelling or grammar errors.
weight 2%	IMAGES, CHARTS, GRAPHICS	Poor visual aids. Often difficult to understand, distracting, or irrelevant.	Inadequate visual aids. Sometimes difficult to understand, distracting, or irrelevant.	Effective visual aids. Support argument in relevant ways, aiding comprehension.	Exceptional visual aids. Greatly enhance delivery and understanding.

Version 4

Appendix B
Army Direct to Phase II Evaluation Criteria

Army SBIR DP2 Evaluation Criteria

U.S. ARMY SBIR

		DEFINITION
INTRODUCTION	weight 2%	Write a clear, concise description of what your innovation does or will do, and where you are in your evolution. Make clear its intended impact on the Army. Evaluators should "get it" after reading this.
ARMY BENEFITS	ALIGNMENT	Argue your technology innovation is aligned with this Army topic's priorities as defined in the solicitation.
	SOLUTION'S ADVANTAGES	Prove your prospective customers will choose you given limited resources and myriad choices. Have you accounted for indirect substitute products as well as direct competitors?
weight 15%	SOLUTION'S IMPACT	The Army seeks higher-risk, high-impact solutions through SBIR/STTR not engineering changes or incremental improvements. Use this section to describe your technology's impact and improvement upon the state of the art.
FEASIBILITY FOR DP2	PROOF OF FEASIBILITY	Provide documentation to substantiate the scientific and technical merit and feasibility has been met.
	WORK OWNERSHIP	Document the people and organizations and any intellectual property (IP) ownership responsible for the work products in this section. The work must have been at least "substantially" performed by your organization and/or the proposed principle investigator for this research, and your firm must either own any IP discussed outright, or has appropriate and sufficient licenses thereto.
	NEW RESEARCH	Prove that the proposed DP2 research is a not in any way a logical extension of previous or ongoing federally funded SBIR or STTR research.
weight 15%	PROTOTYPE DELIVERY	Demonstrate that the research will result in appropriately mature Prototype at the conclusion of the DP2 SBIR contract.
TECHNICAL APPROACH	SCIENTIFIC FEASIBILITY	Convince readers that your innovation is built atop sound scientific and/or engineering principles. Ensure that your feasibility argument adequately responds to the requirements this Army topic.
	ENABLING TECHNOLOGIES	Do the required enabling technologies introduce added risk?
	TECHNICAL TEAM	Briefly list and describe your core scientific and technical team with an emphasis on their past accomplishments and experiences that would relate to this Army SBIR/STTR topic.
	TECHNICAL RISKS AND MITIGATION PLANS	Describe any technical risks that still exist between you and a fully mature solution. What are your plans to mitigate those risks?
weight 25%	DATA QUALITY, TECHNICAL	Use data to substantiate your claims that your Technical Approach (this section of your proposal) is credible. Provide quality data attributed to reliable, credible sources.
PROGRAMMATIC POTENTIAL	PROJECT MILESTONE SCHEDULE	Outline your execution plan. What milestones do you hope to accomplish, and what deliverables (if any) do you hope to produce during this phase and subsequent phases of the effort?
	ARMY CUSTOMER DISCOVERY & VALIDATION	Argue you are "getting out of the building" to engage in productive customer-discovery with Army stakeholders. Describe any customer validation you may have received formally or informally to date on this proposed technology.
weight 20%	ARMY TRANSITION PATHWAY	Describe the next type of deal you aim to make with the Army following this award. Briefly outline your current plan to unlock that next opportunity and/or share the biggest risks you see post this SBIR/STTR award to transition this technology to the Army.
COMMERCIAL POTENTIAL	R&D TO PRODUCT REVENUE	Argue that your team members have transitioned research and development efforts into products successfully, as evidenced by product revenue. (Product revenue is realized by directly selling a solution to solve a problem vs. selling consulting, services or research activities.)
	COMPETITIVE EDGE	Why will you win? A small company needs to have a competitive edge in the marketplace: Something your team does very well that's difficult to match. Some examples include: well protected intellectual property, unmatched relevant expertise, a novel business model, or network effects
weight 20%	OTHER PEOPLE'S MONEY	Make the case for the commercial market (non-DOD) potential of your technology from which the Army will benefit.
PROPOSAL QUALITY	QUALITY OF PROSE	Provide a clear, well written, and convincing proposal. Avoid jargon and define technical terms.
weight 3%	IMAGES, CHARTS, GRAPHICS	Graphics are encouraged throughout. Ensure they are logical and easy to read. Supporting images should be thoughtful and visually attractive. For plots and charts include: title, axis labels and captions. For technical images include appropriate scales or legends.

Version 4

Army SBIR DP2 Evaluation Criteria

		UNSATISFACTORY	MARGINAL	SATISFACTORY	SUPERIOR
INTRODUCTION	weight 2%	Ineffective introduction. Failed to provide concise innovation proposition.	Adequate introduction. Gradually conveyed innovation's purpose and value. Should be more crisp.	Effective introduction. Systematically conveys innovation's purpose and value.	Exceptional introduction. Immediately conveys innovation's purpose and value.
ARMY BENEFITS	ALIGNMENT	Not aligned with this Army topic's priorities.	Somewhat aligned with this Army topic's priorities.	Aligned with this Army topic's priorities.	Perfectly aligned with this Army topic's priorities.
	SOLUTION'S ADVANTAGES	No evidence of competitive analysis. Undifferentiated product.	Incomplete or too narrow competitive analysis. Weak product differentiation.	Thorough competitive analysis. Strongly differentiated product. Accounted for most substitutes.	Persuasive competitive analysis. Highly differentiated, accounted for all substitutes, provides novel solution.
weight 15%	SOLUTION'S IMPACT	If successful, no improvement vs. the state of the art.	If successful, incremental improvement vs. the state of the art.	If successful, significant improvement vs. the state of the art.	If successful, radical improvement vs. the state of the art.
FEASIBILITY FOR DP2	PROOF OF FEASIBILITY	Fails to demonstrate Feasibility of solution.	Partially demonstrates Feasibility of solution.	Successfully demonstrates Feasibility of solution.	Unquestionably demonstrates Feasibility of solution.
	WORK OWNERSHIP	Fails to document prior Feasibility work was substantially completed by the offeror and/or the PI, AND offer's IP rights are unclear.	Partially documents prior Feasibility work was substantially completed by the offeror and/or the PI, AND offeror's rights to any necessary IP.	Sufficiently documents prior Feasibility work was substantially completed by the offeror and/or the PI, AND offeror's rights to any necessary IP.	Persuasively documents prior Feasibility work was substantially completed by the offeror and/or the PI, AND offeror's rights to any necessary IP.
	NEW RESEARCH	This research is likely a logical extension of offeror's prior SBIR / STTR work.	This research might be a logical extension of offeror's prior SBIR / STTR work.	Evidence this research is not a logical extension of offeror's prior SBIR / STTR work.	Compelling evidence this research is not a logical extension of offeror's prior SBIR / STTR work, OR offeror has no prior SBIR / STTR contracts.
weight 15%	PROTOTYPE DELIVERY	Unlikely that an appropriately mature prototype can be delivered.	Flawed argument that an appropriately mature prototype can be delivered.	Credible argument that an appropriately mature prototype can be delivered.	Convincing argument that an appropriately mature prototype can be delivered.
TECHNICAL APPROACH	SCIENTIFIC FEASIBILITY	No scientific basis for presented approach.	Incomplete scientific basis for presented approach.	Credible scientific basis for presented approach.	Convincing scientific basis for presented approach.
	ENABLING TECHNOLOGIES	Requires nonexistent or unavailable technology.	Requires emerging, cutting edge technology.	Requires proven technologies.	Requires Army-fielded technologies.
	TECHNICAL TEAM	Technical people lack qualifications OR have no experience.	Technical people are somewhat qualified and have some experience.	Technical people are highly qualified OR have significant experience.	Technical people are highly qualified AND have significant experience.
	TECHNICAL RISKS AND MITIGATION PLANS	Failed to present challenges and risks.	Inadequate risk analysis. Mitigation marginally addressed.	Credible risk analysis. Mitigation effectively addressed.	Highly credible risk analysis. Mitigation convincingly addressed.
weight 25%	DATA QUALITY, TECHNICAL	Poorly supported by data. Little to no data attribution.	Partially supported by data. Some data attribution.	Credibly supported by data. Adequate data attribution.	Persuasively supported by meaningful data. Comprehensive data attribution.
PROGRAMMATIC POTENTIAL	PROJECT MILESTONE SCHEDULE	Unclear or non-credible project milestones, or timing.	Mostly clear, credible project milestones and timing. Mostly appropriate level of detail.	Mostly clear, credible project milestones and timing. Appropriate level of detail.	Completely clear, credible project milestones and timing. Appropriate level of detail.
	ARMY CUSTOMER DISCOVERY & VALIDATION	No customer interviews completed. No validation.	A handful customer interviews completed. No validation.	Extensive interviews completed. Early validation beginning to inform transition strategy.	Exhaustive interviews completed. Validation informs credible transition strategy.
weight 20%	ARMY TRANSITION PATHWAY	Fails to identify next contract goal and/or fails to present a plan for near-term execution.	Identifies next contract goal. Has a plan for near-term execution.	Identifies stage-appropriate next contract goal. Credible plan for near-term execution.	Identifies ideal next contract goal. Convincing plan for near-term execution.
COMMERCIAL POTENTIAL	R&D TO PRODUCT REVENUE	No evidence of creating product revenue from R&D efforts.	Evidence of R&D yielding product revenue at previous company(ies).	Evidence of R&D yielding product revenue at this company.	Evidence of R&D yielding product revenue sufficient to fuel this company's growth.
	COMPETITIVE EDGE	Undifferentiated firm. Fails to argue it has an advantage.	Weakly differentiated firm. Some evidence of an advantage.	Strongly differentiated firm. Credibly argues it has durable advantage.	Highly differentiated firm. Convincingly argues it has durable advantage.
weight 20%	OTHER PEOPLE'S MONEY	Fails to present non-DoD sources for future R&D funding.	Evolving non-DoD sources of future R&D funding.	Secure non-DoD source(s) of future R&D funding.	Diverse and robust non-DoD sources of future R&D funding.
PROPOSAL QUALITY	QUALITY OF PROSE	Poorly written. Very difficult to impossible to follow argument. Several spelling or grammar errors.	Moderately written. Sometimes difficult to follow argument. A few spelling / grammar errors.	Effectively written. Convincing, easy to follow argument. No spelling or grammar errors.	Clearly and persuasively written. Compelling arguments. No spelling or grammar errors.
weight 3%	IMAGES, CHARTS, GRAPHICS	Poor visual aids. Often difficult to understand, distracting, or irrelevant.	Inadequate visual aids. Sometimes difficult to understand, distracting, or irrelevant.	Effective visual aids. Support argument in relevant ways, aiding comprehension.	Exceptional visual aids. Greatly enhance delivery and understanding.

Version 4

Army SBIR 25.4 Topic Index
Release 8

The following dates are only applicable to topics A254-031, A254-032, A254-033, A254-034, A254-035, A254-036, A254-037, and A254-038

May 7, 2025: Topics Pre-release
May 28, 2025: Topics Open; DoD begins accepting proposals in DSIP
June 11, 2025: DSIP Topic Q&A closes to new questions at 12:00 p.m. ET
June 25, 2025: Topics Close; Deadline for receipt of proposals is 12:00 p.m. ET

Version 4

A254-031 TITLE: Augmented Reality/Virtual Reality (AR/VR) for Railroad Inspection and Maintenance

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber; Human-Machine Interfaces

OBJECTIVE: This topic seeks to develop and demonstrate the feasibility of a stand-alone augmented-reality/virtual-reality (AR/VR) system for railroad inspection, maintenance, and training to enhance military logistics and infrastructure repair through real-time visualization and predictive capabilities.

DESCRIPTION: AR and VR technologies can enable real-time, interactive overlays of digital data onto the physical world. They can be fully or partially immersive and offer a wide range of applications that can reduce downtime and increase knowledge for inexperienced users. A recent study by Workplace from Meta in 2022, indicated that up to 45% of frontline workers were planning to leave their job that year alone, impacting the ability to maintain institutional knowledge. To combat the reduction in knowledge and understanding the need to train new employees in a rapid fashion, companies are modernizing their training methods by adding AR and VR technologies to the training process. A survey conducted by Forbes showed that 86% of respondents had a favorable view of the changes and saw improvement with their quality of the training they received [1].

Traditional methods of railroad track inspection, assessment, and repair are time-consuming, labor-intensive, and require trained and experienced personnel. AR/VR technologies can also be utilized to give military personnel access to important, detailed information, such as schematics, diagnostic data, and repair instructions while working in remote locations. The Army awarded Microsoft a 10-year contract to modify their Hololens into a mixed reality headset to support the warfighter that can utilize and combine multiple battlefields sensors already used by soldiers. The Hololens is an untethered holographic device that is used by a wide variety of commercial entities such as airlines and auto manufacturers of high-end vehicles to train personnel and improve efficiency of new employees. The first design was made for civilian use and did not have ruggedized features needed for combat or utilization in the field. According to The Office of the Director, Operational Test and Evaluation (DOT&E), the Integrated Visual Augmentation System (IVAS), the DoD's version of the Hololens developed by Microsoft, is a head mounted device, worn by soldiers, that includes a see-through heads-up display (HUD), with a variety of sensors used for navigation and operation in low light environments [2]. There have been many issues with advancement and several iterations of the software but "The Army is planning to use IVAS 1.0 systems in its schoolhouses as mission planning tools" [3]. The utilization of the IVAS, will allow maintenance tasks to be completed quicker, reduces errors, and enhances overall operational efficiency, especially in remote or high-risk environments where downtime can be critical [4].

AR and VR technologies are important to include to enhance railroad inspections and maintenance capabilities, particularly for military logistics. The ability to overlay maintenance guidance directly onto equipment and other detailed tasks will enable soldiers to perform their tasks more effectively, without requiring extensive technical expertise [5].

These changes will help create a safer working environment and while enabling soldiers be more adaptable and versatile while handling different types of maintenance on rail and other infrastructure systems. AR and VR technologies will reduce repair times and improve the accuracy of inspections, which strengthens military logistics capabilities and enhances the warfighter's ability to sustain operations in dynamic, challenging environments.

Version 4

PHASE I: This topic is only accepting Phase I proposals for a cost up to $250,000 for a 6-month period of performance.

Demonstrate the feasibility of using a stand-alone, goggle-based system to detect and identify railroad components, differentiate gauge types, and estimate crater volumes in a remote location or contested environment. Develop augmented reality, virtual reality, and mixed reality example scenarios to highlight the differences to formulate the best methodology [6]. Deliver a report documenting the research and development efforts along with a detailed description of the proposed methodology.

PHASE II: Program and develop the proposed software technology. Develop a set of small-scale field scenarios to demonstrate the performance of the developed goggle-based system. Apply the proposed visualization methodology to a track in operational condition and a track that has experienced real-world or simulated damage that results in a crater in the crib of the track. Demonstrate that the technology could be used on a wide range of rail geometries and designs and could estimate crater volumes to generate subgrade and ballast material quantities needed to make repairs. Determine the limitations of performance in the field and field-of-view capabilities of the prototype. Demonstrate the feasibility of using the system in various weather and lighting conditions. Develop a study that systematically varies the rail gauge, depth of ballast, and volume of missing ballast to determine the conditions for field operations. In addition, determine the environmental stability of the goggle system: relevant variables to consider are temperature effects, corrosion resistance, and battery life.

Deliver a reporting document that includes the development and execution of small-scale scenarios, on various track conditions, displaying the ability of the system to identify track components, the analysis on the ability of the system to accurately estimate fill material quantities, and the environmental stability of the proposed equipment and limitations for use. Provide a field demonstration of Phase II findings.

PHASE III DUAL USE APPLICATIONS: Yes, there are multiple industries that have already adopted AR/VR or are moving to AR/VR for training and evaluation. There is potential in the railroad industry for track inspection and maintenance and maintenance of locomotives and rail cars. Other infrastructure such as bridges or tunnels could use improvements to field evaluations to increase safety. For military applications, the technology could be used for improving logistics and augmented mission planning and training.

REFERENCES:

1. https://fedtechmagazine.com/article/2021/01/army-uses-ar-make-training-more-dynamic
2. https://www.interaction-design.org/literature/article/beyond-ar-vs-vr-what-is-the-difference-between-ar-vs-mr-vs-vr-vs-xr#:~:text=Augmented%20reality%20(AR)%3A%20a,a%20fully%2Dimmersive%20digital%20environment
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7. https://www.forbes.com/councils/forbestechcouncil/2022/11/18/how-ar-can-improve-the-training-and-retention-of-frontline-workers/

Version 4

KEYWORDS: Augmented reality; virtual reality; AR/VR; mixed reality; immersive; artificial intelligence; repair instructions; contested environments; railroad; inspection; maintenance; training

A254-032 TITLE: Emerging Materials for Cryogenic Optical Modulation

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials; Microelectronics; Quantum Science

OBJECTIVE: Army is seeking emerging optical material platforms that provide energy efficient modulation at cryogenic temperatures. This effort will develop emerging photonic components for cryogenic application alongside high-performance infrared sensor arrays.

DESCRIPTION: Our Warfighters rely on an ever-increasing amount of data to perform the mission. Individual sensors, such as high-definition thermal cameras, counter-UAV sensors, and advanced radio frequency spectrum analyzers, all generate many gigabytes of data per second. Moving data between sensor and processor, around the vehicle, or between command posts is most effectively done via optical fiber. Optical data transport benefits from decades of commercial development, leading to lower power, faster communications, and higher bandwidth when compared to electrical signals. However, just as getting fiber to individual households was the “last mile” challenge for internet availability, getting fiber to where the data is generated is the photonics challenge for today’s military.

Laboratory demonstrations have shown that electrical outputs from high resolution sensors can successfully be converted to optical data transmission utilizing optical modulators. This enables a drastic increase in data transmission rates, superior energy efficiency, and flexible fiber routing to downstream Artificial Intelligence computer electronics. Optical conversion permits system designers to push beyond current resolution, frame rate, functionality and bit depth limitations, providing the DoD a leap-ahead capability with advances in ultra-large format sensors, wide field-of-view systems, and fast-event detection providing value to a multitude of detect, decide, track and reconnaissance missions.

The electro-optic modulator (EOM) is a core component within an optical signal processing chain. An EOM can be made of a variety of materials and can be based on a number of physical effects, such as the Pockels effect, plasma dispersion effect, DC Kerr effect, and the Franz-Keldysh effect. Many EOM materials and related components (laser, transceiver, etc.) have benefited greatly from datacom and telecom industries. Enormous data rates and excellent energy efficiency are achievable with several EOM solutions, but offerings are primarily intended for room temperature use and are susceptible to performance degradation at cryogenic temperatures. The most mature foundry offering to date has been the silicon photonics (SiPh) micro-ring resonator. SiPh modulators are susceptible to carrier-freeze out at low temperature and operate at a very narrow wavelength bandwidth. For system adoption, an EOM solution that exhibits superior robustness of operation and resilience or performance improvement at cryogenic temperatures is desirable.

We are seeking EOM material platform solutions that exhibit excellent modulation efficiency at low temperatures (< 100 K) required for adoption into high performance Army infrared imaging systems. Excellent energy efficiency, compact physical size, low bit error rate (<1E-10), and low voltage biasing are key considerations for development of the most appropriate EOM solution. EOM solutions must be able to achieve high aggregate data rates (> 20 Gbps) and have viable scalability to higher data rates. Compatible integration alongside mixed signal digital read-out integrated circuit (DROIC) components is a key consideration in identifying the best solution. Modulator drive voltages should be appropriately aligned with existing DROIC I/O voltages. While this work focuses on the development of cryogenic optical modulator materials, topics must also consider a pathway for integration into existing foundry processes. Technologies that have the potential to mature to standard foundry offerings will be received favorably.

PHASE I: This topic is only accepting Phase I proposals for a cost up to $250,000 for a 6-month period of performance.

In Phase I, performers will describe, develop, and begin fabrication of EOM solutions for use in cryogenic environment. This phase can include material device design, modeling, platform and process fabrication improvements, and system level architecture considerations. Additionally, performers will begin preliminary work in identifying hardware and software required for conversion of digital data to optical output link in an appropriate cryostat environment for demonstration effort in Phase II. In all cases, energy per bit and total system energy costs should be minimized. By the end of Phase I, performers are expected to have comprehensive plan for EOM fabrication, improvement, and demonstration in Phase II.

PHASE II: In Phase II, performers will fabricate and refine necessary photonic components to begin bit error rate testing at cryogenic temperatures. This will likely include multiple fabrication runs, improvements in design and/or processing, and advanced manufacturability of the material platform. Test temperatures range for consideration is between 20K – 150K. Understanding of drive voltages, system coupling, insertion, and chip-to-chip losses should be documented in this phase to better understand system energy budget when implementing this technology alongside advanced infrared Army imaging systems. The Phase II deliverable includes a developed test chip and full cryogenic performance report to include bit error rate test and system power budget analysis. Depending on initial maturity, the project must also make progress towards making the fabricated EOM compatible with current and future foundry processes and material platforms. This could be represented by a proof-of-concept demonstration or a detailed analysis of existing processing opportunities that would make this EOM technology a standard offering at a domestic foundry. Phase II will also include engagement with camera system vendors that provide relevant DROIC components to Army programs. This engagement will bring down the risk of interfacing the proposed EOM solution within an Army infrared imaging product by ensuring this technology can be driven either directly from the DROIC I/O, or less preferably via an intermediary bias board that can supply the required voltages to operate the EOM.

PHASE III DUAL USE APPLICATIONS: Cryogenic optical modulators could have use for commercial quantum computer technologies.

REFERENCES:

1. https://www.semanticscholar.org/paper/High-Speed-SiGe-EAMs-at-Cryogenic-Temperatures-Chansky-Dorch/c25c130d1eb141155811db01fdea69f780efec6f
2. https://www.nature.com/articles/s41566-021-00903-x
3. https://www.nature.com/articles/s41563-020-0725-5
4. https://ieeexplore.ieee.org/document/9192179
5. https://opg.optica.org/oe/fulltext.cfm?uri=oe-26-6-6663&id=383132
6. https://www.nature.com/articles/s41586-018-0551-y
7. https://opg.optica.org/aop/abstract.cfm?uri=aop-13-2-242

KEYWORDS: Photonics; Sensors; Cryogenic Optical Modulators; High-Speed Data Transport; Infrared; Interconnects; Large Format Arrays; Focal Plane Arrays

A254-033 TITLE: Turn-Key Micro Optical-Frequency-Comb Module

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Network Systems-of-Systems, Integrated Sensing and Cyber, Microelectronics, Quantum Science, Space Technology, Trusted AI and Autonomy

OBJECTIVE: This topic seeks to research and develop a low size, weight, and power (SWaP), soliton-based miniature optical frequency comb module. The goal is to deliver a turn-key microcomb-based prototype including an external pump-laser that fits within an industry standard 14-pin butterfly package with control electronics board.

DESCRIPTION: Low-noise and stable microwave sources are a critical component in RF EW/Radar, data communication, and long-range detection/sensing systems for fast response and precision targeting. The Nobel prize winning optical frequency comb provides a phase-coherent connection between optical and microwave domains that can be configured as precision microwave oscillator. Recent advances in integrated photonics have enabled chip-scale photonic micro-resonator frequency combs, or microcombs, a miniature precision frequency source with low SWaP-Cost (SWaP-C) able to fit into smaller platforms (UAVs). Microcombs have evolved quickly from early laboratory demonstrations to more advanced devices that are being explored in multiple DoD applications including microwave synthesis in Radar and EW system, timing for a PNT system, high-bandwidth data communication and bio-chem sensing. Very recently, a new generation of microcombs has been reported that enable turnkey, direct semiconductor laser pumping. The pump laser frequency is self-injection locked by the microcomb; therefore, it does not require special triggering mechanisms such as pump laser frequency or amplitude kicking techniques for soliton generation, making them significantly more reliable and user friendly. For the first time, fully functional and turnkey microcomb modules operating at X and K-band repetition-rates are feasible. These modules could incorporate features that enable multi-modality operation, electronic control and user diagnostics. As low-SWAP-C, fully packaged systems, they would find immediate applications within the DoD. Furthermore, their existence would accelerate development of critical systems by removing a current entry barrier to system integrators. Access to microcomb devices with such a full spectrum of features would also support the photonics research community, enabling a new generation of photonics systems development.

PHASE I: This topic is only accepting Phase I proposals for a cost up to $250,000 for a 6-month period of performance.

A successful proposal will address challenges associated with pump power and modal volume in self-injection locked microcombs and take advantage of industry standard fabrication techniques found in CMOS foundries within the US. For the Phase 1 effort the team will design the microcomb source. The design will include a micro-resonator design and layout for foundry fabrication; design of the pump-laser module and photonic interconnects to the micro-resonator chip; model the packaging layout; design the control electronics module. The team will also provide a manufacturing plan describing how they would support large volume fabrication and packaging. Finally, the team will conduct initial laboratory bench-top experimental tests demonstrating comb generation and verifying frequency and stability metrics.

PHASE II: Building on Phase 1 design work the team will proceed with the fabrication of the microcomb module and assembly of two microcomb modules (minimum) with their associated control modules. Prototype devices will be fully tested for comb generation, stabilization and tunability for locking purposes. At the end of Phase II, the team will deliver two fully functional microcomb units along with all associated testing data and an operation manual. Prototype devices will meet the following requirements:

- Microcomb module including an external pump laser in an industry standard 14-pin butterfly package
- Electronic control module using a single power source
- Whole unit within 10 cc volume
- Complete turnkey operation (simple on/off switch)
- Comb repetition rates: between 10 to 40 GHz.
- Comb repetition rate and Carrier envelop frequency (f_{CEO}) can be independently tuned by external signals, each with a bandwidth of at least 10 kHz.
- Microcomb bandwidth: 30 nm for 20 GHz comb, 60 nm for 40 GHz comb
- Power consumption: Optical Module (2 W) Electrical Control Module (3 W)

PHASE III DUAL USE APPLICATIONS:

1. RF Electronics (including microelectronics, Radars, wireless communications)
2. PNT (including precision clocks for timekeeping, precision distance measurement/ranging)
3. Computing and Data communication (high-speed computing and data communication, data center)
4. Spectroscopy (Bio medical and chemical sensing, spectroscopy instruments)
5. Automation (UAVs and drones)
6. Space (satellites, spacecrafts)
7. Astronomy (synchronized Radar and detection system, frequency spectroscopy)

REFERENCES:

1. https://doi.org/10.1038/s41586-024-07057-0
2. https://doi.org/10.1038/s41586-018-0065-7
3. https://doi.org/10.1038/s41586-024-07058-z

KEYWORDS: optical frequency comb; micro-resonator; microcomb; turn-key microcomb; chip-scale precision oscillator; chip-scale clock; PNT; integrated photonics; microelectronics

A254-034 TITLE: Small Innovative Mission Power Sources

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

OBJECTIVE: There is a need to increase the supplier base and production capacity for power sources currently implemented in advanced ammunition fuzing applications.

Joint Program Executive Office Armaments and Ammunition (JPEO A&A) Project Manager Maneuver Ammunition Systems (PM MAS) desires alternate power sources to increase the supplier base and production capacity to meet the increasing demand of cartridges employing these advanced fuzing technologies. The proposed power source solutions should meet or exceed the performance and reliability of the current solution. The proposed solutions need to be capable of maintaining an extended shelf-life, fitting within a 400 mm3 cylindrical volume, and functioning under high g-load and spin rate conditions and within cold and hot temperature extremes IAW MIL-STD-810 while supplying 50 to 200 mW for the duration of the mission. Acceptable proposed solutions can implement energy harvesting or stored energy.

DESCRIPTION: PM MAS is currently producing ammunition with advanced fuzing technologies which require small form-factor power sources. Additional ammunition solutions are currently in development to support numerous services and platforms, with demand for such capabilities steadily increasing. Additional power source solutions are being sought to either replace the current solution or be used as an alternate source.

The proposed solutions need to be capable of maintaining an extended shelf-life, fitting within a 400 mm3 cylindrical volume, and functioning under high g-load and spin rate conditions and within cold and hot temperature extremes IAW MIL-STD-810 while supplying 50 to 200 mW for the duration of the mission. Acceptable proposed solutions can implement energy harvesting or stored energy.

PHASE I: This topic is only accepting Phase I proposals for a cost up to $250,000 for a 6-month period of performance.

During the Phase 1 SBIR project, a feasibility study will be conducted on power source options. The Phase 1 study should include a review of the available technologies and their suitability in Medium Caliber fuzing applications and a recommended down select of the proposed solution. The study should also include costs and timelines for implementation of a prototype/production power source as well as production capacity projections. If feasible, a small sample of prototypes will be fabricated and evaluated to assess performance at the component level in a laboratory test environment.

PHASE II: The Phase 2 SBIR project is expected to result in an improved prototype power source which will be delivered to U.S. Army Combat Capabilities Development Command (DEVCOM) Armaments Center (AC) for follow-on integration and testing. The improved prototype will be based on the results of the Phase 1 study. A first iteration of prototypes in this phase will be integrated into fuze assemblies and will undergo laboratory testing and testing in a simulated launch environment. For this iteration, it is desired but not required to achieve full scale-down to the 400 mm3 cylindrical volume form factor. A second iteration of prototypes in this phase will be required to achieve the necessary target volume, and will be integrated into prototype fuzes and cartridges for a Technology Readiness Level (TRL) 6 assessment, which will include full prototype cartridges fired from a relevant weapon system.

PHASE III DUAL USE APPLICATIONS: This technology could be used to power commercial or residential Internet of Things (IoT) devices, remote sensors, medical devices, and Micro-Electromechanical Systems (MEMS) in various fields and applications.

REFERENCES:

1. https://ndia.dtic.mil/wp-content/uploads/2019/fuze/21767_Schisselbauer.pdf

KEYWORDS: Ammunition; Medium Caliber; Fuze; Power Source

Version 4

A254-035 TITLE: Micro Display for Augmented Reality Information Overlay

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Microelectronics, Advanced Materials
OBJECTIVE: The proposed topic will examine tradeoffs for ground Soldier applications for micro displays, create new backplane architectures, determine optimal Si process nodes and wafer size, and ultimately entail the fabrication and characterization of the micro displays, for further integration into head-mounted display (HMD) systems for augmented reality (AR) outside of this SBIR.

DESCRIPTION: This project will define, build, and characterize micro display technologies (e.g. microLED or OLED) which could eventually be paired with see-through visor optics to build low Size, Weight, and Power, Cost (SWaP-C) Augmented Reality (AR) Heads-up Display (HUD) hardware for the Soldier. Even though the display and optics technologies have been demonstrated separately, additional SBIR research is needed to minimize power draw during operation while maintaining high brightness that, when combined, ultimately deliver a useful and comfortable Mixed Reality (MR) product for the Soldier. Enabling components will primarily be the trade study to determine high brightness micro display, and the off-the-visor see through optics for displaying the AR content onto. Vendors can draw on existing fabrication expertise and operational fabrication facilities to lower the entry barrier costs. Additional components like batteries and controls will be required to drive the display with valuable AR content. The basic approach of using micro displays (multi-stack OLEDs, microLEDs, LCD, LCOS, etc.) for high brightness has been demonstrated on other SBIR programs. What is needed from this effort is a micro display optimized for ground Soldier applications that could separately be paired with an optical combiner HUD, and then optimization for AA battery power operation for hours of use.

PHASE I: This topic is only accepting Phase I proposals for a cost up to $250,000 for a 6-month period of performance.

The goal is to achieve a micro display with mission capable performance (1000+ line resolution, color, 40+ degree field of view) night or day in a lightweight affordable system which runs several hours on AA batteries. The inherent low-cost nature of this device should make it affordable for wide proliferation among dismounted Soldier units, with an objective target of exceeding the fielding rates of night vision goggles or other heads up displays.

PHASE II: Prototype most ideal micro display, fabricate it, and characterize it in United States Government facility.
PHASE III DUAL USE APPLICATIONS: Medical device contractors have expressed interest for visor-display systems. Consumer augmented reality also uses micro displays.

REFERENCES:

1. https://doi.org/10.1117/12.2569848
2. https://doi.org/10.1117/12.2270224

KEYWORDS: Micro display; ground Soldier; augmented reality; information overlay; head-up display; microLED; OLED, micro LED; microdisplay

Version 4

A254-036 TITLE: AI-tool for Data Quality Management of Human Resources Database

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

OBJECTIVE: The aim of this topic is to harness advanced AI/ML technologies to enhance the IPPS-A system by achieving the following objectives:

- HR/Pay Data Quality Enhancement: Ensure high data integrity and reliability. Develop generative AI or ML solutions to identify and rectify data inaccuracies, inconsistencies, and complete missing information.
- HR/Pay Anomaly Detection and Prevention: Implement AI-driven mechanisms to detect anomalies, prevent data duplication, and ensure ongoing data quality improvement, adapting to evolving operational needs.

AI/ML is best suited to tackle these issues over traditional software approaches because the tool can be trained to identify common and new issues with data. Finding incongruencies in our data requires manual intervention and that requires time and money. We want to reduce or eliminate the time it takes to triage/adjudicate data quality issues and AI/ML can do this instantaneously and accurately. An AI/ML tool can scan an entire data set for anomaly identification while manual mean relies on specific data attributes.

DESCRIPTION: The Army has massive data quality issues going back decades. IPPS-A inherited quite a bit of incomplete or incorrect data, which does not function well in a modern system with data quality checks. There were minimal data completeness or correctness checks in legacy systems, and Soldiers could have a record in more than one of the four legacy databases in some degree of currency. IPPS-A converted 1.1 million records from those four databases and made some decisions on what was coming from where, or with our partners who are relying on complete, correct data from us. A human captures datapoints from paper documents to establish personal identity data and service data in accessions systems, which pass data to IPPS-A. IPPS-A is building a payroll system bringing data from legacy systems to the functioning HR system.

This solution would improve the Service Members quality of life by delivering accurate pay, reduced interactions with HR and Pay Administrators on data issues, increase the reliability on the program, and concentrate on duty tasks more efficiently. Normal data quality implementations check and validate specified data fields through a manual process that takes time, whereas an AI driven anomaly detection could look at the entire data set from an inbound interface system and within the IPPS-A system.
We want to introduce AI/ML driven anomaly detection to IPPS-A. This capability would help users at multiple levels even though the improvement is not outward facing and noticeable to end-users.

PHASE I: This topic is only accepting Direct to Phase II proposals for a cost up to $2,000,000 for a 24-month period of performance.

Proposers interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific and technical merit and feasibility equivalent to a Phase I project has been met. Documentation can include data, reports, specific measurements, success criteria of a prototype, etc.

(DIRECT TO) PHASE II: Improve the Service Members quality of life by delivering accurate pay, reduced interactions with HR and Pay Administrators on data issues, increase the reliability on the program and concentrate on duty tasks more efficiently.

- Programed data quality implementations check and validate specified data fields, whereas an AI driven anomaly detection could look at the entire data set from an Inbound Interface System.
- Introduce AI/ML driven anomaly detection to IPPS-A.

Speaking with multiple vendors about data quality improvement utilizing AI/ML is completely possible and being done today. Companies are eager to solve this problem and want to be a part of improving the Army for everyone. Justify that the enabling technologies are mature enough to position a diverse set of companies to deliver a prototype via a Direct to Phase 2, instead of initiating this topic with a Phase 1 feasibility study.

PHASE III DUAL USE APPLICATIONS: Data quality improvement solutions can span across many organizations. For example, if companies merge or acquired, the parent company can utilize data quality improvement solutions to optimize their HR and payroll data.

REFERENCES:
1. https://www.edq.com/blog/the-value-of-artificial-intelligence-ai-to-data-quality/
2. https://www.youtube.com/watch?v=M99BvYJSawQ&list=PL8IYfXypsj2CyuGjqjXHiMR6EtsPffLqU&index=4

KEYWORDS: Scraping; anomaly detection; data quality; data correctness; data completeness; data quality dashboard; artificial intelligence; machine learning

Version 4

A254-037 TITLE: Single Aperture Night plus Polarization Compass

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

OBJECTIVE: Celestial compasses used in handheld targeting systems are typically comprised of multiple optical channels for day (sun) and night (stars). During twilight (sunrise and sunset) the sun is low on the horizon and is potentially occluded and stars are not yet fully visible. Emerging sky polarization sensors can bridge the twilight gap and provide Soldiers accurate target azimuth. Combining the night (star) and polarization optical channels reduces system weight, complexity, and cost.

DESCRIPTION: Celestial compasses have been in service for north finding on aircraft, vehicles, and handheld by Soldiers for decades and are typically configured as multi-aperture (day and night channels) devices with moveable filters. The current devices require nearly unobstructed views of the sky and have significant gaps in performance under twilight conditions. A newly available camera chip from Sony enables the night (star) channel and sky polarization channel to be merged into a single aperture with a common Focal Plane Array (FPA) and objective lens, while eliminating the need for moving parts. The integration of polarization into the night celestial camera extends the operational effectiveness in that North finding solution can be achieved when the sun is partially obscured by objects/clouds, is low on the horizon, and when it is slightly below the horizon when the sky is still too bright for stars to be observed. In addition to the increased availability, the Single Aperture Night plus Polarization Compass (SANPC) reduces the celestial system weight, decreases integration complexity, and lowers the unit cost.

PHASE I: This topic is accepting Direct to Phase II proposals for a cost up to $2,000,000 for a 24-month period of performance.

Proposers interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific and technical merit and feasibility equivalent to a Phase I project has been met. Documentation can include data, reports, specific measurements, success criteria of a prototype, etc.

(DIRECT TO) PHASE II: The outcome is to have the vendor design, demonstrate, and deliver two single aperture night plus polarization celestial compasses for use in a handheld targeting system. Interested companies must show that they currently have a foundational experience base into celestial compass systems and components, by having integrated a celestial compass into a targeting system (at least into a prototype targeting system). A working knowledge of the key aspects of celestial compass system such as optical design, digital image processing, computational algorithms, micro-processor, and other support electronics is a necessity in order to be considered for award.

While the SANPC could have many applications, this SBIR has a specific potential application for incorporation into an army system. the SANPC must obtain azimuth solutions without reorientation

The required azimuth requires high accuracy in night (star) mode and polarization mode. A design goal is to minimize or eliminate the time between when a polarization azimuth solution can last be obtained as the sun sets and moves further below the horizon, and when star-based azimuth solutions can first be obtained.

"*Error Modeling and Testing of Celestial Compass Equipped Precision Targeting Systems,"* 3 November 2015, discusses error modeling/testing of night celestial compasses, but not polarization mode. This document is Distribution A (Approved for Public Release) but is not available in a public forum. A request for this document can be made by contacting nakia.s.ewing.ctr@army.mil.

PHASE III DUAL USE APPLICATIONS:

- **Civilian navigation**: Compasses can be used as backup navigation tools when in a GPS-denied environment (e.g., sea shipping, air travel).
- **Scientific Research**: Provides remote sensing and "time-keeping" for geological surveys, animal observation, etc.
- **Emergency Rescue**: Enables redundant navigation tools in likely GPS-denied areas.

REFERENCES:

1. https://doi.org/10.1242/jeb.204.17.2933
2. https://doi.org/10.1117/1.1847656

KEYWORDS: sky polarization; polarization filter; focal plane array; celestial compass; handheld targeting system; azimuth determination; forward observer

A254-038 TITLE: Meta Lens Solar Compass (MLSC)

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

OBJECTIVE: Recent advancements in meta lens technology show promise for reducing the size and cost of optical sensors used for daytime (solar) celestial navigation. This topic's objective is to design and prototype a solar compass that leverages meta lens technology to increase performance while reducing weight and cost.

DESCRIPTION: Traditional solar compasses often require multiple optical elements, which cause them to be bulky and complex. The meta lens, being a single-element structure, could simplify solar compass design while still performing as well or better than traditional lenses for celestial compass applications. Product Manager, Soldier Precision Targeting Devices (PdM SPTD) has funded the development of a prototype meta lens by Johns Hopkins University/Applied Physics Lab (JHU/APL). Upon award of the SBIR contract, six samples of the prototype lenses can be provided by JHU/APL to the vendor to execute this effort, along with technical documentation on the design. When the sun is visible and unobscured, the meta lens solar compass (MLSC) will provide accurate azimuth information to precisely geo-locate objects at extended ranges. The MLSC will increase accuracy, reduce system weight, and lower cost compared to traditional multi-element refractive fish-eye objective lens assemblies.

PHASE I: This topic is accepting Direct to Phase II proposals for a cost up to $2,000,000 for a 24-month period of performance.

Proposers interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific and technical merit and feasibility equivalent to a Phase I project has been met. Documentation can include data, reports, specific measurements, success criteria of a prototype, etc.

(DIRECT TO) PHASE II: The desired outcome is for the vendor to design, demonstrate, and deliver two solar compasses utilizing meta lens technology. Interested companies must show that they currently have a foundational experience base into celestial compass systems and components, by having integrated a celestial compass into a targeting system (at least into a prototype targeting system). A working knowledge of the key aspects of celestial compass system such as optical design, digital image processing, computational algorithms, micro-processor, and other support electronics is a necessity in order to be considered for award.

While the MLSC could have many applications, this SBIR has a specific potential application for incorporation into an army system. The MLSC must obtain azimuth solutions without reorientation

The azimuth requires high accuracy measured as the root-mean-square (RMS) of data taken over all headings, and with a specific solar elevation angle.

"*Error Modeling and Testing of Celestial Compass Equipped Precision Targeting Systems,"* 3 November 2015 highlights the difficulty of obtaining a high accuracy solar celestial solution over the operational temperature range. This document is Distribution A (Approved for Public Release) but is not available in a public forum. A request for this document can be made by contacting nakia.s.ewing.ctr@army.mil.

It is acceptable to base the MLSC on the existing meta lens prototype previously funded by PdM SPTD, samples of which can be provided upon award as noted above. Proposers are not precluded from developing their own design of a meta lens. The purpose of this effort is to develop a complete MLSC ready for transition into an army system and other applications.

PHASE III DUAL USE APPLICATIONS:

- Consumer electronics: Electronics ranging from smart phones and wearables leverage similar enabling technologies.
- Scientific Research: Similar optical technologies are used in tools like microscopes.
- Healthcare: Like the above, the enabling technologies are used in healthcare sensing technologies and health IT equipment

REFERENCES:

1. https://doi.org/10.1021/acs.nanolett.0c02783
2. https://doi.org/10.1021/acsphotonics.0c00479

KEYWORDS: Meta lens; solar compass; celestial compass; azimuth determination; handheld targeting system; far target location; forward observer; geolocation; celestial navigation

Version 4

xTech Search 9 SBIR Finalist Open Topic Competition

Note: The topic listed below is part of the xTechSearch 9 Prize Competition: See the full xTechSearch 9 competition RFI here: https://www.xtech.army.mil/competitions/

xTechSearch 9 will be used to identify small business concerns that meet the criteria for award. Winners selected from the xTechSearch 9 prize competition will be the only firms eligible to submit an SBIR proposal under the topic listed above. Proposals submitted to the topic listed above by non-winners of the xTechSearch 9 competition will not be evaluated. See the full xTech competition RFI here: https://www.xtech.army.mil/competitions/

June 4, 2025, 5pm ET: white paper submission deadline via link above

A254-P039: xTechSearch 9 SBIR Finalist Open Topic Competition

Version 4

A254-P039 xTech Search 9 SBIR Finalist Open Topic Competition

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI; Integrated Sensing and Cyber; Advanced Infrastructure & Advanced Manufacturing; Integrated Network Systems-of-Systems

OBJECTIVE: xTechSearch is seeking novel, disruptive concepts and technology solutions with dual-use capabilities that can assist in tackling the Army's current needs and apply to current Army concepts. The intent is to provide the Army with transformative technology solutions while enabling cost savings throughout the Army systems' life cycle. Critical technology focus areas include Artificial Intelligence / Machine Learning (AI/ML); Advanced Materials; Advanced Manufacturing; Cyber; Electronics; Human Performance; Immersive; Network Technologies; Position, Navigation and Timing (PNT); Power; Software Modernization; and Sensors.

DESCRIPTION: xTechSearch is an open-topic competition designed to identify groundbreaking technologies with strong commercial traction that may also provide game-changing capabilities for the Army. This competition will be used to competitively down-select up to 24 winners who can submit an Army SBIR Phase I proposal under topic "A254-P039 – xTechSearch 9 SBIR Finalist Open Topic Competition" for a potential follow-on award of up to $250,000. By partnering with the Army SBIR|STTR Program, technologies that are selected from this competition to have the highest potential impact on the Army will have a structured pathway to continue developing those solutions for Army systems alongside Army customers. xTechSearch encourages submissions that may not be familiar with the Army problem your technology can solve, but can clearly articulate the solution's advantage, the technical viability, and commercial potential. The xTechSearch competition is supported by a wide range of subject matter experts across the Army and DoD to help evaluate the potential of your technology to improve operational effectiveness, reduce lifecycle costs, and accelerate the transition of cutting-edge technology into Army systems.

The SBIR|STTR program has aligned technologies that are experiencing rapid commercial traction with critical Army priorities into five portfolios of priority interest for this competition, each with core technology components identified. While xTechSearch encourages submissions aligned to the following SBIR|STTR portfolios and the associated core technology components, the program also welcomes proposals in any other technology domain with the potential to provide a disruptive advantage to the Army:

- Sensors: Devices that detect stimuli and produce an output, as well as onboard processing technologies that handle the output prior to transmission.
- Immersive and Wearables: Immersive focuses on the simulation or extension of the real world, such as XR. Wearables focuses on devices, garments, or equipment for readiness, performance, recovery, or protection.
- AI/ML: Technologies designed to enhance the full spectrum of Army operations and supplement decision-making capabilities. Includes advanced tools designed to augment business analytics and warfighting capabilities across multi-domain operations.
- Energy Resiliency: Focuses on expeditionary applications of energy technologies designed to produce systems that maximize efficiency, adapt Army systems to reduce net energy demand or reliance on logistic fuel supply, and meet the power demands of future Army systems across echelons.
- Contested Logistics and Sustainment: Strategic and operational technologies that involve planning and executing the movement and maintenance of forces and materials under adversarial conditions. Includes logistical operations, supply chain management, and sustainment activities.

Additional information on the Transition Broker Teams (TBT) can be found in the Appendix A section of the xTechSearch 9 competition RFI found here: https://www.xtech.army.mil/competitions/.

Technologies that fall exclusively within the portfolio of the U.S. Army Medical Research and Development Command, which include military infectious diseases, military operational medicine, chemical biological defense, and clinical and rehabilitative medicine, are excluded from xTechSearch.

Join us for an exciting Ask Me Anything (AMA) session! This is a unique opportunity for interested companies to engage with experts, ask questions, and learn more about the xTech competition and how to participate. The meeting will take place May 21, 2025 at 1500 ET, you can access here via MS Teams.

The white paper submission deadline for xTechSearch 9 is June 4, 2025at 5pm ET. White papers must be submitted by following instructions provided at the xTechSearch 9 competition site here: https://www.xtech.army.mil/competitions/.

NOTE: White papers are NOT submitted to DSIP. Small business concerns that do not submit a concept white paper to the xTechSearch 9 competition before the June 4, 2025 deadline will be ineligible to compete or submit a full SBIR proposal to DSIP.

PHASE I: Companies will complete a feasibility study that demonstrates the firm’s competitive technical advantage relative to other commercial products (if other products exist) and develop concept plans for how the company’s technology can be applied to Army modernization priority areas. Studies should clearly detail and identify a firm’s technology at both the individual component and system levels, provide supporting literature for technical feasibility, highlight existing performance data, showcase the technology’s application opportunities to a broad base of customers outside the defense space, a market strategy for the commercial space, how the technology directly addresses the Army’s modernization area as well as include a technology development roadmap to demonstrate scientific and engineering viability.

At the end of Phase I, the company will be required to provide a concept demonstration of their technology to demonstrate a high probability that continued design and development will result in a Phase II mature product.

PHASE II: Produce prototype solutions that will be easy to operate by a Soldier. These products will be provided to select Army units for further evaluation by the soldiers. In addition, companies will provide a technology transition and commercialization plan for DOD and commercial markets.

PHASE III DUAL USE APPLICATIONS: Complete the maturation of the company’s technology developed in Phase II to TRL 6/7 and produce prototypes to support further development and commercialization. The Army will evaluate each product in a realistic field environment and provide small solutions to stakeholders for further evaluation. Based on soldier evaluations in the field, companies will be requested to update the previously delivered prototypes to meet final design configuration.

REFERENCES:

1. https://www.xtechsearch.army.mil

Version 4

KEYWORDS: Electronics; Human Performance; Open Topic; Prize Competition; Dual Use; Artificial Intelligence / Machine Learning (AI/ML); Advanced Materials; Advanced Manufacturing; Cyber; Electronics; Human Performance; Immersive; Network Technologies; Position, Navigation and Timing (PNT); Power; Software Modernization; Sensors

Version 2

DEPARTMENT OF THE AIR FORCE
AIR FORCE
25.4 SMALL BUSINESS INNOVATION RESEARCH (SBIR)
PHASE I
PROPOSAL SUBMISSION INSTRUCTIONS
Release 8

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

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

- Full component-specific instructions and topic descriptions are available on DSIP at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations. Be sure to select the tab for the appropriate BAA cycle.

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, "25.4 Address Change".

Points of Contact:

General information related to the AF SBIR/STTR program and proposal preparation instructions, contact the AF SBIR/STTR One Help Desk at usaf.team@afsbirsttr.us. All applicants have ample opportunity to request clarifying information. **The DAF encourages applicants to request clarifying information as early as possible, as delays in such requests constrain the DAF's ability to provide satisfactory resolution to applicant concerns.**

- 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 SBIR 25.4 BAA.
- Air Force SBIR/STTR Contracting Officer (CO):
  - Mr. Daniel J. Brewer, Daniel.Brewer.13@us.af.mil

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

PHASE I PROPOSAL SUBMISSION

The DoD SBIR 25.4 Broad Agency Announcement, https://www.dodsbirsttr.mil/submissions/login, includes all program requirements. Phase I efforts should address the feasibility of a solution to the selected topic's requirements.

PHASE I PROPOSAL FORMAT

Complete proposals must include all of the following:

Volume 1: DoD Proposal Cover Sheet

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

Volume 2: Technical Volume

Volume 3: Cost Volume

Volume 4: Company Commercialization Report

Volume 5: Supporting Documents

Volume 6: Fraud, Waste, and Abuse Training

Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

DoD PROPOSAL COVER SHEET (VOLUME 1)

Complete the proposal Cover Sheet in accordance with the instructions provided via DSIP. The technical abstract should include a brief description of the program objective(s), a description of the effort, anticipated benefits and commercial applications of the proposed research, and a list of keywords/terms. The technical abstract of each successful proposal will be submitted to the Office of the Secretary of Defense (OSD) for publication and, therefore, must not contain proprietary or classified information.

TECHNICAL VOLUME (VOLUME 2):

The Technical Volume should include all graphics and attachments but should not include the Cover Sheet, which is completed separately as Volume 1. The Phase I technical volume (uploaded in Volume 2) shall contain the required elements found below. Ensure that all graphics are distinguishable in black and white.

The Phase I Technical Volume page/slide limits identified for the topics do not include the Cover Sheet, Cost Volume, Cost Volume Itemized Listing (a-h). The Technical Volume must be no smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins. Only the Technical Volume and any enclosures or attachments count toward the page limit. In the interest of equity, pages/slides in excess of the stated limits will not be reviewed. The documents required for upload into Volume 5, "Other", do not count toward the specified limits.

These instructions supplement the 25.4 SBIR BAA. In addition to the requirements found in the 25.4 SBIR BAA, applicants are required to provide the following information in Volume 2:

Key Personnel: Identify in the Technical Volume all key personnel who will be involved in this project; include information on directly related education, experience, and citizenship.

- A technical resume of the principal investigator, including a list of publications, if any, must be included. Only one principal investigator/project manager can be designated to a proposal at any given time.
- Concise technical resumes for subcontractors and consultants, if any, are also useful.
- Identify all U.S. permanent residents to be involved in the project as direct employees, subcontractors, or consultants.
- Identify all non-U.S. citizens expected to be involved in the project as direct employees, subcontractors, or consultants. For all non-U.S. citizens, in addition to technical resumes, please provide countries of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project, as appropriate. Additional information may be requested during negotiations in order to verify the foreign citizen's eligibility to participate on a contract issued as a result of this announcement. **Note:** Do not

upload information such as Permanent Resident Cards (Green Cards), birth certificates, Social Security Numbers, or other PII to the DSIP system.

Phase I Statement of Work Outline
NOTE: The DAF uses the work plan outline as the initial draft of the Phase I Statement of Work (SOW). Therefore, **do not include proprietary information in the work plan outline**. To do so will necessitate a request for revision, if selected, and may delay award.

Include a work plan outline in the following format:
Scope: List the effort's major requirements and specifications.
Task Outline: Provide a brief outline of the work to be accomplished during the Phase I effort.
Milestone Schedule
Deliverables
Progress reports
Final report with SF 298

COST VOLUME (VOLUME 3)

Cost information should be provided by completing the Cost Volume in DSIP and including the Cost Volume Itemized Listing specified below. The Cost Volume detail must be adequate to enable Air Force personnel to determine the purpose, necessity and reasonability of each cost element. Provide sufficient information (a.-g. below) regarding funds use. The DSIP Cost Volume and Itemized Cost Volume Information will not count against the specified page limit. The itemized listing also may be submitted in Volume 5 under the "Other" dropdown option.

a. **Direct Cost Materials**: Justify costs for materials, parts, and supplies with an itemized list containing types, quantities, prices and where appropriate, purpose. Material costs may include the costs of such items as raw materials, parts, subassemblies, components, and manufacturing supplies.

b. **Other Direct Costs**: This category includes, but is not limited to, specialized services such as machining, milling, special testing or analysis, and costs incurred in temporarily using specialized equipment. Proposals including leased hardware must include an adequate lease v. purchase justification.

c. **Direct Labor**: Identify key personnel by name, if possible, or by 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.

d. **Travel**: Travel costs must relate to project needs. Break out travel costs by trip, number of travelers, airfare, per diem, lodging, etc. The number of trips required, as well as the destination and purpose of each, should be reflected. Recommend budgeting at least one trip to the Air Force location managing the contract.

e. **Subcontracts**: Involvement of university or other consultants in the project's planning and/or research stages may be appropriate. If so, describe in detail and include information in the Cost Volume. The proposed total of consultant fees, facility lease/usage fees, and other subcontract or purchase agreements may not exceed **one-third of the total contract price** or cost (do not include profit in the calculation), unless otherwise approved in writing by the CO. The SBIR funded work percentage calculation considers both direct and indirect costs after removal of the SBC's proposed profit. Support subcontract costs with copies of executed agreements. The documents must adequately describe the work to be performed. At a minimum, include a Statement of Work (SOW) with a corresponding detailed Cost Volume for each planned subcontract.

f. **Special Tooling, Special Test Equipment, and Material**: The inclusion of equipment and materials will be carefully reviewed relative to need and appropriateness to the work proposed. Special tooling and special test equipment purchases must, in the CO's opinion, be advantageous to the Government and relate directly to the effort. These toolings or equipment should not be of a type that an offeror would otherwise possess in the normal course of business. These may include items such as innovative instrumentation and/or automatic test equipment.

g. **Consultants**: Provide a separate agreement letter for each consultant. The letter should briefly state what service or assistance will be provided, the number of hours required, and the hourly rate.

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

COMPANY COMMERCIALIZATION REPORT (VOLUME 4)

Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR 25.4 BAA for full details on this requirement. Information contained in the CCR will not be considered by the Air Force during proposal evaluations.

SUPPORTING DOCUMENTS VOLUME (VOLUME 5)

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

1. DD Form 2345: For proposals submitted under export-controlled topics, either International Traffic in Arms or Export Administration Regulations (ITAR/EAR), a copy of the certified DD Form 2345, Militarily Critical Technical Data Agreement, or evidence of application submission must be included. The form, instructions, and FAQs may be found at the United States/Canada Joint Certification Program website, http://www.dla.mil/HQ/InformationOperations/Offers/Products/LogisticsApplications/JCP/DD2345Ins tructions.aspx. DD Form 2345 approval will be required if proposal if selected for award.
2. Verification of Eligibility of Small Business Joint Ventures (Attachment 3 to the DOD SBIR 25.4 BAA)
3. Technical Data Rights Assertions (if asserting data rights restrictions)

FRAUD, WASTE AND ABUSE TRAINING (VOLUME 6)

Fraud, Waste and Abuse training material can be found in the Volume 6 section of the proposal submission module in DSIP and must be thoroughly reviewed once per year to proceed with proposal submission.

DISCLOSURES OF FOREIGN AFFILIATIONS OR RELATIONSHIPS TO FOREIGN COUNTRIES (VOLUME 7)

Small business concerns must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission. Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a PDF Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5. For additional details, please refer to the DoD SBIR Program BAA.

Version 2

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

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

AIR FORCE PROPOSAL EVALUATIONS

Proposals will be evaluated for overall merit in accordance with the criteria discussed in the 25.4 BAA. DAF is seeking varying technical/scientific approaches and/or varying and new technologies that would be responsive to the problem statement(s) and area(s) of interest in the topic. Multiple procurements are planned and anticipated to be awarded as a result of the topic, each proposal is considered a separate procurement and will be evaluated on its own merit, and that the Government may award all, some, or none of the proposals. Any per-award or per-topic funding caps are budgetary estimates only, and more or less funding may become available. Funding decisions are made with complete disregard to the other awards under the same topic.

In accordance with 15 USC 638(vv) (Section 4 of the SBIR and STTR Extension Act of 2022), and the Deputy Secretary of Defense Memorandum; Subject: Defense Small Business Innovation Research and Small Business Technology Transfer Due Diligence Program dated May 13, 2024, the DAF will review all proposals submitted in response to this BAA to assess security risks presented by small business concerns seeking a Federally funded award. The DAF will use information provided by the small business concern in response to the Disclosure of Foreign Affiliations or Relationships to Foreign Countries and the proposal to conduct a risk-based due diligence review on the cybersecurity practices, patent analysis, employee analysis, and foreign ownership of a small business concern, including the small business concern and employees of the small business concern to a foreign country, foreign person, foreign affiliation, or foreign entity. The DAF will also assess proposals utilizing open-source analysis and analytical tools, for the nondisclosures of the information set forth in 15 U.S.C. 638(g)(13). If DAF assesses that a small business concern has security risk(s), DAF will review the proposal, the evaluation, and the security risks and may decide not to select the proposal for award based upon a totality of the review.

MAJORITY OWNERSHIP IN PART BY MULTIPLE VENTURE CAPITAL, HEDGE FUND, AND PRIVATE EQUITY FIRMS

Small business concerns that are owned in majority part by multiple venture capital operating companies (VCOCs), hedge funds, or private equity funds are ~~not~~ eligible to submit applications or receive awards for DAF Topics.

PERFORMANCE OF WORK REQUIREMENTS AND LOCATION OF WORK

For Phase I, a minimum of two-thirds of the research or analytical effort must be performed by the Awardee. The DAF measures percentage of work by both direct and indirect costs, not including profit. Occasionally, the DAF will consider deviations from this performance of work requirement. **Requests for Performance of Work deviations must be made twice: prior to submission during the topic open period and as part of the initial proposal submission.** For requests prior to the initial proposal submission, the DAF will consider the request and approve or disapprove requesting applicants to proceed with DSIP submission. Upon proposal receipt, the DAF will again consider such requests for approval for the resultant award.

All R/R&D work must be performed in the United States. Based on a rare and unique circumstance, the DAF may approve a particular portion of the R/R&D work to be performed or obtained in a country outside of the United States. The awarding Funding Agreement officer must approve each specific condition in writing. Applicants seeking this approval must make such a request with their initial proposal submission. The DAF will not consider these requests prior to proposal submission.

DAF USE OF SUPPORT CONTRACTORS

Restrictive notices notwithstanding, proposals may be handled for administrative purposes only, by support contractors. These support contractors may include, but are not limited to TEC Solutions, Inc., APEX, Oasis Systems, Riverside Research, Peerless Technologies, HPC-COM, Mile Two, Montech, Wright Brothers Institute, and MacB (an Alion Company). 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 and Missiles Centers may evaluate proposals. All support contractors are bound by appropriate non-disclosure agreements. Contact the AF SBIR/STTR CO Daniel J. Brewer (Daniel.Brewer.13@us.af.mil) with concerns regarding the use of support contractors.

PROPOSAL STATUS AND FEEDBACK

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

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

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

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

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

DAF SUBMISSION OF FINAL REPORTS

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

PHASE II PROPOSAL SUBMISSIONS

DAF organizations may request Phase II proposals while Phase I technical performance is ongoing or at any time after the conclusion of the period of performance. This decision will be based on the awardee's technical progress, as determined by an DAF Technical Point of Contact review using the Phase II review criteria outlined above.

Phase II is the demonstration of the technology found feasible in Phase I. Only Phase I awardees are eligible to submit a Phase II proposal. All Phase I awardees will be sent a notification with the Phase II proposal submittal date and detailed Phase II proposal preparation instructions. If the physical or email addresses or firm points of contact have changed since submission of the Phase I proposal, correct information shall be sent to the DAF SBIR/STTR One Help Desk. Phase II dollar values, performance periods, and proposal content will be specified in the Phase II request for proposal.

NOTE: The DAF primarily makes SBIR Phase I and II awards as Firm-Fixed-Price contracts. However, awardees are strongly urged to work toward a Defense Contract Audit Agency (DCAA)-approved accounting system. If the company intends to continue work with the DoD, an approved accounting system will allow for competition in a broader array of acquisition opportunities, including award of Cost-Reimbursement types of contracts. Please address questions to the Phase II CO, if selected for award.

All proposals must be submitted electronically via DSIP by the date indicated in the Phase II proposal instructions. Note: Only ONE Phase II proposal may be submitted for each Phase I award.

DAF SBIR/STTR PROGRAM MANAGEMENT IMPROVEMENTS

The DAF reserves the right to modify the Phase II submission requirements. Should the requirements change, all Phase I awardees will be notified. The DAF also reserves the right to change any administrative procedures that will improve management of the DAF SBIR/STTR Program at any time.

Version 2

Air Force SBIR 25.4 Phase I Topic Index
Release 8

Topic Number	Topic Title	Maximum Value*	Maximum Duration (in months)**	Volume 2 Page/Slide Limit***
AF254-0801	AI/ML-Generated Decoy Networks	$140,000.00	6	20
AF254-0802	Thermoplastic Composite Panel Repair & Restoration (TCP R&R)	$140,000.00	6	20
AF254-0803	Vertical β-Ga2O3 device development for extreme environment power converters	$140,000.00	6	20
AF254-0804	Lidar Tomography for Remote Sensing	$140,000.00	6	20
AF254-0805	Direct Digital-to-mm-Wave Data Converter Development and Modeling	$140,000.00	6	20
AF254-0806	Hyperdimensional Computing for Low Size, Weight, and Power Systems	$140,000.00	6	20
AF254-0807	Autonomous Unmanned Aircraft Systems (UAS) Intelligence, Surveillance, Reconnaissance and Targeting (ISR-T)	$140,000.00	6	20
AF254-0808	F-22 ECS/ACFC Robotic Coatings Application test and demonstration	$140,000.00	6	20
AF254-0809	Use of Artificial Intelligence / Machine Learning (AI/ML) Applied to the National Environmental Policy Act (NEPA) Process	$140,000.00	6	20
AF254-0810	Tactics, Techniques, & Procedures (TTP) for Analyzing the Use of Open Source Software (OSS) in Software Development Enclaves	$140,000.00	6	20
AF254-0811	A Cockpit Compatible Eye Tracking System	$140,000.00	6	20
AF254-0812	Novel Sensors for Robotic Non-destructive Inspection in Confined Space	$140,000.00	6	20
AF254-0813	AI-driven Team Manager and Translator (ATMAT)	$140,000.00	6	20

*Proposals in excess of this value will not be considered for award.
**Proposals in excess of this duration will not be considered for award.
***Pages/slides in excess of this number will not be considered during proposal evaluations.

AF254-0801 TITLE: AI/ML-Generated Decoy Networks

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Provide a software application that generates decoy networks that are 1) efficient to employ (maximum automation, minimum manual inputs) and 2) realistic enough to deceive a sophisticated state-sponsored hacker. It is expected that recent advancements in machine learning and artificial intelligence will support this objective.

DESCRIPTION: Defensive Cyber Operations (DCO) across the Air Force and DoD face a daily onslaught of state-sponsored expert hackers. Due to the quantity and sophistication of these adversaries, it is insufficient to rely solely on firewalls, anomaly/intrusion detection software, and human monitors. An additional method of defense is to create decoy networks, often referred to as “honey pots” or “honey nets” (in the case of multiple connected decoy networks). These decoys are intended to lure adversaries into wasting time and exposing their tactics, techniques, and procedures (TTPs) in a simulated environment where they can do no harm. While promising, past attempts to create decoy networks have been overly burdensome to create and largely ineffective against expert hackers because they are too easy to identify as fake. Air Force CyberWorx, 16th Air Force, and Air Combat Command are highly interested in novel approaches to create more realistic “digital twin” decoy networks that are dynamic. These networks need to accurately simulate users, infrastructure, data, and data flows. It is believed that emerging work in artificial intelligence, machine learning, expert systems, virtualization, and block chain technologies could dramatically improve realism and assist in counter measures. Proposed solutions could be trained on live networks to mirror characteristics and behaviors then apply algorithms to create the decoy and dynamically change like real networks would and adapt to threat behavior. Additional training of the algorithms could be provided by expert “white hat” cyber operators to improve fidelity. The system should detect, distract, and track the adversary and report activity to authorized defensive cyber operators. Decoy modifications or actions against the threat in real time should be selectable as automated, semi-automated, and/or manual.

PHASE I: Provide a feasibility study that evaluates potential AI/ML or other similar methodologies and recommend an approach to implement these methodologies in a user-friendly software application that allows defensive cyber operators to generate and manage realistic, dynamic decoy networks and track hacker activity in real-time without the hacker knowing they are being watched or manipulated.

PHASE II: Provide a prototype software application that allows defensive cyber operators to generate and manage realistic, dynamic decoy networks and track hacker activity in real-time without the hacker knowing they are being watched or manipulated. Demonstrate the prototype in a realistic development "sand box" environment (TRL 6 maturity).

PHASE III DUAL USE APPLICATIONS: Advance from a TRL 6 lab tested prototype to a TRL 9 product in an operational environment. This will require a Risk Management Framework and Authority to Operate approval with assistance from Air Force CyberWorx and the 67th Cyberspace Wing. Once proven effective, this technology is expected to have applications throughout DoD, USG, and commercial markets.

REFERENCES:

1. Sun, Kim. "Design and Implementation of Decoy Enhanced Dynamic Virtualized Networks." Final Technical Report. Grant #N00014-15-1-2396. 12/12/2016;
2. Dougherty, Jeffrey T. "Evasion of Honeypot Detection Mechanisms Through Improved Interactivity of ICS-SCADA Systems." Technical Report. Naval Post Graduate School. Sept 2020;
3. Chong, Wai H. and Koh, Chong K. "Learning Cyberattack Patterns with Active Honeypots." Technical Report. Naval Post Graduate School. 8/1/2018.

KEYWORDS: Honey pot; honey net; decoy networks; artificial intelligence; machine learning; AI/ML

AF254-0802 TITLE: Thermoplastic Composite Panel Repair & Restoration (TCP R&R)

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The goal of this R&D effort is to develop an understanding of 1) what types of damage can be incurred in TPC panels, representative of aerospace structures, 2) what types of repairs are possible by leveraging the recyclability/reformability of TPCs, and 3) what types of repairs are best for a given damage scenario enabling restoration of the TPC panel to original strength. A final capstone objective would be to demonstrate a repair of a damaged TPC panel and validate the restoration of its strength through testing. This processing technology would then be repeatable for other types of repairs and integrated with a hand held device or robot arm for transition.

DESCRIPTION: Thermoplastic composites (TPCs) are impact resistant, light weight and strong. Unlike thermoset composites (TSC), traditionally used for aero structures, they do not require intensive, time consuming bagging and autoclaving. TPCs can be consolidated (no curing required) out of autoclave and can be stamp formed and welded, further differentiating them from TSCs. In order to meet the demand for high rate, low-cost structures to support CCAs and AAM vehicles, high-rate manufacturing processes are needed; TPCs are the leading candidate material because they can be processed and consolidated by these faster manufacturing techniques.

TPCs are also fundamentally different than TSCs, in that they can be remelted and recrystallized repeatedly. While this trait is leveraged to enable welding, it could also be exploited to enable rapid repair. If a crack forms in a TPC panel, due to air battle damage or manufacturing error for instance, TPCs can conceivably be re-melted and re-solidified to enable a fast repair in depot or in forward positions. Repair could be in the form of a reinforcing patch welded over the crack or in the form of material being melted inside the crack for filling and closing.

For Phase I, types of representative damage will be identified and simulated in TPC panels (such as surface cracks, through cracks, holes). This will be followed by identifying and designing proposed repairs leveraging the inherent properties of the TPC resin. Proof of concept of a down selected repair option will be demonstrated in the laboratory.

Phase II activities could include demonstrating other repair types and mechanical testing of the repaired panel as compared to baseline pristine TPC panels. Increasing the scalability and rate of repair would be a focus of Phase II. Final objectives would be tailoring the repair equipment for integration into robotic arms for automated repair and/or miniaturization of the repair equipment to a hand-held form factor with simple operating rules.

Technical goals for Phase 1 to achieve the final objective would be 1.1) classifications and simulation of types of TPC damage, 1.2) a menu of possible repair options identified for each type of damage, 1.3) successful laboratory scale demonstration of a down selected repair type. Phase II technical goals would be 2.1) large scale implementation of the repair and 2.2) validation of the repair as measured by mechanical testing of repaired panels as compared to the baseline and 2.3)integration of the technology to a robotic arm or a hand-held device for simple manual operation.

PHASE I: Phase I period of performance objectives and expectations include 1) identification and classification of types of damage that can be incurred by TPC panels either through manufacturing or air battle damage, 2) proposal and design of possible repairs, including the equipment to be use and materials, 3) down selection of an example of damage with it's appropriate repair, 4) proof of concept at the laboratory scale that the repair can be implemented with the damaged panel.

PHASE II: The final Phase II objectives/expectations are as follows: 1) the rapid identification of type/class of TPC panel damage and the needed repair, 2) repair equipment that is miniaturized sufficiently to be adapted to a hand-held or robot arm mounted form factor, 3) implementation of a repair that is then 4) validated by mechanical testing of the panel as compared to the baseline, a pristine panel. This process ought to be repeatable for another type of damage/repair scenario as identified in Phase I studies. Finally, areas of improvement will be identified to increase rate/speed of repair process.

PHASE III DUAL USE APPLICATIONS: The Phase III effort will involve transitioning the technology to MQ-25 PEO in NAVAIR which is developing a thermoplastic chine for LRIP phase 3 or to DAF CCA PEO which is looking into thermoplastic components for the future. Also, Boeing and DAF are collaborating to develop a land based variant of the MQ-25.

REFERENCES:

1. F. Ozturk, M. Cobanoglu, and R. E. Ece, "Recent Advancements in Thermoplastic Composite Materials in Aerospace Industry." Journal of Thermoplastic Composite Materials, vol. 37, issue 9, pg. 3084-3116, 2024.
2. S. D'Urso "Boeing Unveils MQ-25's Land-Based Variant" Published online 16 Sep 2024, accessed 7 Nov 2024 online, in The Aviationist <https://theaviationist.com/2024/09/16/boeing-unveils-mq-25s-land-based-variant/>

KEYWORDS: thermoplastic composites; composites; thermoplastics; thermoplastic welding; polymer fractures; thermoplastic resins; carbon fiber reinforced polymers;

AF254-0803 TITLE: Vertical β-Ga_2O_3 device development for extreme environment power converters

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective is to develop extreme environment compatible power converters that use vertical field-effect transistors developed using Ultra-Wide Band Gap (UWBG) material β-Ga_2O_3. Fabrication devices with multi-kilo-volt breakdown voltage made on 4″ wafers with high uniformity, radiation hardness, and > 300 C temperature compatibility such that the devices enable extreme environment envelop tracking in radio frequency (RF) amplifiers, pulsed RF communication, and pulsed laser diode applications will be the goal of this SBIR.

DESCRIPTION: Radiation-tolerant and high temperature compatible point-of-load (POL) converters are required for Low Earth Orbit (LEO) and hypersonic applications. In current applications, operating voltage of POL converter is significantly derated to reduce single event burnout (SEB) failure. Systems are also designed to reduce the thermal budget for devices by using thermal insulation, active cooling, or by placing devices in low temperature locations. Commercial radiation-hard POL converters are compatible for operation at temperatures significantly below 200 C and are made with low bandgap materials such as Si that can withstand a small breakdown electric field. In comparison, devices made with wider bandgap materials such as Silicon Carbide (SiC), Gallium Nitride (GaN), Gallium Oxide (β-Ga_2O_3) are expected to have better radiation hardness [1] and higher temperature compatibility [2] compared to Si and therefore are considered for space and defense systems. Wide or Ultra-Wide bandgap-based power converters (compared to smaller bandgap devices) also offer significant SWaP (Size, Weight and Power) advantage for LEO applications.
This SBIR requires performers to develop radiation-hard POL converters operating at high voltages and temperatures and responding to MHz input excitation are critical for enabling envelope tracking in RF amplifiers, pulsed RF communication, and pulsed laser diodes. These devices need to have the ability to block high voltages in their OFF state, while operating at a high current and low voltage in ON state – therefore, do not have the self-heating (or thermal conductivity) concerns when the system/package is appropriately designed [3]. High critical field strength (Ecrit), high operating temperature, radiation hardness available in UWBG materials are therefore key material's parameters for designing extreme environment POL converters. Among UWBG family, only β-Ga_2O_3 has shallow dopants and can be grown from melt at diameters up to 6 inches. Devices made with β-Ga_2O_3, therefore, offer the potential for a cost-effective, wafer-scale prototyping solution [4]. Lateral devices have already been made using β-Ga_2O_3 in wafer scale, which are relevant for monolithic integration of β-Ga_2O_3 devices in an electronic system. Vertical devices are however preferable for POL converters operated at high current using a smaller footprint as required for the RF applications mentioned above [5-7]. The processing and device fabrication of vertical devices however will require materials and engineering solutions, in terms of large-scale epitaxial growth, controlled ion implantation and etching, high-quality dielectric integration, etc. Characterization of these devices will also require access to radiation and high temperature test facilities available in DoD laboratories and FFRDCs (Federally Funded Research and Development Centers).

The performers are recommended to address the regulatory and legal challenges associated with SBIR, provide a comprehensive timeline, and outline a detailed transition and commercialization plan. The performers are also recommended to specify technology readiness levels (TRLs) at the beginning and end of different phases. Appropriate TRL identification will ensure feasibility within the Phase I scope, enhancing credibility and potential for successful implementation in space and hypersonic applications.

PHASE I: Under the Phase I effort, the selected performers will demonstrate the capability to fabricate vertical β-Ga_2O_3 transistors and Schottky-barrier diodes (SBDs) in a facility. The performers will also study the extreme environment compatibility of their devices and offer potential solutions. These solutions will address all aspects of vertical device fabrication challenges needed to fabricate a multi-kV, low-loss, high pulsating current device with low specific on resistance equivalent to or better than that of similarly rated commercial devices. The projected device performance can be supported with a technology computer-aided design (TCAD) of the device exposed to radiation.

PHASE II: Eligibility for direct to Phase II (D2P2) is predicated on the performer having accomplished a Phase I-like effort predominantly separate from the SBIR Programs. Under the phase II effort, the performer shall sufficiently develop the technical approach, or process to conduct a 4-inch wafer-scale device demonstration and characterize them in extreme environments. Identification of manufacturing/production issues and or business model modifications required to further improve the process and device performance should be documented. These Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution.

PHASE III DUAL USE APPLICATIONS: The performer will demonstrate multi-kV, high-speed, radiation hard, and > 300 C compatible power converter by integrating vertical transistors and SBDs made with β-Ga_2O_3. The converter shall have power-loss comparable to a similarly rated SiC based converter. The performer may 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 (at AFRL/RQQE and AFRL/RYD) and alternate mission applications. Direct access with end users and government customers (requiring multi-kV converters) 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.

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7. Asbeck, et al., "ET Comes of Age: Envelope Tracking for Higher-Efficiency Power Amplifiers," in IEEE Microwave Magazine, pp. 16-25, 2016.

KEYWORDS: β-Ga2O3; radiation-hard; high temperature; vertical devices; envelop tracking; pulse power RF; converter.

AF254-0804 TITLE: Lidar Tomography for Remote Sensing

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a sensor design that implements a tomographic lidar capable of translating multiple high resolution range measurements from a diversity of look-angles into imagery of remote objects from a moving platform. The lidar sensor system should be capable of <7.5 cm effective range resolution along a single dimension and include computer processor algorithms that can take multiple of these range projections over an angular range of >30 degrees and output a single, high-resolution 2D image of an object.

DESCRIPTION: Lidar tomography is a form of reflective tomography that measures laser light reflected off remote objects and reconstructs an image from multiple projected samples of a scene [1]. Lidar systems can provide high-accuracy, range resolved measurements of objects using either time-of-flight measurements or frequency modulated continuous wave (FMCW) measurements. The lidar tomography approaches shares many similarities to those implemented in the commonly used Computed Tomography (CT) scans for medical imaging [2] as well as synthetic aperture radar (SAR) [3]. Some advantages of this approach are that it overcomes several of the traditional limits of optical remote sensing, such as optical diffraction, geometric aberrations, and atmospheric turbulence, through a technique of incoherent aperture synthesis. The goal of this effort is to design and implement a basic prototype of a remote sensing lidar tomography system that uses active illumination from a laser to perform high resolution range measurements of an object. The lidar sensor can be assumed to be on a moving platform such that over time it can take multiple 1D projections of the object over a diversity of angles spanning a range of 30 degrees or more. A 2D range-cross range image can then be reconstructed from this series of 1D measurements using a back-projection type algorithm, for example.
With recent improvements in timing resolution from technologies such as superconducting nanowire single photon detectors (SNSPDs) [4], up-conversion single-photon detectors [5], and single-photon avalanche photodiodes (APDs) in the form of Geiger Mode APD (GmAPD) technology [6], there are several prospects for generating high timing resolution of optical pulses better than 500 ps. The use of novel components such as integrated photonics, electro-optical crystals, or other photonic technologies to increase the effective timing resolution of the lidar system is also encouraged. Photon counting approaches may also offer a way to extend the overall sensor range and increase the detection SNR. The tomographic lidar should use a laser transmitter with a wavelength in the near-infrared (NIR) spectrum of roughly 780 nm – 2500 nm. The proposed solution should also consider algorithms to form high resolution imagery from the measured tomography data.

PHASE I: In this initial phase, tomographic lidar sensor concepts will be developed, evaluated, and computer modeled. Design challenges and trade-offs for an airborne or spaceborne payload will be tabulated and areas in need of additional R&D will be identified. Critical factors to consider are the sensor range resolution, laser power, overall system SWAP, and innovative image reconstruction algorithms that account for platform motion. A feasibility study will be conducted in consultation with relevant stakeholders to develop a significant concept of operations (CONOPS). Preliminary designs should be developed for Phase II which will be assessed based on scientific merit and technical readiness levels.

PHASE II: A prototype tomographic lidar will be constructed and tested against key performance metrics. Testing can use a combination of calibrated test targets and 3D objects on rotating platforms to simulate the motion of the sensor. A detailed design for a packaged prototype system will be developed and key components tested. The design and performance will be assess relating to the preparedness of the proposed technology for further development, transition, commercialization, and integration with Space Force operations. Preliminary designs will be made for a Phase III system.

PHASE III DUAL USE APPLICATIONS: A breadboard version of the design will be built and tomographic lidar measurements taken in a simulated environment that will test and validate the design to a Technology Readiness Level (TRL-5) for a space payload. The proposed manufacturing process will be evaluated and refined to improve yield while reducing cost.

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5. B. Wang, M.-Y. Zheng, J.-J. Han, X. Huang and X.-P. Xie, "Non-Line-of-Sight Imaging with Picosecond Temporal Resolution," Physical Review Letters, vol. 127, no. 5, p. 053602, 2021;
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KEYWORDS: lidar; tomography; avalanche photodiodes; remote sensing; infrared

AF254-0805 TITLE: Direct Digital-to-mm-Wave Data Converter Development and Modeling

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: This topic seeks the development of advanced architectures for fully integrated Digital-to-mm-Wave Digital-to-Analog Converters (DACs) and Analog-to-Digital Converters (ADCs) for use in direct-RF beamforming transceivers (TRX). These advancements would have significant impact in the performance of DoD airborne and spaceborne sensing, electronic warfare capability, and communications effectiveness. This DAC and ADC development will be accompanied by the creation of corresponding cross-domain functional models which enable a high-fidelity system-level simulation of multiple TRXs channels, supporting rapid analysis of benefit, system integration planning, and insertion into identified DoD systems.

DESCRIPTION: Element-level digital beamforming has shown significant reduction in size, weight, and mechanical complexity when compared with traditional analog or digital sub-array architectures. In these element-level radar and EW systems, analog manifolds, RF receiver-exciters, and analog phase shifting are replaced with high-bandwidth data converters followed by high-throughput digital processing [1]. This shift has improved the agility and adaptability of phased array systems [2]; however, data converter performance is a limiting factors in element-level beamforming. Data converters with high instantaneous bandwidth (>4 GHz), millimeter wave (mmWave) signal acquisition (up to 45 GHz), low transceiver power (<400 mW per transceiver channel), high resolution (>6.5 Effective Number of Bits), and high linearity (>65 dB Spurious Free Dynamic Range) are needed for future airborne, spaceborne, low power, and attritable applications. To meet these performance challenges in a mixed-signal transceiver block, both the Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) will require novel methods of up-conversion, calibration, element-level synchronization, low power data processing, and other improvements to current data converter architectures. In addition to the design of a direct Digital-to-mm-Wave ADC and DAC, the development of high-fidelity cross-domain models for the data converters is also required. Such models will provide visibility into the digital hardware, analog/RF hardware, and the software needed to integrate advanced mmWave data converters and will support architectural trade-offs and performance simulations at the system level (e.g. element synchronization, multi-element beamforming, agile spectrum allocation, etc.), enabling the rapid and virtual integration and prototyping of mmWave transceivers.

PHASE I: In this initial phase, the DAC and ADC architectures will be explored, the fabrication technology selected, and simulations using current mix-signal design best-practices will be conducted. These simulations will demonstrate the ability of the converter architectures to meet the design specifications laid out in the description. From this exploration, design trade-offs and technical risks will be documented, circuit architectures and design strategies will be established, and cost/schedule estimates for Phase II will be outlined. Additionally, the digital-engineering strategy for the DAC and ADC cross-domain functional models will be established to support future virtual integration and prototyping efforts. in Phase II.

PHASE II: Under Phase II, the full design of the DAC and ADC will be completed; layouts will be finalized and submitted for fabrication. During the fabrication process, the cross-domain functional models will be developed, demonstrating both close comparison to the mixed-signal simulations and scalability for full-system modeling and architecture evaluation. Upon receipt of the manufactured prototype, initial testing will be used to confirm part yield, general functionality, and initial specification compliance.

PHASE III DUAL USE APPLICATIONS: The awardee(s) will fully test the prototype fabricated in Phase II, demonstrating the capability of the DAC and ADC against the desired specifications and feasibility for potential transition. The test results will be compared to the prefabrication simulations and reported with discrepancies addressed. Additionally, the results will be used to baseline the cross-domain functional model to be used in future system development efforts. The DAC and ADC will be refined with feedback from testing, and the design will be prepared for higher rate fabrication. Commercialization of this technology for transition to government and civilian use is encouraged at this phase and access to potential users and applications will be provided. Opportunities for Phase III awards for additional research, capability development, services, or direct procurement of IP will be possible.

REFERENCES:
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2. P. K. Bailleul, "A New Era in Elemental Digital Beamforming for Spaceborne Communications Phased Arrays," in Proceedings of the IEEE, vol. 104, no. 3, pp. 623-632, March 2016

KEYWORDS: Data Converters; Digital-to-mm-Wave; Beamforming, Analog-to-Digital Converter; Digital-to-Analog Converter; Cross-Domain Modeling; Real Number Modeling; Phased Array; Microelectronics Digital Twins

AF254-0806 TITLE: Hyperdimensional Computing for Low Size, Weight, and Power Systems

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

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OBJECTIVE: Develop a unified hyperdimensional framework for integrating and optimizing the performance of heterogeneous artificial neural network (ANN) architectures to enable development of modular machine learning solutions.

DESCRIPTION: Work on this topic should consider at least one of the following research areas.
1) Hyperdimensional Computing (HDC) Integration: Investigate and develop methods for seamlessly integrating diverse ANN architectures, such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep reinforcement learning (DRL) networks, into a single hyperdimensional processing pipeline.
2) Optimization and Resource Allocation: Research and develop optimization techniques that allow for dynamic resource allocation among the integrated ANNs, considering factors such as the computational requirements, data availability, and available resources.
3) Domain Adaptation and Transfer Learning: Explore how HDC can facilitate domain adaptation and transfer learning across different ANN architectures, ensuring that the unified framework remains flexible and adaptable to various DoD security applications and datasets.
4) Robustness and Fault Tolerance: Develop methods for integrating ANNs that provide inherent robustness and fault tolerance against noisy or incomplete data.
5) Energy Efficiency and Scalability: Optimize the integrated HDC framework for both energy efficiency and scalability, considering size, weight, and power (SWaP) constrained military platforms and applications that require processing large volumes of data.
6) Demonstration and Evaluation: Demonstrate the effectiveness of the unified HDC framework through evaluation on standard AI datasets, as well as custom experimentation tailored to DoD applications.

PHASE I: Phase I awardee(s) will experiment with and assess feasibility of different approaches to implementing and optimizing hyperdimensional computing techniques for specific applications such as pattern recognition, sensor fusion, and information retrieval tasks. In support of this, awardee(s) will obtain baseline performance metrics, such as (but not limited to) accuracy, computational efficiency, robustness to noise, and scalability to evaluate the potential benefits of hyperdimensional computing over traditional methods. Based on these results, awardee(s) will identify and prioritize the most promising approaches for further development in Phase II, with the goal of advancing the state-of-the-art in hyperdimensional computing and creating new opportunities for practical applications.

PHASE II: During Phase II, the awardee(s) will demonstration a prototype of a heterogenous machine learning system with an HDC backbone. Such demonstrable capabilities include can include (but are not limited to) efficient encoding and decoding, accuracy, computational efficiency, robustness to noise, and scalability. Prototype may involve integrating hardware and software components, such as specialized processors, memory systems, and software frameworks, to create a complete end-to-end solution. Lastly, awardees will identifying potential commercial applications.

PHASE III DUAL USE APPLICATIONS: In Phase III, performers should expand ML capability demonstrations of heterogenous sensors on a single ML agent to orchestration of and/or collaboration with multiple agents via HDC as a shared information representation. The proposed technology is expected to start at TRL 5-6, concluding with a TRL 7 demonstration in a mission relevant environment, e.g. air, space, or ground.
HDC stands to make artificial neural networks more human-interpretable and therefore lower the technical barrier to model adaptation by non-experts. Generally speaking, AI/ML as a data processing tool is considered a dual-use technology, since both industry and the AF desire ML solutions demonstrating high task performance, e.g. classification accuracy, from minimal training data. However, an SBIR is an appropriate vehicle to fund this type of research and development since the AF specifically has size, weight, and power (SWaP) restrictions not found in industry generally. HDC not only augments performance capabilities of artificial neural networks, it also drastically reduces the algorithmic resource requirements, making it suitable for ultra-low SWaP AF assets, e.g. UAVs and CubeSats.

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2. Kleyko, Denis, Dmitri Rachkovskij, Evgeny Osipov, and Abbas Rahimi. "A survey on hyperdimensional computing aka vector symbolic architectures, part ii: Applications, cognitive models, and challenges." ACM Computing Surveys 55, no. 9 (2023): 1-52.

KEYWORDS: hyperdimensional computing; vector symbolic architectures; holographic reduced representations; binary spatter codes; symbolic reasoning; edge processing; computational neuroscience; cognitive architectures; artificial neural networks; fusion

AF254-0807 TITLE: Autonomous Unmanned Aircraft Systems (UAS) Intelligence, Surveillance, Reconnaissance and Targeting (ISR-T)

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

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OBJECTIVE: The USAF is actively seeking a low Size, Weight, and Power (SWaP) solution for a group 2 or 3 UAS to conduct Intelligence, Surveillance, Reconnaissance and Targeting (ISR-T) in highly congested and contested operational environments. The low-SWaP solution should allow the UAS to autonomously acquire and track specific ground targets using EO/IR video and RF sensors. The UAS will conduct its mission and exit the area with limited or no communications while being jammed or spoofed. To avoid detection, the ground targets may employ Camouflage, Concealment, and Deception (CCD) or may hide among many other vehicles (e.g., a parking lot) [1]. Alternatively, to increase tracking difficulty, the ground targets may attempt evasive motion and/or high-speed turns.

DESCRIPTION: Modern UAS designs can operate autonomously, avoiding collisions with other UAS, buildings, and terrain using low power/short-range sensors. A ground target attempting to evade the UAS may use occlusions (tunnels, bridges, foliage, parking garage etc.) to temporarily hide from the surveillance. Through the combination of a gimballed camera system and high camera frame rate, the UAS can detect a partially hidden target, track a ground target robustly through aggressive maneuvers, and also recognize a particular target vehicle when surrounded by many similar vehicles.
A group 2 or 3 UAS can autonomously search an area using a flight pattern at low altitude for camouflaged or concealed ground targets without GPS, command and control (C2), or video signals (so that it cannot be jammed or spoofed) [2, 3]. To accomplish this task, the numbers of pixels per target must be sufficient for the Automated Target Recognition (ATR) algorithms despite blur [4]. The UAS may initially detect a concealed ground vehicle using an RF signal (e.g., communications, radar, or unintentional).

PHASE I: Implement the EO/IR and RF signal processing, flight optimization, and target detection/tracking algorithms via real-time software. Demonstrate queuing and tracking detections in realistic, high-fidelity coupled EO/IR and RF simulations. The RF simulations must incorporate site-specific scattering and multipath [5]. Transfer sections of the real-time software to a low-SWaP processing solution. Validate performance of the processing algorithms and low-SWaP hardware in terms of tracking accuracy and power consumption for simulated flight tests in realistic environments.

PHASE II: In development flight tests, demonstrate autonomous single or cooperative UAS swarm detection of ground vehicle classes using RF signals of opportunity and/or EO/IR video. Establish tracking performance for specific ground vehicles through aggressive maneuvers, temporary occlusions, and CCD. UAS will approach vehicles from behind to avoid detection. UAS will not utilize GPS or C2 signals in contested areas.

PHASE III DUAL USE APPLICATIONS: The proposer will work with the Air Force to identify military platforms that could benefit from this technology and develop plans for integration.
Commercial applications of UASs are growing significantly year over year. Law enforcement, prison protection, entertainment, package delivery in challenging environments, etc. In many of these applications, there is a need for a UAS to detect, ID and track a variety of objects such as ground vehicles and even people, etc. The proposed topic will contribute directly to these commercial dual use applications.

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1. R. Visina, Y. Bar-Shalom, and P. Willett, "Multiple-model estimators for tracking sharply maneuvering ground targets," IEEE Transactions on Aerospace and Electronic Systems, vol. 54, no. 3, pp. 1404-1414, 2018.
2. C. Wang, J. Wang, X. Zhang, and X. Zhang, "Autonomous navigation of UAV in large-scale unknown complex environment with deep reinforcement learning," in 2017 IEEE Global Conference on Signal and Information Processing (GlobalSIP), 2017, pp. 858-862: Ieee.
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4. T.-Y. Lin, P. Goyal, R. Girshick, K. He, and P. Dollár, "Focal loss for dense object detection," in Proceedings of the IEEE international conference on computer vision, 2017, pp. 2980-2988.
5. S. Gogineni et al., "High fidelity RF clutter modeling and simulation," IEEE Aerospace and Electronic Systems Magazine, vol. 37, no. 11, pp. 24-43, 2022.

KEYWORDS: Target Tracking; Sensor Fusion; Automated Target Recognition (ATR); GPS-Denied Environments; Flight Optimization; Deep Learning Neural Network; Neuromorphic Computing

Version 2

AF254-0808 TITLE: F-22 ECS/ACFC Robotic Coatings Application test and demonstration

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Materials; Human-Machine Interfaces; Advanced Infrastructure & Advanced Manufacturing

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OBJECTIVE: Robotic coatings application to F-22 ECS/ACFC.

DESCRIPTION: Coating application to the F-22 ECS/ACFC could be substantially improved through robotics/automation. This program would like to develop a new coating application robot capable of navigating small, unique shaped ducts. Utilizing robotics for coatings will reduce coating application time, rework rate, and improve aircraft performance. They will also allow for technician labor to be re-tasked to other processes as well as having substantial cost savings. Currently, coating applications are difficult for technicians due to the small space constraint. Many technicians are unable to complete the work without the use of specialized tools that are not ideal. Robotic coatings application could also be used to keep jets in the field longer.

PHASE I: Past efforts have proven robotic coatings application can be done. This project would expand that technology to include application in the small and unique geometry of the ECS/ACFC.

PHASE II: This project would use past development to design a system that can apply coatings in a small space and very close to the surface. It will also need to navigate the unique geometry of the ECS/ACFC. A prototype system would need to be delivered to show the capability of reach and coatings application.

PHASE III DUAL USE APPLICATIONS: If successful it is expected that phase 3 would be to procure multiple coating application robots for the F-22's at the depot and at operating bases. At phase 3 it is expected to be TRL 8 proven for F-22 with proven production operating parameters.

REFERENCES:

1. Lockheed Martin Process Specification 5PTPTL30

KEYWORDS: Robotic; Coating Application; Robot

AF254-0809 TITLE: Use of Artificial Intelligence / Machine Learning (AI/ML) Applied to the National Environmental Policy Act (NEPA) Process

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Development of AI/ML software that can facilitate the NEPA Process

DESCRIPTION: The National Environmental Policy Act (NEPA) is the law that applies to all federal agencies when proposing an action that has a potential to affect the environment. According to the Council on Environmental Quality (CEQ) there are appropriately 40-50 thousand Environmental Assessments (EAs) and 300-500 Environmental Impact Statements (EISs) done each year. Each EA cost approximately $100,000-$500,000 and each EIS approximately 1-3 million dollars. In the Air Force (AF) these documents have been historically done by contractors that specialize in environmental analysis with review and approval by AF personnel. Edwards AFB is currently performing 3 EAs costing over $400,000.
The NEPA mandates the evaluation of the environment against the relevant laws and as they apply to the proposed action. This evaluation against all relevant federal, state, and local laws and regulations is reviewed by the courts for adequacy. The AI/ML process should identify the relevant facts about the proposed action, screen them against the NEPA requirements, identify the environmental facts relevant to the action and briefly summarize all these factors to determine the level of analysis. While the NEPA CEQ Regulations apply to all US states and territories, NEPA impact analysis is very site-specific requiring extensive use of local environmental documents.
The use of AI/ML in the NEPA process to screen, summarize, simplify to plain language, determine level of documentation needed and ultimately NEPA compliance determining if documentation is adequate/inadequate and summarize may significantly shorten the time required while increase the quality of analysis. For example, the ability to analyzing a large number (several thousand) of public comments, organizing, combining like comments, a task that currently takes several individuals typically weeks, could be done by the system in a few minutes. While most AI/ML systems use the internet as the data source, this is not expected to work for the NEPA process which is a law and fact-based process. The AI/ML system should use only the government provided data to include all the NEPA requirements, summary of NEPA compliance interruption, as well as all the Edwards AFB environmental data to be analyzed in a “confine sand box” (using only the CEQ requirements and Edwards AFB specific data). The intent is to limit or eliminate “hallucinations” (i.e. having conclusionary statements) common to most AI/ML systems, summarize and answer questions about resource areas and the proposed action, and analyze impacts, while preforming the task exponentially faster and resulting in much reduced cost.

PHASE I: Research in this phase should focus on screening and reviewing with summarization of documents and provide a prove of concept

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PHASE II: Should be focused on system development, design and prototyping to identify issues, data gaps and intensity of impacts. From the government provided data, develop a working, comprehensive review/summary of the proposed action.

PHASE III DUAL USE APPLICATIONS: Military Application: All Military bases in the US and territories are required by the NEPA to analyze proposed actions effect on the environment. The AI/ML systems should provide all the analysis of a proposed action to support an informed decision by the decision-makers. Historically, these actions have been done by “boots on the ground” environmental professionals which are expensive and have historically difficult to find.

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4. U.S. Army, (2007) NEPA Analysis Guidance Manual

KEYWORDS: NEPA, CEQ Regulations, Resource Areas, Action impacts, answer questions, Scoping, Public Involvement

AF254-0810 TITLE: Tactics, Techniques, & Procedures (TTP) for Analyzing the Use of Open Source Software (OSS) in Software Development Enclaves

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software; Integrated Sensing and Cyber; Sustainment & Logistics; Emerging Threat Reduction

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To develop tactics, techniques, & procedures (TTP) for analyzing the use of Open Source Software (OSS) in software development enclaves

DESCRIPTION: This effort shall provide a comprehensive analysis of the OSS risk that software development enclaves face. During the Risk Management Framework (RMF) authorization process, it is necessary to determine if the system architecture will enable a credible basis for secure operation. The result of this work will be OSS Analysis Tactics Techniques & Procedures (TTP) that can be applied across all of the AFSC Software Enterprise (SWENT) and related systems.
Open Source Software (OSS) is community-developed software distributed with its source code, making it available for use, modification, and distribution with its original rights. OSS provides common solution elements that accelerate software development cycles and reduce costs; however, doing so in this manner also creates risk. At its inception, developers embraced open access and transparency associated with community-based development to improve code reliability. Now, threat actors exploit community-based development to embed security vulnerabilities into software leveraged in widely-used commercial and government solutions. Depending on the solution criticality, rogue execution paths and other vulnerabilities can affect national security.
A repeatable documented methodology would allow cybersecurity personnel to determine if a system architecture and its use of OSS will enable a credible basis for secure operation. Increased scrutiny of OSS is required under the Zero Trust (ZT) mandates. This aligns to DoD ZT capability 3.3, Software Risk Management. Furthermore, the new NIST SP 800-53 Rev 5 controls include CM-10(1), which specifies the need for analysis of OSS software.

PHASE I: Research and evaluate the subject concern, producing feasibility documentation of the same. Render a proof of concept for how the stated goal of Tactics, Techniques, & Procedures (TTP) for Analyzing the Use of Open Source Software (OSS) in Software Development Enclaves may be developed and realized in relevant environment.

PHASE II: Develop technology for Tactics, Techniques, & Procedures (TTP) for Analyzing the Use of Open Source Software (OSS) in Software Development Enclaves. The development here should provide a detailed, comprehensive, accurate TTP that allows cybersecurity personnel to determine if a system architecture and its use of OSS would enable a credible basis for secure operation.

PHASE III DUAL USE APPLICATIONS: If Phase II is successful, the Air Force and other government agencies will work with the company to transition and implement the technology wherever net present value of the same proves to be profitable and practicable.

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2. NIST SP 800-53 Rev. 5 - Security and Privacy Controls for Information Systems and Organizations - https://csrc.nist.gov/pubs/sp/800/53/r5/upd1/final
3. IST SP 800-204D - Strategies for the Integration of Software Supply Chain Security in DevSecOps CI/CD Pipelines - https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-204D.pdf
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KEYWORDS: Zero Trust, Open Source Software, Device Security, Software Risk Management, Risk Management Framework, Software Supply Chain Security

AF254-0811 TITLE: A Cockpit Compatible Eye Tracking System

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop an eye-tracking system for pilots capable of integrating with Air Force airframes during training and military operations. Such a system should be capable of monitoring pilot eye gaze dynamics, saccades, and pupil physiology in real-time/semi-real time via hardware that meets all airworthiness standards, per MIL-HDBK-516. for integration into military aircraft.

DESCRIPTION: Recent efforts in the Air Force have emphasized measuring and modeling of the human operator's functional and cognitive status during military aviation, in order to drive human performance enhancement and gain a decisive advantage in the future fight. Psychophysiological methods – including technology to monitor changes in human physiological variables that correlate with psychological states – are widely used to monitor an individual's functional status and to infer internal cognition. Extensive work in academia, medicine, and military research labs has demonstrated the promise of monitoring the human operator via robust field-deployable biosensors (e.g., using neural activity, heart rate, pupil dilation) to infer an individual's cognitive state in real-time/semi-real time (Chakladar & Roy, 2024; Charles & Nixon, 2019; Wilbanks et al., 2021). However, state-of-the-art sensor technologies in several biosensing modalities are unsuitable for sustained operational use during military aviation (e.g., electroencephalogram, EEG). Further, physiological sensing modalities achievable during flight (e.g., heart rate, respiration, skin conductance) often do not covary with cognition at the "speed of thought," lacking the temporal variability required for high frequency, real-time decoding of internal cognitive states. Measuring and decoding cognitive states during military operations in real-time and in the cockpit will require technology for inferring large-scale patterns of central nervous system (CNS) activity, motivating development of high-quality systems for field-deployable eye tracking. As the adage goes, the eyes are a window to the mind. Ample evidence suggests that eye and pupil parameters vary at the "speed of thought" and are highly correlated with various cognitive states: ranging from arousal, attention, working-memory, cognitive control, and relational long-term memory (Mahanama et al., 2022). State-of-the-art eye tracking systems (both wearable and off-body) have begun to transition this technology to automotive (Said, et al., 2018), gaming (Zhang et al., 2024), healthcare (Liu et al., 2021), and educational settings (Strohmaier et al., 2020). Current software and hardware limitations for such systems can include the need for operator setup and (re)calibration, the impact of head and body motion on signal quality, the impact of changes in ambient light on image quality and pupil diameter, near-infrared light interference, reliability and transparency of underlying processing algorithms, and on-line generation of gaze and pupil physiological data. These challenges are amplified in a cockpit as additional equipment is donned by the human operator and environmental variables are introduced (such as altitude, cabin pressure, vibrations, or G-forces). Further, workable solutions for the Department of Defense (DoD) must address these challenges by making design choices from a human-factors engineering perspective that attends to the realities and ergonomics of military aviation, including robustness, reliability, user comfort, and cockpit ergonomics. Specifically, the eye tracking system must be designed to be operational with helmets required by most Air Force aircraft both with and without an additional visor. If principles of universal design are invoked, the eye tracking system may also be operable outside of the cockpit on additional aircrew not required to wear helmets (e.g., medical flight crew). This SBIR therefore seeks to develop an eye-tracking system that retains the functionality of similar lab-grade eye-tracking systems and can deploy these capabilities during military aviation. The system must be able to output real-time measures of gaze/saccade and pupil physiology, be capable of recording these data for post-hoc processing and analysis, and sample at sufficient frequency to guide real-time inferences about pilot's internal cognitive states (hardware/software requirements). Additionally, the developed system should use an open-architecture framework that can easily interface with third-party software and hardware (open-architecture requirement). The hardware/software and open-architecture requirements are the focus of this SBIR, however implementations of algorithms to transparently and accurately assess an individual's cognitive state, such as fatigue, workload, stress, etc.,are of potential interest and may be evaluated for relevance to the Air Force. References: Debashis Das Chakladar, & Partha Pratim Roy. (2023). Cognitive workload estimation using physiological measures: A review. Cognitive Neurodynamics. https://doi.org/10.1007/s11571-023-10051-3 Charles, R. L., & Nixon, J. (2019). Measuring mental workload using physiological measures: A systematic review. Applied Ergonomics, 74, 221–232. https://doi.org/10.1016/j.apergo.2018.08.028 Mahanama, B., Jayawardana, Y., Rengarajan, S., Jayawardena, G., Chukoskie, L., Snider, J., & Jayarathna, S. (2022). Eye Movement and Pupil Mea

PHASE I: Phase 1 should focus on concept development and technical feasibility. The resulting proposal should completely document: 1) The proposed approach to implementing a cockpit compatible eye tracking system, including assessment of and solution for flight-specific environmental challenges to eye tracking. 2) The design of the proposed system, including a description of any proposed modifications to existing eye tracking systems as well as the technical specifications for each camera/optical sensing component in the eye tracking system. 3) The interoperability of the proposed eye tracking system with various required piloting headgear, including the HGU-55/P helmet by Gentex worn by most Air Force pilots and associated, modular components like visors. 4) If available, examination of preexisting data collected in dynamic, naturalistic, outdoor environments using eye tracking. 5) Plans for a relevant hardware and open software API that allows users to interface with raw or processed eye tracking data. 6) Plans for a small form-factor (i.e., pilot wearable) processing computer and data storage device to process real-time eye tracking data and store for later use or stream for online integration with other sensors. 7) Plans for testing the functionality of the system in a systematic fashion, stepping up from simulation, phantom testing, to human subjects testing. Include demonstrated capability to gain human subjects research protocol approval, conduct a study, and analyze data in 24 months.

PHASE II: Performers will develop and demonstrate a prototype eye tracking system. This prototype shall demonstrate 1) ability to output eye tracking data of sufficient fidelity under flight-like conditions, and 2) a flexible ergonomic form factor compatible with various aviation equipment (helmets, corrective lenses, respirators, night vision googles/devices, etc.) The ability to output eye tracking data of sufficient fidelity under flight-like conditions will depend on a high sampling rate of eye and gaze cameras (>200 Hz), the ease of use for the operator to setup and (re)calibrate the device quickly (< 2 minutes), the ability of the device to mitigate the impact of head and body motion on signal quality, and the ability of the device to adjust to various ambient lighting conditions while maintaining high image quality. Online processing of data must be conducted in real-time generating online gaze and eye physiology data), to either record to the device or stream over a native API. Recording high-fidelity data will enable development of methods to transparently and accurately assess fatigue, workload, stress etc. Specifically, the eye tracking system must be operational while pilots are wearing a helmet and also wearing a visor. Additional form factors regarding helmets without visors and operability on non-helmet wearing aircrew will also be evaluated, though not required. A flexible and ergonomic form factor will depend on user comfort level from wearing the device, its suitability for use in a military cockpit, and interoperability with aircrew flight equipment. 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: The performer will pursue further generalization and pursue airworthiness approvals of the technology developed, with the aim of transition to a working commercial or warfighter solution that can be operated by non-experts. Special attention should be paid to MIL-STD-810G, "Department of Defense Test Method Standard: Environmental Engineering Considerations and Laboratory Tests" and the latest version of MIL-HDBK-516C, "Department of Defense Handbook: Airworthiness Certification Criteria."

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KEYWORDS: Eye tracking; Pupil dynamics; Eye gaze; Cockpit-compatible; Airworthy; Integrated System, saccade, military aviation, biosensing, cognitive model

AF254-0812 TITLE: Novel Sensors for Robotic Non-destructive Inspection in Confined Space

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Sustainment & Logistics

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OBJECTIVE: Nondestructive evaluation sensor(s) designed for integration with highly compliant and/or small-scale robotic systems to enable inspection without disassembly. Sensor(s) should enable nondestructive characterization using ultrasonic, electromagnetic, thermal, visible light imaging, or other nondestructive characterization techniques.

DESCRIPTION: This topic seeks innovative solutions for sensors to facilitate robotic-assisted nondestructive evaluation, which utilize miniature or soft robotic platforms to perform measurements with limited-or-no disassembly of the system. Innovative sensing approaches using ultrasonic or electromagnetic (e.g., eddy current) that are optimized for use in either highly-flexible and conformal systems (embedding in soft, deformable materials) or in miniature systems that are cm-scale and smaller are of specific interest. Advancements for thermal, visible light imaging, or other nondestructive characterization methods that are compatible with soft and/or miniature robots and also advance the state-of-the-art are also of potential interest. This Phase I topic is expected to deliver at least one working prototype and an initial demonstration for a potential follow-on Phase II effort.

PHASE I: The Phase I effort will establish potential feasibility of developing nondestructive evaluation (NDE) sensor technology compatible with state of the art miniature (cm-scale) and/or highly flexible robotic systems. The feasibility effort should include (i) identification of promising NDE approach for small and/or flexible sensor development; (ii) description of projected approach to sensor-robot integration; (iii) development of prototype sensor with initial demonstration. Target robotic platforms and associated requirements will be provided by AFRL stakeholders.

PHASE II: Under the Phase II effort, the offeror will further develop the sensor technology and approach to robotic integration for demonstration. Identification of sensing limitations relative to existing NDE sensors with handheld operation should be provided. If relevant, impact of robotic hardware limitations on sensor performance should be documented. Sensor performance in an operational environment should be demonstrated.

PHASE III DUAL USE APPLICATIONS: Finalize sensor validation in an operational environment, preferably integrated with a relevant robotic platform if possible. Pursue commercialization of sensor technology and complete sensor ruggedization and testing in relevant, operational or field environments.

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KEYWORDS: nondestructive evaluation; flexible sensors; miniature sensors; robot-sensor integration

Version 2

AF254-0813 TITLE: AI-driven Team Manager and Translator (ATMAT)

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a software tool/platform to enhance teamwork and coordination in Joint All Domain Command and Control (JADC2) operations, specifically addressing challenges associated with fluid teams operating within distributed Multiteam Systems (MTS) in denied and degraded communications environments. The platform will leverage interactive machine learning, knowledge graphs, and large language models to generate and update operationally relevant representations of individual and team states and dynamics and to integrate and reason over disparate forms of data, enabling advanced features like real-time alerts, predictions, and intelligent information dissemination.

DESCRIPTION: Future JADO and CJADC2 operations will necessitate the formation of fluid teams, composed of operators from diverse backgrounds and expertise, who must rapidly integrate into temporary, distributed MTS. These fluid teams, characterized by limited shared experience and potentially restricted communication, often face shortcomings compared to stable teams due to challenges in rapidly developing teamwork structures like shared mental models, transactive memory, and calibrated trust. Additionally, the complexities of MTS, with varying levels of functional interdependence and integration mechanisms, further complicate coordination efforts. Finally, the need to coordinate and collaborate in denied and degraded communication environments necessitates coordination devices that allow rapid synchronization of knowledge within and across echelons and MTS and for real-time and accurate prediction of MTS state enabled through modeling of MTS dynamics and conditions-based authorities.

The resolution of these issues will require a detailed model of MTS state and dynamics that is scalable, adaptable, and compatible with established and emerging AI frameworks. In particular, this problem space calls for a comprehensive solution that can create dynamic knowledge databases and predictive models that leverage existing documentation and information to contextualize and understand ongoing team and system dynamics. Software solutions are needed that can ingest, parse, and process disparate sources of potentially unstructured information into standardized representations that can model entities, properties, and relationships and use these as a priori models to ground and contextualize team communications, functioning, and dynamics. Importantly, the system will need to be scalable such that higher-order entities (e.g., teams) that comprise combinations of lower-order entities (e.g., teammates) can be modeled with properties that are more than the aggregate of the individual parts. This concept should be scalable to individuals, teams, MTS systems, operational systems, etc., with capabilities to model unique properties and dynamics at each scale of observation. Additionally, individual elements should also retain identity and properties so that changes in the higher order meta-stable properties and relationships can be traced to root causes.

The system should be modular, with accessible APIs and standard libraries to allow tailored use of interchangeable LLMs, retrieval augmented generation, scalable databases, along with intuitive GUI-implemented manual and human-in-the-loop interactive machine learning capabilities for updating and augmenting all models, documents, and other relevant contextual information. This GUI interface should be usable by those with little to no computer programming experience. Finally, in addition to grounding and predicting MTS states, the system should be able to leverage generative AI operating on the knowledge graphs and models of MTS communications and dynamics to create forecasts of team performance and possible interventions, as well as synthetic data for data augmentation capabilities and null hypotheses distributions to allow statistical inference about observed MTS dynamics.

The proposed software tool aims to augment teamwork and optimize coordination within these fluid MTS environments by providing team members with accessible information about each other's relevant experiences, knowledge, skills, abilities, and platform capabilities, integrated into a comprehensive knowledge graph framework. The system will also represent the dynamics of knowledge across temporal and spatial dimensions within the modeling framework, enabling AI reasoning about changes in the operational environment and team states over time to predict teaming outcomes and assist in ensuring distributed situational awareness by generating real-time alerts, predictions, and pushing critical information to the appropriate level at the appropriate time. This will ultimately enhance decision-making and responsiveness through AI managed distributed situational awareness.

PHASE I: The primary objectives of Phase I are to develop a conceptual framework for a scalable and adaptable knowledge management and representation framework for distributed multi-team systems. This system will leverage LLMs, RAG, knowledge graphs, interactive machine learning, and graphical user interfaces. The framework's scalability and transferability will be conceptually demonstrated across different domains through incorporating pipelines and procedures for easily augmenting and annotating databases, implementing retrieval augmented generation techniques, tailored use of LLMs, and providing intuitive interfaces for interactive machine learning. These interfaces will facilitate the generation, verification, maintenance, and updating of the underlying knowledge representations and generative AI framework and should be accessible to both those with little to no programming ability (e.g., through graphical user interfaces) and to developers (e.g., through APIs, accessible databases, and libraries). Furthermore, an analysis of fluid team dynamics and MTS coordination and communication challenges within JADC2 operational contexts will be conducted, with a specific emphasis on dynamic targeting or kill-web operations to inform targeted model development.

This phase aims to develop a conceptual framework for the software tool, outlining its key functionalities and integration with existing or novel experimental MTS systems and testbeds. The expected outcomes of Phase I include an initial conceptual framework and a demonstration of the technical feasibility of the proposed software tool. Additionally, this phase will describe initial AF-relevant use cases, including the application of the framework to previously collected data and its integration into existing or novel MTS experimental testbeds capable of simulating denied or degraded communications environments, ideally incorporating dynamic tactical, operational, and strategic elements. Finally, Phase I will identify key individual and teamwork performance indicators and metrics for subsequent phases.

PHASE II: Phase II objectives include implementing the conceptual framework from Phase I and conducting a full cognitive task analysis (CTA) of team interdependencies within the identified MTS use cases. A prototype will be designed and implemented to demonstrate core capabilities, such as incorporating CTA results into the modeling framework, constructing knowledge graphs from diverse data sources (including USAF and DoD doctrine, team communications, task performance data, etc.), and showcasing real-time updates and reasoning in a use case identified in Phase 1. The framework's scalability and transferability will be demonstrated by analyzing multiple data sources across at least two domains, and a suite of basic alert and prediction models will be created based on knowledge graph analysis and models of team effectiveness. Prototype effectiveness will be routinely evaluated and refined by testing the ability of subject matter experts with little to no programming experience to rapidly build out annotated data sets and models of MTS dynamics, through evaluation of generated models for

evaluating, predicting, and improving MTS functioning and dynamics in Air Force-relevant scenarios, and through user feedback testing these models. The expected outcomes of Phase II are a well-defined, user-friendly prototype demonstrating streamlined data annotation and model building, significant improvements in fluid team performance and MTS coordination, validation of the software's effectiveness in enhancing situational awareness and decision-making, and readiness for transition into operational environments.
PHASE III DUAL USE APPLICATIONS: Phase III objectives encompass the continued development and maturation of the framework established in Phase II. Leveraging insights gained in the previous phase, the interface, capabilities, and components will be refined to facilitate the transition of the technology to both military customers and the open market. The software tool will be demonstrated in high-fidelity training or operational use cases within JADC2 or similar environments. Rigorous testing and evaluation will be conducted in realistic operational settings, involving representative user groups, followed by further testing in real-world scenarios. The framework will be expanded and developed to effectively handle real-time information flows and evolving contexts. Additionally, plans and mechanisms will be provided for seamless integration with existing JADC2 or other operationally deployed systems and platforms. Comprehensive training and support will be offered to end-users to ensure successful adoption and utilization. Expected TRL level at Phase III entry is TRL 7. Potential transition partners include ACC/A307 and A326 and this will be enabled by leveraging existing complementary programs with likely paths for transition to these customers.

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KEYWORDS: "AI-Enabled Team Manager, Team Translator, Lingua Franca, Joint All Domain Operations, Combined Joint All Domain Command and Control, Distributed teaming, Fluid Teams, Multiteam Systems, Coordination, Communication, Shared Situational Awareness, Distributed Situational Awareness, Mental Models, Information Flow, Transactive Memory, Team Dynamics, Knowledge Graphs, Artificial Intelligence, Large Language Models, Natural Language Processing, Teamwork, Team Processes, Team Performance, Modeling, Prediction, Conditions-based authorities, Denied and Degraded Communications, Interactive Machine Learning"

Version 5

DEPARTMENT OF AIR FORCE (DAF)
AIR FORCE & SPACE FORCE
25.4 SMALL BUSINESS INNOVATION RESEARCH (SBIR)
DIRECT-TO-PHASE-II (D2P2)
PROPOSAL SUBMISSION INSTRUCTIONS
Release 8

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 SBIR Program BAA posted on the DoD SBIR/STTR Innovation Portal (DSIP) at the proposal submission deadline date/time.**

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

- Full component-specific instructions and topic descriptions are available on DSIP at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations. Be sure to select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at: https://www.dodsbirsttr.mil/submissions/login.

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, "25.4 Address Change".

Points of Contact:

- For general information related to the AF SBIR/STTR program and **proposal preparation instructions**, contact the AF SBIR/STTR One Help Desk at usaf.team@afsbirsttr.us. All applicants have ample opportunity to request clarifying information. **The DAF encourages applicants to request clarifying information as early as possible, as delays in such requests constrain the DAF's ability to provide satisfactory resolution to applicant concerns.**
- For 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 25.4 SBIR BAA.
- Air Force SBIR/STTR Contracting Officer (CO):
  Mr. Daniel J. Brewer, Daniel.Brewer.13@us.af.mil

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

DIRECT TO PHASE II

15 U.S.C. §638 (cc), as amended by the SBIR AND STTR EXTENSION ACT OF 2022, allows DoD to make a SBIR Phase II award to a small business concern with respect to a project, without

regard to whether the small business concern was provided an award under Phase I of an SBIR program with respect to such project. DAF is conducting a "Direct to Phase II" implementation of this authority for these 25.4 SBIR topics and does not guarantee D2P2 opportunities will be offered in future solicitations. Each eligible topic requires documentation to determine whether the feasibility requirement described in the Phase I section of the topic has been met.

DIRECT TO PHASE II PROPOSAL SUBMISSION

The DoD SBIR 25.4 Broad Agency Announcement, https://www.dodsbirsttr.mil/submissions/login, includes all program requirements. Phase I efforts should address the feasibility of a solution to the selected topic's requirements.

The complete proposal must be submitted electronically through DSIP. Ensure the complete technical volume and additional cost volume information is included in this sole submission. The preferred submission format is Portable Document Format (.pdf). Graphics must be distinguishable in black and white. **VIRUS-CHECK ALL SUBMISSIONS.**

INTRODUCTION: D2P2 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 25.4 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: DAF will not consider the applicant's D2P2 proposal if the applicant fails to demonstrate technical merit and feasibility have been established. It will also not be considered if it fails to demonstrate the feasibility effort was substantially performed by the applicant and/or the principal investigator (PI). Refer to the topics' Phase I descriptions for minimum requirements needed to demonstrate feasibility. Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

DIRECT TO PHASE II PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

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

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

DIRECT TO PHASE II PROPOSAL FORMAT

Complete proposals must include all of the following:
Volume 1: DoD Proposal Cover Sheet
Note: If selected for funding, the proposal's technical abstract and discussion of anticipated benefits will be publicly released. Therefore, do not include proprietary information in this section.
Volume 2: Technical Volume
Volume 3: Cost Volume
Volume 4: Company Commercialization Report
Volume 5: Supporting Documents, e.g. DoD Form 2345 (if applicable), Militarily Critical Data Agreement (if applicable); etc.
Volume 6: Fraud, Waste, and Abuse Training Completion
Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

Phase II proposals require a comprehensive, detailed description of the proposed effort. AF D2P2 efforts are to be proposed in accordance with the information in these instructions. Commercial and military potential of the technology under development is extremely important. Proposals emphasizing dual-use applications and commercial exploitation of resulting technologies are sought.

All D2P2 research or research and development (R/R&D) must be performed by the small business and its team members in the United States, as defined in the DoD SBIR 25.4 BAA. The Principal Investigator's (PI's) primary employment must be with the small business concern at the time of awardand during the entire period of performance. Primary employment means more than one-half the PI's time is spent in the small business' employ. This precludes full-time employment with another entity. Only one principal investigator/project manager can be designated to a proposal at any given time.

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

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

DOD PROPOSAL COVER SHEET (VOLUME 1)

Complete the proposal Cover Sheet in accordance with the instructions provided via DSIP. The technical abstract should include a brief description of the program objective(s), a description of the effort, anticipated benefits and commercial applications of the proposed research, and a list of keywords/terms. The technical abstract of each successful proposal will be submitted to the Office of the Secretary of Defense (OSD) for publication and, therefore, must not contain proprietary or classified information.

TECHNICAL VOLUME (VOLUME 2)

The technical proposal includes all items listed below in the order provided. Refer to topic index for page limitations. Pages in excess of this count will not be considered by the Government in evaluations.

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

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

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

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

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

(6) **<u>Work Plan</u>:** 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) <u>1.0 – Objective</u>: This section is intended to provide a brief overview of thespecialty area. It should explain the purpose and expected outcome.
b) <u>2.0 – Scope</u>: This section should provide a concise description of the work to beaccomplished, including the technology area to be investigated, goals, and majormilestones. The key elements of this section are task development and deliverables, i.e., the anticipated end result and/or the effort's product. This section must also be consistent with the information in Section 4.0 below.
c) <u>3.0 – Background</u>: The applicant shall identify appropriate specifications, standards, andother documents applicable to the effort. This section includes information or explanation for, and/or constraints to, understanding requirements. It may include relationships to previous, current, and/or future operations. It may also include techniques previously determined ineffective.
d) <u>4.0 – Task/Technical Requirements</u>: The detailed individual task descriptions must be developed in an orderly progression with sufficient detail to establish overall program requirements and goals. The work effort must be segregated into major tasks and identified in separately numbered paragraphs.

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

(7) **<u>Deliverables</u>:** Include a section clearly describing the specific sample/prototype

hardware/ software to be delivered, as well as data deliverables, schedules, and quantities. Be aware of the possible requirement for unique item identification IAW DFARS 252.211-7003, ItemIdentification and Valuation, for hardware. If hardware/ software will be developed but not delivered, provide an explanation. At a minimum, the following reports will be required under ALL Phase II contracts.

a) Scientific and Technical Reports: Rights in technical data, including software, developed under the terms of any contract resulting from a SBIR Announcement generally remain with the contractor. The Government obtains SBIR/STTR data rights in all data developed or generated under the SBIR/STTR contract for a period of 20 years, commencing at contract award. Upon expiration of the 20-year SBIR/STTR license, the Government has Government purpose rights to the SBIR data.

i. Final Report: The first page of the final report will be a single-page project summary, identifying the work's purpose, providing a brief description of the effort accomplished, and listing potential result applications. The summary may be published by DoD. Therefore, it must not contain any proprietary or classified information. The

remainder of the report should contain details of project objectives met, work completed, results obtained, and technical feasibility estimates.

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

b) Additional Reporting: AF may require additional reporting documentation including:

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

(8) **Related Work:** Describe significant activities directly related to the proposed effort, including any previous programs conducted by the Principal Investigator, proposing firm, consultants, or others, and their application to the proposed project. Derscribe how these activities interface with the proposed project and discuss any planned coordination with outside sources. Also list any applicant-identified subject matter experts, regardless of affiliation, providing comments regarding the applicant's knowledge of the state-of-the-art in the specific approach proposed. Describe previous work not directly related to the proposed effort but similar. Provide the following:

a. Short Description
b. Client for which work was performed (including individual to be contacted and phone number)
c. Date of completion

(9) Commercialization Potential:

a) The DoD requires a commercialization plan be submitted with the Phase II proposal,specifically addressing the following questions:
   i. What is the first planned product to incorporate the proposed technology?
   ii. Who are the probable customers, and what is the estimated market size?
   iii. How much money is needed to bring this technology to market and how will it be raised?
   iv. Does your firm have the necessary marketing expertise and, if not, how will your firm compensate?
   v. Who are the probable competitors, and what price/quality advantage is anticipated by your firm.

b) The commercialization strategy plan should briefly describe the commercialization potential for the 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.

c) If awarded a D2P2, the awardee will be required to update periodically 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.
d) Note, the "Commercialization Plan" and the "Company Commercialization Report" are distinct documents. The Company Commercialization Report (CCR) comprises Volume 4 as separately indicated in these instructions.

(10)**Relationship with Future R/R&D Efforts**:
   a) State the anticipated results of the proposed approach, specifically addressing plans for Phase III, if any.
   b) Discuss the significance of the D2P2 effort in providing a basis for the Phase III R/R&D effort, if planned.

D. **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 25.4 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.

E. **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.

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

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

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

NOTE: If this section does not apply, state in the proposal, "No prior, current, or pending support for proposed work."

COST VOLUME (VOLUME 3)
A detailed cost proposal must be submitted. Cost proposal information will be treated as proprietary. Proposed costs must be provided by both individual cost element and contractor fiscal year (FY) in sufficient detail to determine the basis for estimates, as well as the purpose, necessity, and reasonableness of each. This information will expedite award if the proposal is selected. Generally, Firm-Fixed-Price contracts are appropriate for Phase II awards. In accordance with the SBA SBIR/STTR Policy Directive, Phase II contracts must include profit or fee.

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

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

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

c) **Other Direct Costs:** This includes specialized services such as machining or milling, special test/analysis, and costs for temporary use/lease of specialized facilities/ equipment. Provide usage (hours) expected, rates, and sources, as well as brief discussion concerning the purpose and justification. Proposals including leased hardware must include an adequate lease versus purchase rationale.

d) **Special Tooling, Special Test Equipment, and Material:** The inclusion of equipment and materials will be carefully reviewed relative to need and appropriateness to the work proposed. Special tooling and special test equipment purchases must, in the CO's opinion, be advantageous to the Government and relate directly to the effort. These toolings or equipment should not be of a type that an 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, assignedpersonnel, hours and rates, materials (if any), and proposed travel (if any). A letter from the subcontractor agreeing to perform a task or tasks at a fixed price is not considered sufficient. The proposed total of all consultant fees, facility leases or usage fees, and other subcontract or purchase agreements may not exceed one-half of the total contract price, unless otherwise approved in writing by the Contracting Officer.

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

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

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

h) **Indirect Costs:** Indicate proposed rates' bases, e.g., budgeted/actual rates per FY, etc. The proposal should identify the specific rates used and allocation bases to which they are applied. Do not propose composite rates; proposed rates and applications per FY throughout the anticipated performance period are required.

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

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

COMPANY COMMERCIALIZATION REPORT (VOLUME 4)
Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD SBIR 25.4 BAA for full details on this requirement. Information contained in the CCR will not be considered by the DAF during proposal evaluations.

SUPPORTING DOCUMENTS VOLUME (VOLUME 5)

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

1. DD Form 2345: For proposals submitted under export-controlled topics either International Traffic in Arms or Export Administration Regulations (ITAR/EAR), a copy of the certified DD Form 2345, Militarily Critical Technical Data Agreement, or evidence of application submission must be included. The form, instructions, and FAQs may be found at the United States/Canada Joint Certification Program website, http://www.dla.mil/HQ/InformationOperations/Offers/Products/LogisticsApplications/JCP/DD2345Ins tructions.aspx. DD Form 2345 approval will be required if proposal if selected for award.
2. Verification of Eligibility of Small Business Joint Ventures (Attachment 3 to the DOD SBIR 25.4 BAA)
3. Technical Data Rights Assertions (if asserting data rights restrictions)

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

1. D2P2 proposals require a comprehensive, detailed effort description. Proposals should demonstrate sufficient technical progress or problem-solving results to warrant more extensive RDT&E. Developing technologies with commercial and military potential is extremely important. Particularly, AF is seeking proposals emphasizing technologies' dual-use applications and commercialization.
2. * NOTE: The 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. 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 cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.**
3. If appropriate, include a reference or works cited list as the last page.
4. Feasibility efforts detailed must have been substantially performed by the 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, applicants 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 25.4 BAA for technical data rights information.

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

FRAUD, WASTE AND ABUSE TRAINING (VOLUME 6)

Fraud, Waste and Abuse training material can be found in the Volume 6 section of the proposal submission module in DSIP and must be thoroughly reviewed once per year to proceed with proposal submission.

DISCLOSURES OF FOREIGN AFFILIATIONS OR RELATIONSHIPS TO FOREIGN COUNTRIES (VOLUME 7)

Small business concerns must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission. Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a PDF Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5. For additional details, please refer to the DoD Program BAA.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

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

METHOD OF SELECTION AND EVALUATION CRITERIA

D2P2 proposals are evaluated on a competitive basis by subject matter expert scientists, engineers, or other technical personnel. Throughout evaluation, selection, and award, confidential proposal and evaluation information will be protected to the greatest extent possible. D2P2 proposals will be disqualified and not evaluated if the Phase I equivalency documentation does not establish the proposed technical approach's feasibility and technical merit.

Proposals will be evaluated for overall merit in accordance with the criteria outlined in the 25.4 BAA Section 6.0. DAF is seeking varying technical/scientific approaches and/or varying and new technologies that would be responsive to the problem statement(s) and area(s) of interest in the topic. Multiple procurements are planned and anticipated to be awarded as a result of the topic, each proposal is considered a separate procurement and will be evaluated on its own merit, and that the Government may award all, some, or none of the proposals. Any per-award or per-topic funding caps are budgetary estimates only, and more or less funding may become available. Funding decisions are made with complete disregard to the other awards under the same topic.

In accordance with 15 USC 638(vv) (Section 4 of the SBIR and STTR Extension Act of 2022), and the Deputy Secretary of Defense Memorandum; Subject: Defense Small Business Innovation Research and Small Business Technology Transfer Due Diligence Program dated May 13, 2024, and the Department of the Air Force Guidance Memorandum to AFI 61-102, on DAF Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Due Diligence Program dated February 25, 2025; the DAF will review all proposals submitted in response to this BAA to assess security risks presented by small business concerns seeking a Federally funded award. The DAF will use information provided by the small business concern in response to the Disclosure of Foreign Affiliations or Relationships to Foreign Countries and the proposal to conduct a risk-based due diligence review on the cybersecurity practices, patent analysis, employee analysis, and foreign ownership of a small business concern, including the small business concern and employees of the small business concern to a foreign country, foreign person, foreign affiliation, or foreign entity. The DAF will also assess proposals utilizing open-source analysis and analytical tools, for the nondisclosures of the information set forth in 15 U.S.C.

638(g)(13). If DAF assesses that a small business concern has security risk(s), DAF will review the proposal, the evaluation, and the security risks and may choose to either 1) create a plan to mitigate the risk(s) or 2) DAF may decide not to select the proposal for award based upon a totality of the review.

MAJORITY OWNERSHIP IN PART BY MULTIPLE VENTURE CAPITAL, HEDGE FUND, AND PRIVATE EQUITY FIRMS

Small business concerns that are owned in majority part by multiple venture capital operating companies (VCOCs), hedge funds, or private equity funds are ~~not~~ eligible to submit applications or receive awards for DAF Topics.

PERFORMANCE OF WORK REQUIREMENTS AND LOCATION OF WORK

For Phase I, a minimum of two-thirds of the research or analytical effort must be performed by the Awardee. The DAF measures percentage of work by both direct and indirect costs, not including profit. Occasionally, the DAF will consider deviations from this performance of work requirement. **Requests for Performance of Work deviations must be made twice: prior to submission during the topic open period and as part of the initial proposal submission.** For requests prior to the initial proposal submission, the DAF will consider the request and approve or disapprove requesting applicants to proceed with DSIP submission. Upon proposal receipt, the DAF will again consider such requests for approval for the resultant award.

All R/R&D work must be performed in the United States. Based on a rare and unique circumstance, the DAF may approve a particular portion of the R/R&D work to be performed or obtained in a country outside of the United States. The awarding Funding Agreement officer must approve each specific condition in writing. Applicants seeking this approval must make such a request with their initial proposal submission. The DAF will not consider these requests prior to proposal submission.

DAF USE OF SUPPORT CONTRACTORS

Restrictive notices notwithstanding, proposals may be handled for administrative purposes only, by support contractors. These support contractors may include, but are not limited to APEX, Peerless Technologies, Engineering Services Network, HPC- COM, Mile Two, REI Systems, MacB (an Alion company), Montech, Oasis, Astrion/Oasis, and Infinite Management Solutions. In addition, only Government employees and technical personnel from Federally Funded Research and Development Centers (FFRDCs) MITRE and Aerospace Corporations working under contract to provide technical support to AF Life Cycle Management Center and Space Force may evaluate proposals. All support contractors are bound by appropriate non-disclosure agreements. **Contact the AF SBIR/STTR Contracting Officer (Daniel.Brewer.13@us.af.mil) with concerns about any of these contractors**.

PROPOSAL STATUS AND FEEDBACK

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

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

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

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

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

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

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Air Force SBIR 25.4 D2P2 Topic Index
Release 8

Topic Number	**Topic Title**	**Award Maximum Value***	**Maximum PoP (in months)****	**Technical Volume (Volume 2) Page/Slide Limit*****
AF254-D0801	High Gain UAS MANET Antennas	$ 1,250,000.00	15	35
AF254-D0802	AI/ML-Enhanced Risk Management Framework	$ 1,250,000.00	24	35
AF254-D0803	Robust Conformal RF Sensors	$ 1,250,000.00	24	35
AF254-D0804	Low Cost Proximity Sensor for C-UAS Munition	$ 1,250,000.00	24	35
AF254-D0805	Indistinguishable deterministic quantum dots for quantum networking	$ 1,250,000.00	24	35
AF254-D0806	Manufacturing Scale-up of 500C Capable, Kilo-Byte Scale, Non-Volatile Memory	$ 1,250,000.00	24	35
AF254-D0807	3000F Oxidizing Extreme Combustion Environment Fiber/Filaments And Rope Seals	$ 1,250,000.00	24	35
AF254-D0808	Robust Processing Techniques for Complex RF Applications Using Generative AI/ML Techniques in the Presence of Training-Testing Distribution Mismatch	$ 1,250,000.00	24	35
AF254-D0809	TIGER – Techniques for the Improvement of Geospatial RF detection	$ 1,250,000.00	24	35
AF254-D0810	Aluminum Scandium Nitride and Aluminum Scandium Nitride/Gallium	$ 1,250,000.00	24	35

	Nitride Epitaxial Technology for RF Devices			
AF254-D0811	APPEAR - Aperture Projects for Passive Engineering and Advanced Research	$ 1,250,000.00	24	35
AF254-D0812	RAPTURE – Radio frequency Passive Technology for Ubiquitous Research and Engineering	$ 1,250,000.00	24	35
AF254-D0813	Development of KGd(WO4)2 Crystals for Solid-State Raman Laser Applications	$ 1,250,000.00	24	35
AF254-D0814	Advanced, low latency, Peer to Peer Protocols for Autonomous Collaborative Platforms	$ 1,250,000.00	24	35
AF254-D0815	Visual Position and Navigation Capability Using Computer Vision for SUAS in GPS-Denied Environments	$ 1,250,000.00	24	35
AF254-D0816	Lightweight Optical Turret for Extended Capability HEL (LOTECH)	$ 1,250,000.00	24	35
AF254-D0817	Conformal, Agile, Beam-Steering High Power Microwave Antenna	$ 1,250,000.00	24	35
AF254-D0818	Cold Field Emitter Arrays for HPM	$ 1,250,000.00	24	35
AF254-D0819	Omni directional aircraft mover for F-16	$ 1,250,000.00	24	35
AF254-D0820	F-35 Scuff Sanding Test and Demonstration	$ 1,250,000.00	24	35
AF254-D0821	Advanced Prediction of Polymer Performance	$ 1,250,000.00	24	35

AF254-D0822	High-Resolution Tactile Fingertip For Intelligent Grasping	$ 1,250,000.00	24	35
AF254-D0823	Shop Floor Human Detection Using Low-Cost Equipment	$ 1,250,000.00	24	35
AF254-D0824	Autonomous Internal Exploration and Inspection of Confined Spaces	$ 1,250,000.00	24	35
AF254-D0825	Smart Electronic System Visualization to Support Depot Sustainment of USAF Systems	$ 1,250,000.00	24	35
AF254-D0826	Automated Scenario Generation for Information Operations Network (ION) Environment	$ 1,250,000.00	24	35
AF254-D0827	Artificial Intelligence/Machine Learning (AI/ML) Driven Personnel Retention Platform	$ 1,250,000.00	24	35
~~AF254-D0828~~				
AF254-D0830	Directed Energy Mobile Environmental Test Bed	$ 1,250,000.00	24	35
AF254-D0831	High Power Airborne Optical Relay	$ 1,250,000.00	24	35
AF254-D0832	Automating the Risk Management Framework for Hybrid Operational Technology to Information Technology Environments	$ 1,250,000.00	24	35
AF254-D0833	Modern Low Cost C-UAS Warhead	$ 1,250,000.00	24	35
AF254-D0834	Autonomous and Adaptive Cold Spray Repair	$ 1,250,000.00	15	35
AF254-D0835	Autonomous Flightline Maintainer Supply Vehicle	$ 1,250,000.00	15	35

AF254-D0836	Small UAS MANET Antennas	$ 1,250,000.00	24	35

*Proposals in excess of this amount will not be considered for award.
**Proposals in excess of this duration will not be considered for award.
***Pages/slides in excess of this number will not be considered by the DAF during evaluations.

Space Force SBIR 25.4 D2P2 Topic Index
Release 8

Topic Number	Topic Name	Maximum SBIR/STTR Funding*	Maximum PoP** (in months)	Technical Volume Page Limit***
SF254-D801	Resilient Military Communications (MilCom) – Enhancing MILSATCOM Resilience through Virtualization, Ground Architecture, Situational Awareness, and Data Management	$1,900,000.00	24	10
SF254-D802	Space-Based Environmental Monitoring (SBEM) in Very Low Earth Orbit (VLEO)	$1,900,000.00	18	10
SF254-D803	Novel Propulsion Solutions for the Very Low Earth Orbit (VLEO) Regime	$1,700,000.00	18	10
SF254-D804	Magnetically Clean Remote Sensing Satellite for VLEO mapping mission	$3,000,000.00	24	12
SF254-D805	Digital Transformation of Space Force Human Resource Presentation Layer	$1,900,000.00	15	10
SF254-D806	United States Space Force Human Capital Management Modernization	$1,900,000.00	18	10

*Proposals that exceed this amount will not be considered for award.
**Proposals that exceed this duration will not be considered for award.
***Pages/slides in excess of this number will not be considered during proposal evaluations.

Version 5

AF254-D0801 TITLE: High Gain UAS MANET Antennas

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

OBJECTIVE: Develop a system capable of increasing the range to up to 50 miles of an air-to-air or air-to ground data connection of at least 1mb/s while using a mobile ad hoc network (MANET) commercially available radio operating in the S-band on a large (>300 lbs GTOW) unmanned aerial system (UAS).

DESCRIPTION: Numerous government and commercial groups have experienced the multitude of benefits of MANET radios operating in the S-band to control and communicate with other systems and operators. Unfortunately, the current range of the systems these types of radios are currently integrated into limit their operational capabilities. Currently most operations are conducted at a range of less than five miles, but the capability of something like air launched small UAS exceed this by orders of magnitude. They are unable to exercise this range because of this limitation and have been mostly relegated to close-in surveillance roles where their loiter time is still useful.
For several existing current and future operations, a greater stand-off between a small UAS or a ground system and a larger airborne asset it is communicating with is greatly desired. The operational benefits of MANET radios are enough to continue utilizing them, but the government needs to develop a system to increase their range to meet emerging needs. The technical challenges include the limitations of staying in the S-band for data transmission, integration into existing UAS where size, weight, power, and drag penalties can cause issues, and the difficulties of receiving and transmitting signals from a moving airborne platform that is constantly changing in orientation with what it is attempting to connect to.
Previous efforts to address this problem have mostly utilized off the shelf omni-directional antennas in systems that are designed to provide an excellent (>10mb/s) link at a short range. The actual requirements for command and control or streaming surveillance video require a much smaller rate and the need is to develop a system to focus on range instead of a higher data rate than is actually required for a mission.
A number of larger systems are integrating beyond line-of-sight systems that use other communications networks to pass data between MANET nodes but that cannot be a solution for this problem because the other air and ground based units are already fielding S-band radios. Any technological approach to increase the range of an S-band radio is welcome, with the only restriction being a requirement for all transmitted data to be encrypted in accordance with AES 256.

PHASE I: This is a Direct to Phase 2 (D2P2) topic. Phase 1 like proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort via some other means (e.g. IRAD, or other funded work). It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show, as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the proposer has developed a preliminary understanding of the technology to be applied in their Phase II proposal to meet the objectives of this topic. Documentation should include all relevant information including, but not limited to technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Develop and demonstrate a system to communicate data reliably over a commercial S-band MANET radio air-to-air from a large UAS to another airborne system or a ground-based operator at a range of at least 50 miles.
i. Develop and demonstrate a system, compromised of one or more pieces of equipment, that is capable transmitting data at 1mb/s from a large UAS to a ground-based operator or another small UAS over S-band

ii. The system should account for differing orientations between the airborne asset it is installed on and the ground-based asset or small UAS it is communicating with
iii. Develop matrix of operational tradeoffs relating to employing the new system that includes impacts of power consumption, cost, weight, and size
iv. Generate Interface Control Document (ICD) and overview descriptions in parallel with the system development.
v. System needs to be encrypted or easily capable of being encrypted using AES 256.
Complete the design of the system, demonstrate performance of a prototype system through field testing, and deliver the prototype for subsequent evaluation by the government.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to large UAS operations for both surveillance and strike missions. Solutions may also have applications to commercial crop survey operations and disaster or forest fire response.

REFERENCES:

1. Perez, Mariano Negron, SAR Image Formation with embedded QPSK communications in LFM guardbands and UAV antenna characterization https://apps.dtic.mil/sti/citations/AD1173453
2. Paula Paloma Sanchez Dancausa, Jose Luis Masa-Campos, Pablo Sanchez Olivares, and Eduardo Garcia Marin, "Omnidirectional Conformal Patch Antenna at S-Band with 3D Printed Technology," Progress In Electromagnetics Research C, Vol. 64, 43-50, 2016.
3. J. Peng, W. Tang and H. Zhang, "Directional Antennas Modeling and Coverage Analysis of UAV-Assisted Networks," in IEEE Wireless Communications Letters, vol. 11, no. 10, pp. 2175-2179, Oct. 2022

KEYWORDS: antennas, conformal antennas, directional antennas, S-band, MANET, UAV, communications, command and control, long range, small UAS

AF254-D0802 TITLE: AI/ML-Enhanced Risk Management Framework

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Network System-of-Systems; Integrated Sensing and Cyber; Trusted AI and Autonomy; Advanced Computing and Software; Advanced Infrastructure & Advanced Manufacturing

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop a software application that employs AI/ML or similar methodologies to automate the Risk Management Framework (RMF) process which is required to achieve Authority To Operate (ATO) for software and hardware products on government networks.

DESCRIPTION: The current RMF process relies heavily on manual efforts and human expertise, which can result in delays, inconsistencies, and potential oversights. As the DoD continues to adopt advanced technologies and faces increasingly sophisticated cyber threats, there is a pressing need to streamline and automate the RMF process to ensure the timely and effective management of risks. AI and ML technologies offer promising solutions to address these challenges by enabling data-driven decision-making, predictive analytics, and automated risk assessment. USAF CIO, USSF, MAJCOM/A6s, and program offices are highly interested in the development of an AI/ML-powered RMF platform that integrates with existing DoD systems and processes. The ideal platform will leverage advanced algorithms and techniques, such as natural language processing, graph analytics, and deep learning, to automate and optimize various aspects of the RMF process.

PHASE I: It is expected that proposers provide evidence of sufficient prior work and feasibility study to apply AI/ML or similar methodologies to the Risk Management Framework.

PHASE II: Provide a prototype software application which employs AI/ML or similar methodologies to automate the RMF process. Provide a demonstration of the prototype evaluating an example product which has already been through the manual RMF process within the last two years (achieve TRL 6 maturity).

PHASE III DUAL USE APPLICATIONS: Provide a software application which employs AI/ML or similar methodologies to automate the RMF process. Provide proof of effectiveness by evaluating an example product which has not been through the manual RMF process (advance from a TRL 6 to TRL 9 maturity). Add the functionality of continuous monitoring after initial Authority To Operate approval. Implement proper User Interface/Experience (UI/UX) concepts to ensure end users can efficiently and effectively operate the tool. If successful, this technology will have broad application and significant impact across DAF, DOD, and USG.

REFERENCES:

1. Graubert, Richard and Bodeau, Deborah. "The Risk Management Framework and Cyber Resiliency." Case #16-0776. The MITRE Corporation. 2016.
2. DoDI 800.01 "Risk Management Framework for DOD Systems."

3. NIST 800-37 "Guide For Applying the Risk Management Framework for Federal Information Systems."

KEYWORDS: RMF; Risk Management Framework; AI/ML

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AF254-D0803 TITLE: Robust Conformal RF Sensors

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Design and demonstrate innovative RF conformal sensors utilizing advances in high-temperature materials and additive manufacturing capable of surviving and operating throughout exposure to the extreme temperatures and environments generated during hypersonic flight.

DESCRIPTION: The government is seeking innovative solutions to enable the adoption of conformal, forward-looking sensors on high-speed platforms for a variety of capabilities. The challenging flight environment of hypersonic vehicles leads to conflicting requirements between maintaining mechanical and thermal survivability and ensuring effective RF functionality. This conflict results in either sub-optimal sensor performance or constraints on vehicle trajectories to protect the sensor. To overcome this conflict, advances in high-temperature materials and, especially, additive manufacturing seek to decouple mechanical and RF disciplines thus removing conflicting design requirements.
Air Force is looking for breakthrough advancements in additively manufactured sensor technology to enable inclusion of robust, high-performance RF sensors on hypersonic vehicles. The selected approach will allow for sensors to be mounted directly on the outer surface of the vehicle minimizing Size, Weight, Power, and Cost (SWaP-C). The sensors must provide high-directivity radiation patterns and appropriate Field-Of-View (FOV) and Field-Of-Regard (FOR) to support a variety of sensing scenarios, while enabling all day, adverse weather, and high-resolution capability.
Due to the wide variety of potential platforms, the proposed solution must also be compatible with integration into a variety of surface skin materials (alloys, carbon-carbon composites, etc.) and compatible with extreme surface temperatures (1000°C+).

PHASE I: This topic is soliciting Direct to Phase II (DP2) proposals only. Therefore, Phase I proposals will not be accepted or reviewed. The offeror is required to provide detail and documentation in the Direct-to-Phase II proposal which demonstrates accomplishments commensurate of a Phase I-like effort, including at minimum, a feasibility study and preferably validation through an antenna prototype. This includes a review of the scientific and technical merit and feasibility of proposed ideas. The offeror should be able to show performance of a conformal sensor utilizing advance manufacturing techniques to achieve desired decouple of RF and mechanical requirements. Successful offerors will demonstrate a plan for the design, construction, and assembly of a robust sensor compatible with high-temperature materials and the extreme environments of hypersonic flight.
For detailed information on DP2 requirements and eligibility, please refer to the DoD BAA and the AFRL Instructions for this topic.

PHASE II: Actively demonstrate the innovative sensor approach by manufacturing prototype designs for laboratory and environmental testing. Evaluate the mechanical and thermal robustness of the design to representative thermal/mechanical loads. RF design tasks shall include: modeling and simulation of the sensor detailing RF performance (e.g. frequency band, bandwidth, directivity, efficiency, FOV, FOR, cross polarization isolation, sidelobe levels, etc.) within the SWAP constraints of the vehicle concept.

Mechanical design tasks shall include: thermostructural analysis of sensor solutions for representative environments and design of a robust mechanical assembly with the ability to integrate into a variety of platform materials and geometries.
Offeror shall work with the government to develop a concept of operations for various supported sensor modes as well as collaborate with platform integrators to facilitate the development of realistic sensor installation concepts.
Technology maturation tasks shall include: fabrication and characterization of a conformal, sensor prototype using actual or surrogate materials. Fabricated prototype will be subjected to RF and environmental testing to validate sensor robustness and ability to maintain operation throughout exposure to representative flight conditions.

PHASE III DUAL USE APPLICATIONS: Fabricate, characterize, and deliver working, high-temperature prototypes for integration into prospective flight vehicles and field demonstrations.

REFERENCES:
1. Jenkel K-D, Sánchez-Pastor J, Baloochian MM, Jakoby R, Sakaki M, Jiménez-Sáez A, et al. Effect of sintering temperature on the dielectric properties of 3D-printed alumina (Al2O3) in the W-band. J Am Ceram Soc. 2024; 107: 2494–2503. https://doi.org/10.1111/jace.19597
2. Y. Lakhdar, C. Tuck, J. Binner, A. Terry, R. Goodridge, Additive manufacturing of advanced ceramic materials, Progress in Materials Science, Volume 116, 2021, 100736, ISSN 0079-6425, https://doi.org/10.1016/j.pmatsci.2020.100736.
3. Josefsson, Lars, and Patrik Persson. Conformal array antenna theory and design. Vol. 29. John wiley & sons, 2006.

KEYWORDS: Sensor; conformal; additive manufacturing; advanced materials; hypersonic; high temperature

AF254-D0804 TITLE: Low Cost Proximity Sensor for C-UAS Munition

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop and demonstrate a low-cost proximity sensor for low cost C-UAS weapon, demonstrating effective performance against slow UAS targets as well as faster UAS or cruise-missile threats. The sensing mode is not limited to RF. Passive IR and semi-active laser IR solutions are of interest. Dual-mode IR/RF solutions are also of special interest though not a requirement.

DESCRIPTION: Concepts which are compatible with the modular Advanced Precision Kill Weapon System (APKWS) rocket system (a guidance conversion to the Hydra-70 unguided rocket) are of particular interest to the government.

The velocity range of the interception, and related proximity sensor performance, is of very high interest. Proposers should consider both the min/max velocity of the kinetic effector, as well as the min/max velocity of Group 1-3 UAS, as well as the possible geometries of engagements, to determine a target for design. Designs may focus on slower UAS, or may attempt to include faster UAS – or even cruise missiles, if the engineer trades are favorable (some description of the cost/benefit of including faster targets would be prudent).

Of equal interest is any unknown component of such a system that ought to be designed, or optimized, in participation with a system-level Prime contractor to achieve the above objectives/mission. The topic authors do not wish to overly prescribe a specific solution, and other solutions – even beyond sensors, are appropriate for this topic insofar as they achieve a meaningful capability for this requirement on the battlefield.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the applicant to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior SBIR/STTR funding agreement. Prior work expected to be completed in a “Phase-I”effort, in order to qualify for this D2P2, requires demonstrated feasibility which should include work and results in the following areas:

Phase I efforts should include modeling and simulation to show feasibility of performance of a proximity sensing device or other sub-system upgrade versus UAS targets and/or other faster aerial threats. Manufacturing, cost, timeline factors should all be established to build confidence that the final product can be tested on a live (inert) rocket in a short-term, relevant, timeframe, and rapidly fielded with additional funding if results are favorable. Early laboratory or field tests showcasing hardware and/or software (sensing capabilities and algorithm detection capabilities) are expected.

PHASE II: Phase II efforts should aim to achieve live (inert) guided free flight testing of the weapon versus C-UAS targets at a TRL 6. Prior to this point, significant integration work is expected to result in a manufacturable and fieldable design. The hardware should be plug-and-play with the fieldable interceptor solution. Weapon metrics mentioned previously, including the sensor subsystem, will be evaluated competitively against other solutions to assess useability for a Phase III.

PHASE III DUAL USE APPLICATIONS: Phase III will include both smaller quantities <100 of prototypes for experimentation, and quantities of >1000 if selected for inclusion within a program of record. It is expected that rapid fielding/production will begin in large quantities of multiple thousands if specification goals and met and proven in flight testing.

REFERENCES:
1. https://www.reuters.com/world/europe/ukraine-downs-41-russian-drones-major-overnight-attack-2023-12-06/
2. https://www.cnn.com/2024/01/09/politics/us-navy-houthi-missiles-drones-red-sea/index.html

KEYWORDS: Base defense; low-cost interceptor; proximity fuze; optical proximity sensor, RF proximity sensor, counter-cruise missile, counter-UAS kinetic kill.

AF254-D0805 TITLE: Indistinguishable deterministic quantum dots for quantum networking

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Microelectronics; Quantum Science; Space Technology; Advanced Materials

OBJECTIVE: This topic seeks to develop a scalable technology for single photon sources that demonstrates indistinguishability between various single photon sources allowing a interference between the various Quantum Dot emitters in integrated photonic circuits.

DESCRIPTION: In this topic, epitaxial quantum dots will be produced and characterized to determine the statistics associated with the fabrication process. This include parameters such as emission wavelength, lifetime and purity. Ideally, these single photon emitters should be coupled to a photonic cavity which will demonstrate full, on-chip entanglement of distinct sources and generate the correlation matrix for the process as well as determine the visibility of the entanglement. All this information should be used to assess problems in the scale up of this technology to large number of single photon sources. Using the epitaxial quantum dots, efforts to assess ability to align single-photon-emitters to other structures (waveguides, optical cavities for Purcell enhancement, etc.) are essential for scalable quantum photonic networks.

PHASE I: This topic is intended for mobile robotic manipulator technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The offeror 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 topic is intended to scale recent demonstrations in mesa-topped single-quantum-dot emitters or droplet-formed epitaxial quantum dots, which show order-of-magnitude improvements to spectral emission uniformity across a wafer. Traditional self-assembled epitaxial quantum dots are stochastically created, which causes a variety of quantum dot sizes across the wafer. The spectral behavior is determined by the quantum dot geometry, which causes large differences in spectral emission between disparate quantum dots (greater than 30 nanometer), thus inhibiting entanglement between them. However recent progress using the aforementioned techniques have dramatically reduced the size uniformity such that the emission from the quantum dots are very similar (often less than 1nanometer) across large areas of the semiconductor wafer). These smaller spectral differences are well within typical tuning techniques such as thermal- and Stark-tuning. Therefore proposers should be able to demonstrate their ability to generate uniform emission across many quantum dots.

PHASE II: Eligibility for D2P2 is predicated on the offeror having performed a “Phase I-like” effort predominantly separate from the SBIR Programs. Under the phase II effort, the offeror shall sufficiently develop the technical approach, product, or process in order to conduct a small number of relevant demonstrations. Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, should be documented. These Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution. The effort should:

1. Demonstrate Molecular Beam Epitaxy (MBE) growth of Quantum Dots with p-i-n junctions, demonstrating emission linewidths less than 800 Megahertz.
2. Optical Cavity Fabrication: Forming a top-down cavity and characterization of the optical cavity and demonstrating a quality factor greater than 10,000.
3. Quantum Dot-Cavity Integration: Embed MBE-grown Quantum Dots inside optical cavities with tunability.
4. Single-Photon Generation (a) Measuring a single-photon rate greater than 10 Megahertz. (b) Measuring a single-photon purity greater than 0.99.

5. Entanglement Generation (a) Measuring a photon pair rate > 10 Megahertz. (b) Measuring entanglement fidelity greater than 0.9.
6. Integration into Air Force Facilities: Ship a device to the Air Force generate and measure entanglement at Air Force facilities.
7. Reporting: Comply with reporting requirements of the Air Force.

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded mission capability to DARPA QuanNEt and AFRL Information Directorate, as well as 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.

REFERENCES:

1. J. Vac. Sci. Technol. B 32, 02C106 (2014), https://doi.org/10.1116/1.4863680
2. Yang et al. Light: Science & Applications (2024)13:33, https://doi.org/10.1038/s41377-024-01384-7
3. Optics Express Vol. 24, Issue 26, pp. 29955-29962 (2016), https://doi.org/10.1364/OE.24.029955

KEYWORDS: single photon source; quantum network; entanglement distribution; epitaxial quantum dot

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AF254-D0806 TITLE: Manufacturing Scale-up of 500C Capable, Kilo-Byte Scale, Non-Volatile Memory

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this project is to mature high-temperature, non-volatile memory (HT-NVM) technology that provides reliable data retention and robust performance under extreme thermal conditions, specifically at 500°C temperatures. This program seeks 6" wafer-scale module and chip level manufacturing of HT-NVM arrays of at least 2 kB in size per module. The program seeks to address several manufacturing and reliability challenges associated with kB level scaling of the NVM including variation in ON/OFF ratios, bit failure rates and cycling endurance as a function of reducing cell sizes at temperatures up to 600 C.

DESCRIPTION: Thermally hardened electronics are necessary for future DAF platforms. The current state-of-the-art solution for these applications involves thermally isolating and/or actively cooling silicon-based electronics. Although recent advances in SiC logic have paved the way for high-temperature microprocessors, significant challenges persist in developing non-volatile, reprogrammable memory and in integrating memory with logic to realize computation in extreme environments. Using volatile memory, such as SRAM or DRAM, is expensive, power hungry and therefore unaffordable in high-temperature environments, where processing power is limited. The only non-volatile memory (NVM) option available today is commercial off the shelf flash memory, which is rated only up to 250 C, is slow (millisecond write time per cell), has a very limited write endurance at temperature and has to be refreshed frequently. Program deliverables will include demonstration and supply of 6" wafers with memory arrays.

PHASE I: AFRL/RXE has funded low TRL development of high temperature non-volatile memory. This resulted in successful demonstration of a ferroelectric diode based-memory technology, established a cross bar array design, and demonstrated memory cell level stability up to 600C. At 600C, the devices exhibit one million read cycles and readable on/off ratios above 1 for over 60 h. The operating voltages of the AlScN ferrodiodes are less than 15 V at 600C and are thus compatible with silicon-carbide-based high-temperature logic technology Additionally, this approach is silicon CMOS compatible and can be incorporated in the back-end-of-line (BEOL) processes.

PHASE II: The successful Phase 2 effort will build on emerging high temperature electronics technology such as ferroelectric memory elements & correlated electron oxide memory elements, to demonstrate read/write capabilities in extreme thermal environments. The contractor will establish a research and development strategy that addresses key manufacturing hurdles in scalable memory fabrication and integration. There is currently no commercially available memory technology that is able to be manufactured in commercial microelectronics foundries, small enough to provide reasonable data densities, and capable of repeated read/write cycles at temperatures above 250 C. Candidate memory technologies must show the potential to satisfy these requirements. The associated read/write protocols should require voltage and current levels that can reasonably be achieved in an integrated microprocessor on a remote air or space platform.

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.

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KEYWORDS: High temperature electronics; non-volatile memory; extreme environments;

AF254-D0807 TITLE: 3000F Oxidizing Extreme Combustion Environment Fiber/Filaments And Rope Seals

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The topic requests that prospective proposers develop and demonstrate either a new resultant fiber/filament, a surface treatment of a fiber/filament, a coating on said resultant fiber/filament, or whatever approach creates a resultant fiber/filament that is capable of surviving the following conditions:

- Exposure to hot combustion gases of temperatures of at least 3000°+F without unacceptable property degradation.
- Exposure to the above hot gases for at least 1 hour without undue usable property degradation.
- Multiple exposures to the above hot gases for 1 hour durations without undue usable property degradation.

The resulting fiber/filament must also meet the above requirements while also being capable of being fabricated into rope seals.

DESCRIPTION: The topic will request that prospective proposers develop a fiber/filament/surface-treatment/coating final resultant fiber/filament capable of, whence fabricated into a rope seal, repeated extreme temperature (3000°F) operations in high heat flux, oxidizing environments for at least 1 hour.

Existing Air Force Flight and Propulsion systems extensively use rope seals most ubiquitously capable of high temperature 1000 to 1500 °F environment applications. Unfortunately, none of the rope seals now available or being investigated for Air Force eventual use are capable of surviving exposure to the 3000>°F propulsion environment anticipated to be experienced by Hypersonic systems for at a minimum of 1 hour. As per Dr Weber’s and Dr Johnson’s (both in OUSD(R&E) DDRE Hypersonics and JHTO) May 2020 presentation, future Air Force Hypersonic Flight and Hypersonic Propulsion Systems will require repeated long operations times (hours), durable, resilient rope seals that can operate in high heat flux, oxidizing environments and restrict the flow of hot gases at extreme temperatures (3000>°F) in static interfaces. Static seal locations include interfaces between leading edges and wings, integration of an aperture and interfaces between thermal protection system elements and engine components. As these rope seals are made out of fibers/filaments these resultant fibers/filaments must first meet these same requirements along with being able to be fabricated into rope seals.

The proposer shall provide an exhaustively detailed report incorporating substantiating previous experimental results and detailed technical explanations as to why the new approach/material will accomplish the topic's performance objectives.

The proposer will provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a “Phase I-like” effort. 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 proposer shall produce a defined, clear and immediately actionable plan with the proposed solution and the AF customer.

The proposer shall sufficiently develop the technical approach, product, or process in order to make a sufficient amount of the resultant fiber/filament and subsequent Rope Seals to conduct property change with exposure to hot combustion gases of temperatures of at least 3000°+F for at least 1 hour testing.

The proposer shall conduct sufficient tests on the exposed fiber/filament and rope seals fabricated from the material to determine rope seal relevant property changes capable of achieving the performance characteristics detailed in the topic's performance objectives. These tests will include but not be limited to but must include dimension changes, weight changes and mechanical property changes. The tests shall demonstrate that the fiber/filament material can achieve the performance characteristics detailed in the topic's performance objectives and be documented as such in a detailed stand alone report.

The proposer shall deliver whence the proposed fiber/filament material has been fabricated into a testable rope seal form to a government acceptable Government test facility for independent performance characterization testing detailed in the topic's performance objectives paid for by the proposer. The tests shall substantiate that the new fiber/filament – rope seal can achieve the performance characteristics detailed in the topic objective and be documented as such in a detailed stand alone report.

With the best test performing fiber/filament material the proposer shall fabricate a sufficient amount of the fiber/filament material and fabricate it into actual rope seals by making five circular cross section circular overall diameter O ring style rope seals.

Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, shall be documented.

PHASE I: The proposer shall provide an exhaustively detailed report incorporating substantiating previous experimental results and detailed technical explanations as to why their new approach/material will accomplish the topic's performance objectives.

The proposer will describe and document previously conducted work which has demonstrated the successful creation of a demo prototype rope or pillow like seal made from either the 3000F fibers of topic interest or fibers capable of being exposed to high 2700+F OR has demonstrated production techniques with high 2700+F fibers which will be needed to successfully fabricate demo prototype rope or pillow seal made from the rather brittle 3000F type fibers.

PHASE II: The proposer shall sufficiently develop the technical approach, product, or process in order to make a sufficient amount of the resultant fiber/filament and subsequent Rope Seals to conduct property change with exposure to hot combustion gases of temperatures of at least 3000°+F for at least 1 hour testing.

The proposer shall conduct sufficient tests on the exposed fiber/filament and rope seals fabricated from the material to determine rope seal relevant property changes capable of achieving the performance characteristics detailed in the topic's performance objectives. These tests will include but not be limited to but must include dimension changes, weight changes and mechanical property changes. The tests shall demonstrate that the fiber/filament material can achieve the performance characteristics detailed in the topic's performance objectives and be documented as such in a detailed standalone report.

The proposer shall deliver whence the proposed fiber/filament material has been fabricated into a testable rope seal form to a government acceptable Government test facility for independent performance characterization testing detailed in the topic's performance objectives paid for by the proposer. The tests shall substantiate that the new fiber/filament – rope seal can achieve the performance characteristics detailed in the topic objective and be documented as such in a detailed standalone report.

With the best test performing fiber/filament material the proposer shall fabricate a sufficient amount of the fiber/filament material and fabricate it into actual rope seals by making five circular cross section circular overall diameter O ring style rope seals.

Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, shall be documented.

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.

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KEYWORDS: Fiber; Filament; Rope Seal; Hypersonic; Scramjet; Rotating Detonation Engine; 3000F; Rotating Detonation Rocket Engine

AF254-D0808 TITLE: Robust Processing Techniques for Complex RF Applications Using Generative AI/ML Techniques in the Presence of Training-Testing Distribution Mismatch

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop efficient techniques to support Generative AI/ML algorithms for RF applications in the presence of severe mismatches in the distributions of the data between training and live operations. These techniques should rapidly detect anomalies in the data and provide corrective measures to assist the Generative AI enhanced AI/ML algorithms to regain the lost performance. The robustness of these techniques to various operating conditions should be demonstrated using a high-fidelity RF Digital Twin for an advanced RF application of relevance to the Air Force.

DESCRIPTION: Training data mismatches have been studied in the RF domain for techniques such as STAP [1]. The increasing use of AI/ML techniques for RF applications that are typically operating in data-starved environments has further highlighted the importance of Digital Engineering tools that can capture and model the real-world effects in a synthetic environment. While state-of-the-art Digital Twins [2] faithfully recreate most of the realistic physics-based phenomenon, it is inevitable that unmodeled or unknown characteristics can end up in the data when the algorithms are exposed to live operations. It is important to develop computationally tractable measures that can detect these anomalies in the data and apply corrections and/or identify severely-out-of-training-distribution scenarios to ensure the AI/ML is not derailed by these unmodeled mismatch between training and testing data.

While classical textbook methods for anomaly detection and classification are computationally scalable, they rely heavily on Gaussianity assumptions which limit their applicability to the envisioned heterogeneous and cluttered operational scenarios. Bayesian and Monte-Carlo techniques suffer from the curse of high dimensionality and are sensitive to parameter selection in their training (e.g. kernel width selection).

Generative AI techniques, including GANs and Diffusion Models [3.4] have recently demonstrated the ability to model complex high dimensional distributions using sufficiently rich training data in ways that can be used to generate new data samples. Their utility in the context of testing for or identifying distributional shifts remains to be fully established. It is important that the computational methods proposed are scalable to high dimensional settings and are able to quantitatively "know what they don't know". [5]

The main deliverables on this project will be advanced techniques that leverage or build on recent advances in generative AI to detect and classify anomalies and distributional shifts in the live/testing data compared to the training datasets, corrective algorithms, and demonstration of this novel approach on an advanced RF application using data from an RF Digital Twin as well as theoretical and/or computational analysis of their associated fundamental inferential limits.

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 offeror 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 offeror should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Relevant areas of demonstrated experience and success include high-fidelity M&S, solutions to complex RF problems using AI/ML, concept development, concept demonstration and concept evaluation.

PHASE II: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Air Force expects the applicant(s) to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. These efforts will include developing a high-fidelity physics-based M&S, simulation of an AI/ML relevant solution for an AF application using the M&S tool, demonstration of the vulnerability of these techniques to model mismatches, and a practical analysis on computationally tractable techniques to overcome these mismatches.

PHASE III DUAL USE APPLICATIONS: The proposer will identify potential commercial and dual use applications for this technology.

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KEYWORDS: Robust Processing; Generative AI/ML; Outlier detection

AF254-D0809 TITLE: TIGER – Techniques for the Improvement of Geospatial RF detection

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective is to develop, analyze, and deploy artificial intelligence (AI) or machine learning (ML) based techniques for the detection and geolocation of weak/obscure RF emitters from a single Collaborative Combat Aircraft (CCA) platform in the presence of strong emitters for improved battlespace awareness.

DESCRIPTION: Traditional geolocation is often accomplished using direction of arrival (DOA) estimation in the single platform case, or time difference of arrival (TDOA)/frequency difference of arrival (FDOA) in the multiple platform case. Multiple platform geolocation has improved geolocation accuracy compared to single platform geolocation but suffers from issues such as slow computation speed and the requirement of precise time synchronization between platforms [1]. These drawbacks make single platform geolocation preferred in a time critical environment such as a battlespace.
Emitter detection sensitivity is an important factor for detecting weak emitters and is often increased by deploying large, high-powered antennas on large unmanned aerial vehicles (UAV). With the previously mentioned time constraints, it is much more feasible to deploy small UAVs with reasonable size, weight, and power (SWaP) requirements. Unfortunately, conventional single platform geolocation techniques suffer from poor resolution and are insufficient for the detection and geolocation of weak emitters in the presence of strong emitters when the antenna array and platform is small [2].
AI/ML advancements have dominated the DOA estimation literature in recent years [3-6]. These techniques have been shown to significantly improve the DOA estimation performance compared to conventional methods, and in many cases reach the theoretical minimum achievable error dictated by the Cramer-Rao bound (CRB) [7]. Despite these advancements with AI/ML techniques, there is a lack of research that progresses from the DOA estimation case to single platform geolocation. Single platform geolocation requires a method of combining multiple DOA estimates accurately and efficiently to achieve geolocation estimates, which is absent from current AI/ML DOA literature. This topic therefore aims to investigate successful AI/ML techniques for DOA estimation that can be expanded for our geolocation scenario.
Investment End State: A software prototype for AI/ML based detection and geolocation of weak emitters in the presence of strong emitters from a single CCA platform.

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 offeror is required to provide detail and documentation in the Direct to Phase II proposal which demonstrates accomplishment of a "Phase I-like" effort. This includes a detailed technical approach to achieving the goal of improved detection and geolocation of weak RF emitters in the presence of strong emitters from a single CCA platform. For this topic, we are classifying "weak" emitters as having a signal-to-noise ratio (SNR) at least 20 dB below the SNR of the strong emitters. Offeror's previous success with AI/ML based DOA estimation and a clear plan to expand from DOA estimation to single platform geolocation is preferred. The proposed geolocation approach should provide solutions and any constraints for the application.

PHASE II: Eligibility for a Direct to Phase Two (D2P2) is predicated on the offeror having performed a “Phase I-like” effort predominantly separate from the SBIR/STTR Programs. Offerors implement the algorithmic approach to geolocation outlined in PHASE I. Offerors are expected to create a proof of concept for their algorithm with simulated data and compare their approach with other conventional geolocation techniques and theoretical bounds such as the CRB. Extensive Monte Carlo simulations with metrics such as detection success rate and geolocation accuracy should be carried out to demonstrate algorithm performance. Offerors should demonstrate computational efficiency of algorithm compared to conventional approaches.

PHASE III DUAL USE APPLICATIONS: The geolocation algorithm will be implemented on a CCA platform and tested in scenarios of interest. 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.

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KEYWORDS: Geolocation; RF Emitters; Artificial Intelligence; Machine Learning; Weak/Obscure Emitter Detection, Single Platform; Air Platforms

Version 5

AF254-D0810 TITLE: Aluminum Scandium Nitride and Aluminum Scandium Nitride/Gallium Nitride Epitaxial Technology for RF Devices

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Microelectronics; Advanced Materials; Space Technology

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop growth system and process for aluminum scandium nitride (AlScN) and aluminum scandium nitride/gallium Nitride (AlScN/GaN) epitaxial structures to enable next generation radio frequency (RF) transistor technology.

DESCRIPTION: Next generation radio frequency (RF) devices are necessary for future Air Force radar and communications systems to advance spectral dominance, range, and efficiency beyond state of the art. This requires new RF transistor technology with higher current and lower losses that can be highly scaled and can operate at high temperatures. High electron mobility transistors (HEMTs) based on AlScN/GaN heterostructures have demonstrated great potential to achieving these goals [1]. Compared to current AlGaN/GaN HEMT technology, AlScN/GaN HEMTs have significantly higher charge density in the two-dimensional electron gas (2DEG) channel, due to higher polarization, resulting in larger on-current and improved device scaling for higher frequency operation. AlScN layer with Sc concentration of ~19% can be epitaxially lattice matched to GaN reducing mechanical strain improving reliability and operating temperatures [2]. To develop this technology, a supply of high quality, uniform, wafer scale AlScN and AlScN/GaN structures will be necessary to produce HEMTs. Currently, ScAlN and ScAlN/GaN is produced only at small laboratory volumes by molecular beam epitaxy (MBE) or metal organic chemical vapor deposition (MOCVD) due to the challenge of efficiently growing high quality epitaxial AlScN layers with Sc concentrations above 18% [2,3]. To achieve the necessary supply of material for development of RF HEMTs based on AlScN/GaN, a suitable process and equipment are essential. MOCVD is the industry standard for GaN but has been challenging to adapt for growth of AlScN due to the low vapor pressure of Sc containing precursors and low incorporation of Sc, which requires novel equipment and process development. The proposed growth system and process should meet the following thresholds: deposition of Al(1-x)Sc(x)N with Sc concentration (x) greater than 18% (x > 0.18) with a thickness greater than 100 nm and sub nm surface roughness (RMS < 5 nm at 25 μm2 scale) at a growth rate greater than 100nm per hour. Deposition of a Al(1-x)Sc(x)N/GaN device heterostructure with x > 0.18, thin Al(1-x)Sc(x)N layer (< 50nm) with nm scale thickness uniformity, and sub nanometer surface roughness (RMS < 2nm). Demonstrate the formation of a 2DEG at the AlScN/GaN interface with high sheet concentration (> 8x1012 cm-2). Demonstrate growth on 2" or larger substrates.

PHASE I: Determine feasibility, establish a plan, and describe the epitaxial growth process, tool features, and issues for controllable deposition of Al(1-x)Sc(x)N with Sc concentration (x) greater than 18% (x > 0.18) with a thickness greater than 100 nm. Provide detail and documentation that demonstrates the accomplishment of a "Phase I-type" effort, including a feasibility study, which should be clearly identified to potential stakeholders, describing the pathway to integrating with Department of the Air Force (DAF) operations, and outlined how the solution could be used by other DoD or Governmental customers. Information on integrating with existing systems and transition and commercialization plans need to be identified.

PHASE II: Develop a fully-functional epitaxy process and system capable of producing Al(1-x)Sc(x)N layers with Sc concentration (x) greater than 18% (x > 0.18) with a thickness greater than 100 nm, and sub nm surface roughness (RMS < 5 nm at 25 µm2 scale) at a growth rate greater than 100nm per hour on a 2" or larger substrate. Producing a Al(1-x)Sc(x)N/GaN device heterostructure with x > 0.18, thin Al(1-x)Sc(x)N layer (< 50nm) with nm scale thickness uniformity, and sub nanometer surface roughness (RMS < 2nm). Demonstrate the formation of a (2DEG) at the AlScN/GaN interface with high sheet concentration (> 8x1012 cm-2) on 2" or larger substrates Identification of manufacturing/production issues and or business model modifications required to further improve the process and device performance should be documented. These Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution. Delivery of a prototype to Air Force of the fully operational system with appropriate control software is required by the end of Phase II for evaluation.

PHASE III DUAL USE APPLICATIONS: The performer shall address scale up and manufacturing of the product developed as a prototype in Phase II. AlScn and AlscN/GaN layers with >80% useable area that meet the Phase II requirements should be achieved. The small business may work with suitable industrial partners for transition to military and civilian applications. An epitaxy process and system of this design will enable devices for efficient high power high frequency RF power amplifiers to replace existing technology for radar and communication 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.

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KEYWORDS: Wide bandgap semiconductor; epitaxial system; aluminum scandium nitride; gallium nitride; high electron mobility transistors; RF power amplifiers

AF254-D0811 TITLE: APPEAR - Aperture Projects for Passive Engineering and Advanced Research

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Network System-of-Systems; Advanced Computing and Software

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The focus of this effort is to examine current antenna apertures and how they are used to detect various signals of interest and investigate new aperture techniques and technology to increase the likelihood of detection. Both single antenna applications and shared aperture applications should be investigated. In addition, single platform and multi, distributed platform concepts of operation should be considered.

DESCRIPTION: The Air Force Research Laboratory's (AFRL) Multispectral Sensing and Detection Division is developing technologies to provide survivable, adaptive, passive, situational awareness for contested, highly contested, and anti-access environments, to include the space domain. The importance of timely, accurate, and relevant sensing capabilities is paramount to ensure the success of critical warfighter operations. Often, these operations require sensing capabilities that have minimal or no active transmissions to maintain a strategic and/or tactical advantage, thereby elevating the need for passive sensing systems.

The Multispectral Sensing and Detection Division is exploring passive sensing systems and operations across a wide range of systems, from the Air Forces' newest manned platforms, un-manned collaborative systems where size weight and power (SWAP) constraints exist.

The focus of this effort is to examine current apertures and how they are used to detect various signals of interest and investigate new aperture techniques and technology to increase the likelihood of detection. Both single antenna applications and shared aperture applications should be investigated. In addition, single platform and multi, distributed platform concepts of operation should be considered.

To help reduce the cost and complexity of sustainment, it is highly desirable to design systems and concepts that leverage commercial products and non-cooperative illumination sources. The Department of Defense (DoD) is interested in passive RF solutions that leverage cost effective commercial-off-the-shelf (COTS) capabilities that maximize interoperability and build upon the state-of-the-art (SOTA). The integration of these capabilities for DoD use-cases provides a conduit to establish feedback loops and collaboration with industry to improve commercial development for Air Force utility.

The goal of this effort is to investigate aperture concepts for passive RF sensing techniques to determine technical feasibility and risk, programmatic costs, and schedule. The information, test, and evaluation (T&E) under this effort will be used to influence and guide passive RF sensing efforts. This topic is intended to reach companies capable of completing a feasibility study and prototype validated 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 main deliverables will be modeling and simulation (M&S), software algorithms, processing architectures, and T&E of concepts that advance the viability and utility of innovative passive RF sensing apertures and techniques that support the reshaping, refocus, and re-optimization of the Air Force to deter and prevail in an era of Great Power Competition (GPC).

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 offeror 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 and preliminary aperture design validated through extensive simulation. This includes determining, insofar as possible, the scientific and technical merit and feasibility of ideas appearing to have commercial potential. 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. Offeror shall provide theoretical results that validate the performance of their aperture design in a M&S environment.
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 offeror 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.

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KEYWORDS: Antenna Apertures; Passive RF; Air Platforms; SWAP Reduction

AF254-D0812 TITLE: RAPTURE – Radio frequency Passive Technology for Ubiquitous Research and Engineering

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: This topic seeks to perform systems engineering, concept exploration, analysis, modeling and simulation, test, and evaluation of passive Radio Frequency (RF) geolocation.

DESCRIPTION: The Air Force Research Laboratory's (AFRL) Multispectral Sensing and Detection Division is developing technologies to provide survivable, adaptive, passive, situational awareness for contested, highly contested, and anti-access environments, to include the space domain. The importance of timely, accurate, and relevant sensing capabilities is paramount to ensure the success of critical warfighter operations. Often, these operations require sensing capabilities that have minimal or no active transmissions to maintain a strategic and/or tactical advantage, thereby elevating the need for passive sensing systems.
The Multispectral Sensing and Detection Division is exploring passive sensing systems and operations across a wide range of systems, from the Air Forces' newest manned platforms, un-manned collaborative systems, and space-based systems. The focus of this effort is to investigate a common baseline for passive geolocation that can be applied across platforms such as high-end systems with sophisticated architectures and processor intensive approaches to a subset of the capability to size, weight and power (SWaP) limited platforms seen in small satellite applications. That is, sophisticated techniques may reside on large space platforms (where the system bus is of 10kw and greater) to small cube satellites that may only consist of a few watts.
This focus directly supports the SECAF's Operational Imperative #4 (Tactical Air Dominance) and Operational Imperative #6 (Global Strike) by supporting the geolocation of RF signals of objects of interest.
An area of interest is how the Government can take advantage of commercial capabilities without taking sole ownership or creating a unique aspect that is Government only, thereby driving up life cycle cost. Another aspect of interest to the Government is the ability to influence designs early on so that if there are unique Department of Defense (DoD) requirements, they can be incorporated into the commercial product enabling a dual-use aspect.
The goal of this effort is to investigate concepts for passive RF geolocation to determine technical feasibility and risk, programmatic costs, and schedule. The information, test, and evaluation (T&E) under this effort will be used to influence and guide passive RF geolocation efforts. This topic is intended to reach companies capable of completing a feasibility study and prototype validated 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 main deliverables will be modeling and simulation (M&S), T&E of concepts that advance the viability and utility of innovative passive RF geolocation systems that support the reshaping, refocus, and re-optimization of the Air and Space Force Departments to deter and prevail in an era of Great Power Competition (GPC).

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 offeror 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 and extensive M&S results. 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. 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 offeror 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 offeror 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.

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2. S. Abulgasem, F. Tubbal, R Raad, P. Theoharis, S. Lu, S. Iranmanesh, "Antenna Designs for CubeSats", IEEE Access (Vol 9), mar 2021.

KEYWORDS: Passive RF Sensing; Modeling and Sim; Air and Space Systems

AF254-D0813 TITLE: Development of KGd(WO4)2 Crystals for Solid-State Raman Laser Applications

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE); Space Technology; Emerging Threat Reduction; Advanced Materials

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this SBIR is to develop an on-shore commercial supply of bulk KGd(WO4)2 single crystals that can be used for various DoD applications. The bulk crystals toward the end of a Phase III should be 50 x 50 x 50mm to handle the anticipated lasing requirements.

DESCRIPTION: Solid state lasers are required for a vast array of Air Force platforms and systems, particularly for Infrared Counter Measures (IRCM), Directional Infrared Counter Measures (DIRCM), and long-range sensing applications. Emerging technology is driving laser source development towards multi-spectral and high energies needed to engage adversarial systems. There are currently no direct generation sources that meet these demands. The traditional approach of using parametric conversion nonlinear optics to provide spectral diversity can no longer necessarily support the evolving required high energies; parametric crystals are simply not available in sufficient sizes to cope with the anticipated pulse energy requirements needed today.

Solid State Raman lasers could provide a solution to many of the issues. Materials such as Potassium Gadolinium Tungstate (KGW) have historically been grown to very large sizes. This class of laser material is highly adaptable to a number of configurations, ranging from a simple “pass-through” to operation as a resonator (external or intracavity), and as master oscillator power amplifiers (MOPA) devices. KGW can even be doped with primary rare earth elements such as Yb, Nd, Er, Tm, and Ho, to create a hybrid device that generates its own pump light to drive the Raman process. The Raman process itself is stimulated amplification of light that is inelastically scattered by the host material. Stimulated Raman conversion can be extremely efficient (>70%) and can generate a range of wavelengths, each separated by a frequency that is characteristic of the Raman material being used. Stimulated Raman scattering is a third order optical nonlinearity and as such requires generally higher optical intensities than second order parametric processes. Fortunately, the bulk optical damage threshold for KGW is of the order of several hundred Joules per cm2, making it very suitable for scaling to high energies. However, there are currently no domestic sources available for this material.

This Direct to Phase II (D2P2) SBIR is seeking to develop a commercial on-shore supply of bulk KGW crystals. Historically, bulk crystals of KGW have been grown by the Top Seeded Solution Growth (TSSG) technique with excess potassium tungstate added to the melt to account for volatility of this species and prevent nonstoichiometry. [1-5] KGW crystals have also been grown via Kyropoulos[6], and top nucleated floating crystal method [7], whereas the Bridgman technique has been demonstrated for the yttrium analogue of KGW.[8] The crystal sizes and quality obtained via TSSG and other techniques demonstrate a level of manufacturing maturity suitable for a D2P2 SBIR effort.

Phase II SBIR Objectives:

Year 1: 5 x 5 mm aperture with at least 25 mm path length; b-axis, (010) direction

A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)

Damage threshold for the finished crystals to exceed 20 Joules per square cm.
Delivery of 1 finished crystals of each size and each waveband (i.e. 2 total per year)
Year 2: 10 x 10 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 20 Joules per square cm.
Delivery of 2 finished crystals of each size and each waveband (i.e. 4 total per year)
Phase III SBIR Objectives:
Year 1: 25 mm x 25 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 50 Joules per square cm.
Delivery of five finished crystals of each size and each waveband (i.e. 10 total per year)
Year 2: 50 mm x 50 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 50 Joules per square cm.
Delivery of five finished crystals of each size and each waveband (i.e. 10 total per year)

PHASE I: In a Phase I effort, demonstration of a viable growth technique to produce monoclinic KGW crystals with sizes of 5 x 5 x 5mm would be required. The chosen crystal growth technique would be need to be scalable to the dimensions provided in the Phase III topic description. The Phase I effort wouldn't require demonstration of an AR coating or damage threshold measurements. Given the number of publications and knowledge based established this doesn’t fit the “establishing feasibility” that accompanies Phase I efforts. Growth is feasible by TSSG especially and a few US-based small businesses have already proven capable of surpassing the Phase I requirements. Thus, a D2P2 is the more preferred method to bring this material to commercialization in an expedient manner.

PHASE II: Year 1: 5 x 5 mm aperture with at least 25 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 20 Joules per square cm.
Delivery of 1 finished crystals of each size and each waveband (i.e. 2 total per year)
Year 2: 10 x 10 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 20 Joules per square cm.
Delivery of 2 finished crystals of each size and each waveband (i.e. 4 total per year)

PHASE III DUAL USE APPLICATIONS: Year 1: 25 mm x 25 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 50 Joules per square cm.
Delivery of five finished crystals of each size and each waveband (i.e. 10 total per year)
Year 2: 50 mm x 50 mm aperture with at least 50 mm path length; b-axis, (010) direction
A/R coated to cover the first three Stokes wavelengths for green pumping and 1 micron pumping (can be separate coatings or a single coating to cover all the wavebands)
Damage threshold for the finished crystals to exceed 50 Joules per square cm.
Delivery of five finished crystals of each size and each waveband (i.e. 10 total per year)

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KEYWORDS: KGW; KGd(WO4)2; Raman; Laser; Crystal Growth; TSSG; Bridgman; IRCM; Nonlinear

AF254-D0814 TITLE: Advanced, low latency, Peer to Peer Protocols for Autonomous Collaborative Platforms

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Network System-of-Systems; Mission Readiness & Disaster Preparedness; Advanced Computing and Software

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop/evolve, demonstrate and standardize a protocol for secure peer to peer off-grid or private networked systems optionally bridged to the internet or securely to other enclaves through the internet. The protocol, reference implementation and hardware should be designed and implemented with resilience in the presence of disrupted, degraded, distributed and low-/no-infrastructure communications in mind. The resulting protocol should be runnable by existing low end embedded radio hardware (often of foreign manufacture) or newly developed US-sourced hardware with low cost, size, weight and power. Other use cases may include low power enabled hardware in a remote location that is connected to sensors for other hardware to collect and report data from. The protocol should be configurable to support many use cases without burdening less capable hardware.

DESCRIPTION: Support for global position information, acquired from a host or embedded hardware, should be optional and leveraged for tracking and network traffic assistance when possible. The hardware should optionally have its own GNSS or leverage the location from the host system/sensor and be capable of supporting a wide variety of existing standards as well as those developed/implemented here.
The protocol should provide a means for hardware to be power- and position-aware and optimize the device- and system-power (transmit power and remaining battery) to maximize network capabilities. If the network architecture is better optimized for a particular purpose it should be possible to easily configure in any combination of a star-, federated- or purely peer-to-peer network. The protocol should allow for either authorized-only, or a mix of open and authorized traffic, and the ability to pass authorized traffic silently across open network nodes optionally through intermediate nodes specifically integrated to these nodes. The protocol, implementation and hardware should all be exportable in accordance with a Department of Commerce EAR-99 classification (and therefore be “non-ITAR”). The hardware should have compatibility with earlier network protocols.
The protocol should be targeted to be useful for low-cost sensor networks, trackers for logistics and human digital communications (ground to ground, local ground to air and ground/air to space) purposes. The protocol should also be able to handle transmitting and loading third party payloads for embedded systems or side loading them, easy integration with sensor boards/systems (optionally via wireless protocol such as Bluetooth) and “gateways” (to other communications architectures such as cellular or satellite), and be integratable with existing mobile applications.
It is desirable, but not required, that the lowest levels of the stack optionally provide for a transmission layer with low probability of detection/intercept, which can be switched out for the public standard discussed above. That lowest layer need not be EAR-99.
The resulting protocol/implementation may be based on an existing protocol. Non-exhaustive example standard protocols/implementations which might be modified/merged/extended to meet this topic include LoraMesh, LoraWan, LoraP2P, Dash7, Meshtastic, Cluster Duck Protocol, Zigbee, Wi-SUN and Thread.

PHASE I: The feasibility study for the proposed technology should have assessed various aspects to substantiate that the technology is at an acceptable stage to award a D2P2. The technology should support optional global position information acquisition from a host or embedded hardware and leverage this information for tracking and network traffic assistance, while being capable of supporting a wide variety of existing standards and those developed/implemented. The protocol should provide a means for hardware to be power- and position-aware and optimize the device- and system-power to maximize network capabilities. The network architecture should be configurable in any combination of a star-, federated- or purely peer-to-peer network. The protocol should allow for either authorized-only, or a mix of open and authorized traffic, and the ability to pass authorized traffic silently across open network nodes. The hardware, protocol, and implementation should all be exportable in accordance with a Department of Commerce EAR-99 classification, and the technology should have compatibility with earlier network protocols. The protocol should be targeted to be useful for low-cost sensor networks, trackers for logistics and human digital communications, and be able to transmit and load third-party payloads for embedded systems or side loading them. The feasibility study should have provided sufficient evidence of the technology's ability to meet these requirements. Based on these expectations, the proposer's technology should be at an acceptable stage to award a D2P2.

PHASE II: Support for global position information, acquired from a host or embedded hardware, should be optional and leveraged for tracking and network traffic assistance when possible. The hardware should optionally have its own GNSS or leverage the location from the host system/sensor and be capable of supporting a wide variety of existing standards as well as those developed/implemented here.
The protocol should provide a means for hardware to be power- and position-aware and optimize the device- and system-power (transmit power and remaining battery) to maximize network capabilities. If the network architecture is better optimized for a particular purpose it should be possible to easily configure in any combination of a star-, federated- or purely peer-to-peer network. The protocol should allow for either authorized-only, or a mix of open and authorized traffic, and the ability to pass authorized traffic silently across open network nodes optionally through intermediate nodes specifically integrated to these nodes. The protocol, implementation and hardware should all be exportable in accordance with a Department of Commerce EAR-99 classification (and therefore be “non-ITAR”). The hardware should have compatibility with earlier network protocols.
The protocol should be targeted to be useful for low-cost sensor networks, trackers for logistics and human digital communications (ground to ground, local ground to air and ground/air to space) purposes. The protocol should also be able to handle transmitting and loading third party payloads for embedded systems or side loading them, easy integration with sensor boards/systems (optionally via wireless protocol such as Bluetooth) and “gateways” (to other communications architectures such as cellular or satellite), and be integratable with existing mobile applications.

PHASE III DUAL USE APPLICATIONS: The expected TRL at Phase III entry would be around TRL 6-7, indicating that the technology has been demonstrated in a relevant environment, and is ready for deployment in an operational environment. This would entail the successful integration of the protocol with various sensor boards/systems and "gateways" (to other communications architectures such as cellular or satellite), as well as its compatibility with existing mobile applications.
In terms of transition planning, the project would need to address regulatory compliance, such as ensuring the hardware and protocol adhere to export control regulations. Additionally, the project would need to consider the development of a business or transition plan, outlining the strategy for commercialization or broader adoption of the technology. This would include identifying potential markets, partners, and customers, as well as a plan for ongoing support, maintenance, and updates to the technology.
The expected Phase III effort for this project would involve further development and refinement of the proposed global position information protocol, aimed at supporting low-cost sensor networks, trackers, and human digital communications. This would include the finalization of the protocol's design, ensuring its compatibility with existing communication standards, and its integration with host or embedded

hardware. The hardware component would be designed to optionally include its own GNSS or leverage the location from the host system/sensor, with exportability in accordance with a appropriate government classification/requirements.
Commercial or private industry uses for the products/prototypes developed through this topic could include low-cost sensor networks for agriculture, environmental monitoring, and industrial automation, as well as secure peer-to-peer communication between drones or other autonomous vehicles. These networks could be used for data collection, real-time monitoring, and control of remote devices in environments with limited or no cellular coverage. The protocol's ability to optimize device and system power, as well as its configurable network architecture, would make it well-suited for a wide range of commercial and industrial applications. Additionally, the protocol's low latency and high resilience could make it useful for real-time data transfer in edge computing applications, where data is processed close to the source rather than in a centralized cloud. Finally, the protocol could be used for secure communication in Internet of Things (IoT) devices, protecting against potential cyber threats and ensuring the privacy of sensitive data.

REFERENCES:
1. https://www.semtech.com/lora/what-is-lora

KEYWORDS: LoraMesh; LoraWan; LoraP2P; Dash7; Meshtastic; Cluster Duck Protocol; Zigbee; Wi-SUN; thread

Version 5

AF254-D0815 TITLE: Visual Position and Navigation Capability Using Computer Vision for SUAS in GPS-Denied Environments

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. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The primary objective is to develop a robust and reliable visual navigation system that ensures uninterrupted drone operations in environments where GPS signals are unavailable, degraded, or subject to jamming. The proposed technology should utilize advanced computer vision algorithms to analyze visual data from the drone's onboard camera, detect and recognize skylines and terrain features, and match these features against a precomputed and preprocessed satellite data repository. This system must deliver high accuracy, with geolocation precision within five meters, ensuring mission success in challenging operational scenarios.

DESCRIPTION: This topic seeks to develop a software-only visual position and navigation capability using computer vision, tailored for deployment on commercial off-the-shelf (COTS) drones operating in GPS-denied environments. The desired solution should leverage existing cameras, storage, and computational resources on these drones to provide accurate, real-time navigation and positioning without the need for additional hardware.

PHASE I: In order to substantiate that the proposer's technology is currently at an acceptable stage to award a Direct to Phase 2 (D2P2) contract, a previously completed feasibility study is expected. This study should have demonstrated the technology's ability to address key requirements such as compatibility with a wide range of COTS drones, terrain feature detection and matching, data security and resilience against cyber threats, and feasibility of the technology through simulations and field tests. By providing evidence of a completed feasibility study that addresses these key requirements, the proposer can demonstrate that their technology is currently at an acceptable stage to award a D2P2 contract.

PHASE II: This topic seeks to develop a software-only visual position and navigation capability using computer vision, tailored for deployment on commercial off-the-shelf (COTS) drones operating in GPS-denied environments. The desired solution should leverage existing cameras, storage, and computational resources on these drones to provide accurate, real-time navigation and positioning without the need for additional hardware.

Deploying a visual navigation system on COTS drones significantly enhances the operational capabilities of the Air Force by providing a resilient alternative to GPS-based navigation. This software solution allows for rapid integration across various drone platforms, eliminating the need for specialized hardware modifications. The capability to maintain accurate positioning and navigation in GPS-denied environments is crucial for reconnaissance, surveillance, and logistics missions, particularly in contested or remote areas. By leveraging existing drone sensors and computing power, the proposed technology ensures cost-effective scalability and operational flexibility.

The proposed solution must be compatible with a wide range of COTS drones, utilizing their onboard cameras and computational resources to minimize additional weight and power consumption. The system should employ machine learning and computer vision techniques to achieve terrain feature detection and matching. It must be capable of operating under diverse environmental conditions, including urban canyons, dense foliage, and varied lighting. Additionally, the software should provide easy integration through an API, supporting rapid deployment and updates, and ensure data security and resilience against cyber threats. The solution should demonstrate the feasibility of the technology through simulations and field tests, showcasing the system's performance and reliability in relevant operational scenarios as well as integration with Android Tactical Assault Kit (ATAK).

PHASE III DUAL USE APPLICATIONS: The expected Phase III effort for this project would involve further development, testing, and refinement of the software-only visual position and navigation capability using computer vision. This would entail optimizing the software to leverage existing cameras, storage, and computational resources on commercial off-the-shelf (COTS) drones, ensuring compatibility with a wide range of drone platforms. The software would need to employ machine learning and computer vision techniques to achieve terrain feature detection and matching, with the ability to operate under diverse environmental conditions, such as urban canyons, dense foliage, and varied lighting. Additionally, the software should provide easy integration through an API, supporting rapid deployment and updates, and ensure data security and resilience against cyber threats.
The expected TRL at Phase III entry would be around TRL 6-7, indicating that the technology has been demonstrated in a relevant environment, and is ready for deployment in an operational environment. This would entail the successful integration of the software with various COTS drone platforms, as well as its compatibility with the Android Tactical Assault Kit (ATAK).
In terms of transition planning, the project would need to address regulatory compliance, such as ensuring the software adheres to data privacy and security regulations. Additionally, the project would need to consider the development of a business or transition plan, outlining the strategy for commercialization or broader adoption of the technology. This would include identifying potential markets, partners, and customers, as well as a plan for ongoing support, maintenance, and updates to the software. Furthermore, collaboration with drone manufacturers and operators would be crucial to ensure seamless integration and adoption of the technology.
Potential commercial and private industry applications for the proposed technology include precision navigation, reconnaissance, search and rescue, and commercial vision metadata tagging. The technology could be used to guide autonomous drones for surveillance and tactical support in military operations, improving situational awareness and mission success. In first responder cases, the technology could monitor and guide autonomous search and rescue equipment, improving safety and efficiency. In commercial vision metadata tagging, location accuracy within feet/meters is required for various applications, such as image geotagging and object tracking. By addressing these needs, the proposed technology has the potential to be a viable solution for various industries, providing a resilient alternative to GPS-based navigation. The technology's better vision and location capabilities without the use of a GPS could also lead to significant energy savings, reduce costs, and avoid sensitive areas such as airports or flying below certain altitudes for legal reasons.

REFERENCES:

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2. F. Cappello, S. Ramasamy and R. Sabatini, "A low-cost and high performance navigation system for small RPAS applications," Aerospace Science and Technology, vol. 58, pp. 529-545, 2016, doi: 10.1016/j.ast.2016.09.017.
3. A. Appleget, J. Watson, J. Gray and C. Taylor, "Navigating a sUAS without GNSS," Inside GNSS, May 29, 2023. [Online]. Available: https://insidegnss.com/navigating-a-suas-without-gnss/

4. J. Kim, K. Lin, S. M. Nogar, D. Larkin and C. M. Korpela, "Detecting and Localizing Objects on an Unmanned Aerial System (UAS) Integrated with a Mobile Device," 2021 International Conference on Computing, Networking and Communications (ICNC), San Diego, CA, USA, 2021, pp. 546-550.
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6. La and M. Matson, "ATAK Integration through ROS for Autonomous Air-ground Team," 2021 IEEE International Systems Conference (SysCon), Vancouver, BC, Canada, 2021, pp. 1–5, doi: 10.1109/SysCon48628.2021.9476676.

KEYWORDS: SUAS, ALT-PNT, Computer Vision on SUAS

AF254-D0816 TITLE: Lightweight Optical Turret for Extended Capability HEL (LOTECH)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To develop a fully functional lightweight 10 centimeter class high energy laser beam director for tactical airborne applications. The beam director must be capable of propagating a high energy laser from a transsonic (Mach 0.8) airborne platform while effectively compensating all relevant aero-effects in order to maintain low jitter and effective focusing of the beam on a non-cooperative target.

DESCRIPTION: The Air Force requires a light weight beam director suitable for integration onto a small airborne platform for tactical high energy laser applications on transsonic aircraft. Significant previous development and testing has been conducted on such beam director concepts, and have shown success mitigating many of the aero-effects which significantly degrade performance of airborne laser systems[1],[2]. Several beam director concepts have been flight tested[3], however those devices were generally built as subscale models to evaluate certain aspects of the aero-effects mitigation, and were not fully functional optical beam directors capable propagating a well focused beam to a non-cooperative target. Recent analysis has shown that there is utility in beam directors with 10 centimeter class aperture sizes. The purpose of this topic is to develop a fully functional beam director of that size class, based on previously developed and demonstrated aero-effects mitigation technologies. The Air Force Research Laboratory has significant experience in designing systems for aero-effects mitigation and will work collaboratively with the contractor on selection and development of the desired system architecture.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Air Force expects the applicant(s) to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Applicant(s) may demonstrate feasibility in the following manner(s):
Development and testing of high energy laser (HEL) turrets for airborne applications
Development of beam control systems for high energy laser applications
Development and performance modeling for aero-effects mitigation (mechanical and optical)

PHASE II: Complete the design of a beam director prototype through critical design review to include all functionality necessary to propagate a laser beam from an airborne platform while maintaining low jitter and effective focusing of the beam on target. The turret should be 10 centimeter class and able to cover a full 360 degrees in azimuth and 150 degrees in elevation. Work collaboratively with the Air Force on selection of aero-effects mitigation approach and defining interfaces with laser, beam control system, and desired airborne platform.

PHASE III DUAL USE APPLICATIONS: Fabricate and integrate the beam director with an Air Force laser and beam control system for use in the Airborne Laser Weapon System Program currently scheduled to start in FY27. Support Air Force in integrating device into the selected aircraft platform and conducting flight testing of the fully integrated high energy laser system. Support the Air Force in developing plans for transition of this technology to a program office and operational customers.

REFERENCES:

1. Crahan, G., “Turret Optimization Using Passive Flow Control to Minimize Aero-Optic Effects”, Ph.D Dissertation, Dept of Aerospace and Mechanical Engineering, University of Notre Dame, Notre Dame IN, 2014;
2. Vukasinovic, B., Glezer, A., Gordeyev, S., Jumper E., Bower, W.W, “Flow Control for Aero-Optics Application”, J Exp Fluids 54:1492, 2013;
3. Jumper, E., Gordeyev, S, Cavalieri, D., Rollins, P., Whiteley, M., Krizo, M., “Airborne Aero-Optics Laboratory - Transonic (AAOL-T).”, 53rd AIAA Aerospace Sciences Meeting (2015).

KEYWORDS: beam director; aero-effects

AF254-D0817 TITLE: Conformal, Agile, Beam-Steering High Power Microwave Antenna

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Deliver an S-band high power, frequency-scalable, steerable, lightweight, conformal antenna. This capability would significantly advance the state-of-the-art of high power microwave antennas by taking advantage of advances in antennas for communication and adapting them to the extreme power handling requirements of directed energy weapons. Applications could involve ground-based or air-based missions. A primary consideration will be power handling. The antenna must be able to perform with high peak power (>100 MW) and should also be able to operate at moderate average power (~ kW). Designs which can maintain these power levels even when scaled to high frequency bands, such as Ku-band, will be prioritized. Peak power density should meet or exceed 200 MW/m^2. Beam acceleration should be on the order of 100 degrees/s^2 with beam velocity exceeding this value. The goal is to quickly find track and maintain power on moving targets. This will also require wide angle steering with >60 degrees off of boresight desired. Meeting these requirements could involve use of electronic or mechanical beam steering. High gain (30 dBi minimum) is desired and gain loss at wide angles should be minimized, e.g. follow a cosine distribution where loss is only owing to projected area decrease with angle. Gain will be evaluated against antenna size and ability to array the antenna – i.e. how large can a single antenna be scaled and how much gain is lost if the antenna must be arrayed to achieve high gain. Side/grating/back lobes should be minimized. Antennas should have switchable linear polarization or circular polarization. High fractional bandwidth (>10%) is desired as a secondary attribute.

DESCRIPTION: The performance of this direct to Phase II should include extensive modeling/simulation/theory of antenna and antenna feed that demonstrate ability to meet topic objective including scalability of design to different frequencies. Use of full-wave EM software such as HFSS, CST, and ICEPIC, is encouraged. For breakdown and power handling limits simulations should show fields which correspond with known models for breakdown (e.g. Kilpatrick criterion) and published dielectric breakdown and flashover strengths. Software such as SPARK3D may also be useful in this regard. For anything exceeding such limits, breakdown mitigation techniques can be proposed. Following design stage, it is also required that a prototype antenna be fabricated and tested to demonstrate key performance parameters. Antennas can be evaluated at AFRL facilities to demonstrate power handling capabilities. Those advancing to Phase III must have demonstrated a functional high power antenna or have a path forward to fix issues encountered in Phase II. Refinements can include design of control electronics to handle high power microwaves, polarizers, optimization to increase bandwidth, and improvements for managing shock and vibration. In Phase III antennas will need to refined and be scaled to operate at high frequency. Beam steering antennas arrays must be demonstrated with low side/grating/back lobes.

PHASE I: Phase 1 awardees should demonstrate through theory and simulation and/or prototype an S-band antenna design which can meet the high performance requirements of the topic objective (frequency-scalable, steerable, lightweight, conformal). Key requirements include gain as a function of beam steering angle, antenna acceleration/deceleration and max velocity, polarization. Side/grating/back lobes should be minimized. The antenna should be reasonably amenable to high power operation in at least the MW regime (e.g. designs based on architectures such as microstrip that are known to be low power handling should not be considered unless a clear power handling strategy is given). Quarterly reports should be sent to AFRL and a final report should be written to include antenna design and verification of all required/key performance parameters including raw data, standard operating procedures, and analyses of experiments vs. simulation/theory.

PHASE II: Phase 2 awardees should procure necessary materials to design, fabricate, and test antennas. Experiments should be performed to demonstrate key performance parameters including gain as a function of beam steering angle, antenna acceleration/deceleration and max velocity, polarization. Side/grating/back lobes should be characterized. Through theory/simulation/experiment it should be demonstrated that the antenna and feed either can or can be reasonably expected to meet power handling requirements. Quarterly reports should be sent to AFRL and a final report should be written to include antenna design and verification of all required/key performance parameters including raw data, standard operating procedures, and analyses of experiments vs. simulation/theory. A plan for Phase III should be provided.

PHASE III DUAL USE APPLICATIONS: Phase 3 awardees must build a high power antenna as outlined in Phase 2 and the topic description with all breakdown issues resolved. This antenna will include refinements including high power motor controls and ability to polarize beam arbitrarily across steering angles. Antenna should be tested for shock and vibration performance. Arrays of 2 or more antennas shall be demonstrated exhibiting low side, back, and grating lobes with emphasis on key performance parameters including maximum power handling (peak and average) and gain and beam agility to wide angles. Designs should be provided which demonstrate ability to scale to higher frequencies (preferably up to Ku-band) without breakdown through use of modeling and simulation and comparisons to previously determined power/field handling limits on S-band design. Contractor will work with DoD and other industry partners to identify more applications of technology including electronic warfare, radar, and communications.

REFERENCES:

1. Benford, James, John A. Swegle and Edl Schamiloglu. High Power Microwaves, Third Edition. CRC Press, 2019.;
2. Balanis, Constantine A. Antenna Theory: Analysis and Design, Fourth Edition. Wiley, 2016;
3. A. Janicek, et. al. "Review of High Power Microwave Weapon System Antennas: Part 1 - AFRL Affiliated Antennas" DTIC 2023;
4. Y. Sun, et al., "Ku-Band Radial-Line Continuous Transverse Stub Antenna with Transmit-Array Lens for High-Power Microwave Application" IEEE Transactions on Antennas and Propagation, 2020.;
5. Y. Sun, et al., “A Beam-Steerable Lens Antenna for Ku-Band High-Power Microwave Applications” IEEE Transactions on Antennas and Propagation, 68 (11), 2020;
6. W. Milroy, et al. “Variable Inclination Continuous Transverse Stub Array” U.S. Patent 6 919 854 B2, 19 July 2005;
7. W. Milroy, “Continuous Transverse Stub Element Devices and Methods of Making Same” U.S. Patent 5 266 961, 30 November, 1993;

KEYWORDS: High power; HPM; antenna; MW; GW; S-band; microwave; peak power; array; counter electronics; directed energy;

AF254-D0818 TITLE: Cold Field Emitter Arrays for HPM

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Establish a modular field emitter array that can be implemented in wide array of devices for generating electron beams and be a reasonable alternative to both thermionic and explosive cold emitting cathodes. These arrays yield consistent performance over hours of on time without the need for a heating element, giving predictable current densities when exposed to known field strengths. The beams are low emittance and compressible using electrostatic and magnetic focusing to give high current density without significant scalloping. These emitters arrays can be scaled to deliver 100s of amperes of total current and provide a variable level field enhancement versus emitting area depending on the application.

DESCRIPTION: Develop Spindt type field emitter arrays at small scale that can be mounted to a cathode and have voltage applied to initiate a beam. The geometry of the field emitter array should be consistent across individual arrays and between multiple arrays. The resulting turn on field value and emitted current density as a function of voltage should be predictable. Preferably, several array geometries should be developed that explore the trade space between field enhancement, emission area, and durability. A minimum lifetime of arrays should be evaluated as a function of the applied field and resulting current density.
Once field emitter arrays have been established at small scale, they should be increased in size or arrayed to create a cathode that can deliver HPM relevant total currents. Proposals should include guidance for mounting emitters and making proper electrical connections. The large area cathode will be evaluated for total current, uniformity of current, and longevity. A cathode composed of an array of field emitter arrays where individual emitters are modular and can be exchanged when necessary is desirable.

PHASE I: Proposals should have demonstrated the ability to create small scale field emitting arrays and measure relevant metrics such as the current versus applied field and the lifetime of the array. The field strength needed to initiate current draw should demonstrate field enhancement at the emitter tips. The magnitude of field enhancement should be known for a given field emitter array geometry. Current densities in excess of 1 Ampere per square centimeter should be demonstrated. Active time for the emitters should demonstrate run times greater than 1 hour with less than 5% change in current draw over that time. Proposals should have plans for scaling the manufacturing capability to deliver the total currents expected in the phase II while keeping costs competitive with existing high performing electron gun technology.

PHASE II: Awardees will fabricate a number of small arrays and internally test the conformity between arrays. These tests will evaluate the statistical variance in field enhancement factor, current density as a function of applied field, and likelihood of exceeding a minimum lifetime. If multiple geometries of field emitter array can be fabricated, only a few (2 – 3) of these will be chosen to undergo conformity analysis. With small scale emitters validated, awardees will propose plans to construct a cathode capable of delivering 100 – 300 Amperes of total current. Awardees will provide the field emitter arrays necessary for this, either an array of small scale arrays or a single large array. They will also either recommend a

procedure and provide any of the materials necessary for mounting the emitters to a cathode substrate, or supply the emitters already mounted to a metallic cathode that can be incorporated into an AFRL test stand.
AFRL facilities will be used to pulse the cathodes at high rep rates. The cathode will be investigated for compatibility with HPM sources measuring the total current as a function of applied field, emission pattern, lifetime under pulsed operation, and vacuum degradation. The technical and financial feasibility of implementing these emitters as an alternative to thermionic and explosive emitters will be evaluated and discussed in a final report.

PHASE III DUAL USE APPLICATIONS: Technology readiness level shall be level 4 at entry to phase III. Cathode arrays relevant to high power microwave sources are likely to be of continued interest and modular, source agnostic electron guns would be a valuable asset that a phase III could deliver. Proposals should additionally mature cathode technology and standardize operating parameters for a range of applications. Pursue commercialization and identify applications beyond directed energy research. Identify commercial partnerships and collaborators.

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2. R. J. Barker and E. Schamiloglu, High Power Microwave Sources and Technologies. IEEE Press, 2001.

KEYWORDS: Cold Field Emitter Array; Spindt Array; High Power Microwaves; Electron Beams; Directed Energy

Version 5

AF254-D0819 TITLE: Omni directional aircraft mover for F-16

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Infrastructure & Advanced Manufacturing; Human-Machine Interfaces

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Moving aircraft in all directions regardless of the direction the aircraft is facing for moving aircraft into docks and paint bays with little or no tow lane.

DESCRIPTION: Aircraft maintenance and repair operations often require frequent movements between locations for various stages of the process, particularly during corrosion control activities. Traditional aircraft tugs are typically used to move the aircraft between locations but result in limitations due to turning radii and operator skill. As processes become increasingly automated, aircraft are required to be placed accurately relative to automated tooling. Accurate placement is a challenge with current technology. Using a multi-directional aircraft mover would reduce to lanes by up to 50% percent and allow for precise location of aircraft for robotic and other automated activities.

PHASE I: The previous efforts were testing robotic and remote-control vehicles, but none were used to carry an aircraft in omni-directional paths. Commercially available systems are available for cars, but none have the capability to carry an aircraft. In discovery we found a Hilti Aircraft Cradle and a Tow Flex. Both types of systems are used in depot maintenance of aircraft. The omni directional aircraft mover would combine both systems by making a powered base similar to the Tow flex except that it could move in all directions like a robotic base with a cradle system that would hold the aircraft with the gear up or down.

PHASE II: The previous efforts were testing robotic and remote-control vehicles, but none were used to carry an aircraft in omni-directional paths. Commercially available systems are available for cars, but none have the capability to carry an aircraft. This project would need to be strengthened compared to the automotive version. It would also need to be able to work seamlessly to not put any undo stress on the aircraft in directions that the aircraft is not designed for.

PHASE III DUAL USE APPLICATIONS: If successful, it is expected that phase 3 would be to use CIP dollars to procure multiples of these systems. They could be used in all depots and possibly even in field units.

REFERENCES:

1. OO-ALC/309 AMXG aircraft moving specs

KEYWORDS: Aircraft moving; Aircraft Tug; Omni-Directional; Robotic: Remote-control

AF254-D0820 TITLE: F-35 Scuff Sanding Test and Demonstration

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Human-Machine Interfaces; Advanced Infrastructure & Advanced Manufacturing

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Robotic scuff sand JSF(F-35) for refresh coating

DESCRIPTION: Strip and recoat programs are time and labor intensive, with little margin for error. Several programs, including F-35, have installed robotic coating systems to streamline the coating process. This program would like to further leverage the robotic capitol investment to auto-sand the coatings using real-time thickness feedback, as well as automatically scuff-sand for recoating. Autosanding would reduce sanding span time, while allowing technician labor to be re-tasked to other processes. By automating it we expect to reduce this time by at least half. Currently, sanding is an incredibly labor intensive repetitive process. Due to the laborious nature of the job, programs have seen a high employee turnover and lack of uniformity of human performed sanding. Depots and production have seen a dramatic increase of injuries to their workforce because of the prolonged and repetitive nature of the materials being sanded.

PHASE I: SBIR contract FA8650-08-C-5307 for AF071-112 topic is very similar to what is required for this project. The test and demonstration need to find the pressure, feeds and speeds for robotic scuff sanding of F-35 top coatings. The contractor would also need to demonstrate the capability to do finite sanding in hard-to-reach areas with complicated geometries.

PHASE II: This project would use past development to develop the applied pressure, feeds and speed for the scuff sanding operation. It would also optimize the size of the sanding head and the amount of heads required to make this operation optimal for use. A prototype system would need to be delivered to show the capability of reach and sanding all oml areas of the JSF aircraft.

PHASE III DUAL USE APPLICATIONS: If successful it is expected that phase 3 would be to use currently programmed activation dollars to procure multiple robotic sanding and coating booths for the F-35 scuff and refresh program. At phase 3 it expected to be TRL 8 proven for F-35(JSF) with proven production operating parameters.

REFERENCES:

1. Lockheed Martin Process Specification 2ZZP00072

KEYWORDS: Robotic Sanding

AF254-D0821 TITLE: Advanced Prediction of Polymer Performance

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To provide validated data and tools for the prediction of fatigue performance of parts printed from AF approved polymers. To provide training to program office engineers on the use of the prediction tools, their limitations and validation approaches to guide testing and approval of parts for use.

DESCRIPTION: Develop a mechanical behavior model that accounts for the anisotropy of a fused filament fabricated material.

PHASE I: PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The offeror 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 the scientific and technical merit and feasibility of ideas appearing to have commercial potential. This feasibility study must include an assessment of the state of the autonomous and adaptive repair processes and how offeror's innovations contribute to cost and schedule reductions for labor costs, material costs, and non-recurring engineering costs. This assessment should validate the product-market fit between the proposed solution and a potential AF stakeholder. The offeror should have defined a clear, immediately actionable plan with the proposed solution and the AF customer.

PHASE II: Develop a mechanical behavior model that accounts for the anisotropy of a fused filament fabricated material. The materials of interest are ULTEM 9085 and Antero 800NA.
Integrate fatigue analysis capability into the model.
Develop S-basis material property database for chopped carbon fiber reinforced FFF material of interest.
Manufacture and test geometries representative of AF components in the materials noted above.
Evaluate models efficacy on predicting size effects of FFF components and materials.

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transition, to include a broad range of potential government and civilian users and alternate 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.

Version 5

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3. High cycle fatigue behavior and thermal properties of PLA/PCL blends produced by fused deposition modeling, Kiani et.al, J Polymer Research v30, 7 2023.

KEYWORDS: Additive Manufacturing, PEKK; Fused Deposition Modeling, PEKK ; PEKK, Fatigue; ULTEM, PEKK;

AF254-D0822 TITLE: High-Resolution Tactile Fingertip For Intelligent Grasping

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: research, evaluate, and develop a compact, image-based tactile sensor with robustness suitable for industrial environments. Additionally, develop learning algorithms to successfully demonstrate dexterous manipulation tasks including pose estimation for part handling and placement.

DESCRIPTION: The use of robots in different industries has become widespread, though use cases are primarily limited to repetitive tasks involving moving components between known locations. As such, many tasks in manufacturing and maintenance activities still require manual labor from skilled human hands. The ability to automate dexterous manipulation tasks using robots would dramatically expand the use of robots in manufacturing and maintenance.
Recent developments in robotics using image-based tactile sensors have shown great progress towards dexterous manipulation. These sensors have demonstrated the ability to sense both shear and normal forces, detect slip, and determine the pose of an object in the grasp. High-resolution implementations of image-based tactile sensors have also demonstrated the ability to measure 3D surface geometry to micron-scale precision with broad applications in aircraft manufacturing and maintenance.
Commercially available image-based tactile sensors have been used successfully for academic research and development. To be deployed in industrial environments, these sensors need to be improved in several ways. The first area of improvement is form factor. Commercial image-based tactile sensors are between 25 mm to 30 mm thick due to the optical design. This device thickness limits integration into robotic hands and other gripper designs used for dexterous manipulation.
The second area of improvement for these sensors is the robustness of the elastomeric sensor. In industrial settings, these sensors should survive at least 50,000 grasps before requiring replacement. This durability specification is at least an order of magnitude larger than the performance of current commercial elastomeric sensors. Still another area of improvement for these sensors is data rate. A higher-speed camera and faster algorithms could deliver 3D data at 50 fps as compared to the 25 fps delivered by current sensors.

PHASE I: For this Direct-to-Phase II topic, evaluators are expecting that the submittal firm demonstrate tactile sensors with the ability to perform intelligent tactile sensing tasks, including texture recognition, 3D shape estimation, and local force measurement. The submittal firm should demonstrate how the data from the sensors is used by an automation system to complete a tactile manipulation task.

PHASE II: Explore image sensor and optical designs to reduce device thickness. Evaluate elastomer formulations for durability in robotic grasping tasks. Explore tradeoffs between resolution and robustness. Develop prototype elastomeric sensors for testing in industrial environments and facilitate integration with a robotic system at an air logistics complex. Develop software algorithms for sensor simulation and sim-to-real transfer of tactile manipulation tasks. Quantify the accuracy of 3D shape measurement and local force measurement.

PHASE III DUAL USE APPLICATIONS: If the Phase II is successful in developing the technology, air logistics complexes will pursue Phase III opportunities to refine hardware and software in order to increase accuracy and reliability and scale to other systems at air logistics complexes and similarly situated operations. Achieve production-ready state for marketing to the Air Force, other related federal agencies, and private industry.

REFERENCES:

1. Johnson and Adelson. “Retrographic sensing for the measurement of surface texture and shape” IEEE Conference on Computer Vision and Pattern Recognition, 2009.
2. Yuan, et al. “Measurement of shear and slip with a GelSight tactile sensor”, IEEE International Conference on Robotics and Automation, 2015
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KEYWORDS: Industrial Tactile Sensing; Robotic Touch; Touch Sensor

AF254-D0823 TITLE: Shop Floor Human Detection Using Low-Cost Equipment

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Infrastructure & Advanced Manufacturing; Sustainment & Logistics

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: to develop a system that can achieve a third party safety rating comprised of software controls and three dimensional time-of-flight (ToF) sensors for data capture. This system will enable existing non-collaborative mobile heavy industrial robots to operate safely in human-populated settings, eliminating the need for static safety measures such as fencing, door interlocks, and light/laser curtains. To ensure a comprehensive field of view, the system will identify and process implied presence zones to account for blind spots in real time. The system must be compliant with international robotic safety standards, and be certified by a third party as PLd, Cat. 3 or SIL 2. This certification is the key here, systems that cannot obtain this certification would be considered unsuccessful.

DESCRIPTION: The industrial landscape is evolving, with increasing demands for automation in environments that are inherently dynamic and populated by human workers. Traditional safety measures, such as static fencing and interlocks, are inadequate in these settings, particularly when mobile robots are involved. These environments pose significant challenges to ensuring safety while maintaining operational efficiency.
In many industrial applications, robotic systems must adapt to varying conditions without compromising safety. The challenge is to create a system that can accurately detect and respond to human presence and other unexpected obstacles in real-time, ensuring that robots can function effectively without the need for external safety systems. Such a system must function for industrial robots mounted on mobile robots as well as for industrial robots mounted on rails, gantries, or pedestals.
This project seeks to develop a system using ToF sensor technologies combined with a custom control system that can map the three-dimensional environment in real-time as well as be integrated into an existing industrial mobile robot at an Air Logistics Complex in order to enable them to operate collaboratively and safely. The goal is to create a solution that not only addresses safety concerns but also enhances the operational capabilities of these robots in human-populated environments.

PHASE I: this is a Direct-to-Phase II initiative and companies must demonstrate, from the outset, a prototype system with the capability to interface with ToF sensors and robotic control hardware. They must demonstrate practical experience detecting unforeseen obstacles and humans using point cloud technology and accurately recognize the position of objects within a global coordinate system. Additionally, companies need to identify regions that are obscured or not visible to each camera in real-time and have an established methodology for incorporating blind spot information into the robotic control system to ensure comprehensive environmental awareness.

PHASE II: Create a functional prototype which communicates with an existing robotic system at an Air Logistics Complex via an application programming interface. This system would send safety signals to the robotic system, similar to traditional safety devices (e.g., pressure mats, light curtains). The system must communicate the detection of unexpected obstacles and humans inside the environment and within different zones (e.g., warning/slow, hazard/stop) in order to trigger appropriate responses from the robot. The prototype should allow for safe operation without the need for additional external safety measures. Furthermore, implement real-time mapping of the dynamic environment to improve the robot's operational flexibility, minimize false positives, and enhance overall system efficiency. Optimize the hardware and software to maximize performance, leading to a robust, reliable solution suitable for integration into an Air Logistics Center's robotic systems. The system will be compliant with international robotic safety standards and be certified by a third party as PLd, Cat. 3 or SIL 2.

PHASE III DUAL USE APPLICATIONS: If the Phase II is successful in developing the technology, the government would like to pursue a phase III to further develop autonomous decision-making algorithms that allow the robotic system to predict and adapt to environmental changes proactively by integrating advanced artificial intelligence-driven predictive analytics, enabling the robot to anticipate potential hazards before they arise. Moreover, Phase III’s would be leveraged to coordinate the technology between multiple robotic systems, allowing them to communicate and collaborate in real-time. Other Phase III activities would include scaling the solution to other robotic systems in a multitude of facilities and refine the prototype into a market-ready product that meets the requirements of federal agencies, such as the Air Force, while also being suitable for private industry applications. This solution should be customizable for deployment across various sectors, providing a scalable, reliable enhancement to robotic systems operating in diverse environments.

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2. Zanchettin. “Human tracking from quantised sensors: An application to safe human–robot collaboration.” 2023, Control Engineering Practice. https://doi.org/10.1016/j.conengprac.2023.105727
3. Marvel, Norcross. “Implementing speed and separation monitoring in collaborative robot workcells.” 2017, Robotics and Computer-Integrated Manufacturing. https://doi.org/10.1016/j.rcim.2016.08.001
4. Robla et al. “Visual sensor fusion for active security in robotic industrial environments.” 2014, EURASIP J. Adv. Signal Process. https://doi.org/10.1186/1687-6180-2014-88
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KEYWORDS: Industrial Safety; Human Detection

AF254-D0824 TITLE: Autonomous Internal Exploration and Inspection of Confined Spaces

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Sustainment & Logistics; Advanced Infrastructure & Advanced Manufacturing

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Research, evaluate, and select the proper sensing required and to develop software controls needed to enable robots to autonomously navigate within and with the required dexterously to inspect closed or confined spaces that are susceptible to unhealthy or low levels of oxygen, and/or may contain materials or noxious gasses that are hazardous to humans. The system will be prototyped with an existing robotic system at an air logistics complex.

DESCRIPTION: Confined or enclosed spaces such as fuel tanks are common across several military and industrial settings. They require regular exploration, internal inspections, and surveillance to the extent that they are hazardous to humans due to their low or unhealthy levels of oxygen, presence of toxic gases, and threat of flooding. Recent advances in robotics and sensors have eased external structural inspections. However, enclosed and confined spaces require robust map generation and localization. These robots must perform dexterous inspections (macro and micro) in low or zero light, adapt in real time to different shapes and geometries during inspections, and detect any critical or structural defects—all without relying on a working network connection or infrastructure.
As an example, current fuel tank inspections either require humans to crawl within a tight fuel tank or tele-operate a robot to take pictures of various clips, rivets, stringers and other components and to inspect tanks for cracks or signs of structural damage. Depending on what needs to be inspected and repaired, these inspections can range from a single shift to a few days to complete. This severely limits the number of fuel tanks that can be inspected in a reasonable amount of time and to meet the stringent requirements that the Air Force maintains in order to keep the fleet operational.
With the proper sensing and robotic controls in place, inspection robots can function efficiently and autonomously in closed spaces. Existing robotic systems require tele-operations and risk collision during retrieval or retraction. The development of this technology will allow robots to safely and autonomously inspect closed areas, such as fuel tanks, characterized by different geometries and dimensions, making these inspection systems more agile and impactful.

PHASE I: For this Direct-to-Phase II topic, evaluators are expecting that the submittal firm demonstrate the ability to autonomously inspect materials or objects safely in real-world environments with varying dynamic factors such as humans, birds, weather etc. through the use of Commercial Off The Shelf sensors. Demonstrate the accuracy and integration of these sensors into robotic systems and accurate performance of the robotic control system for inspections.

PHASE II: Develop a working prototype to autonomously navigate within and inspect closed spaces (such as fuel tanks) while accounting for unseen situations and scenarios using an existing air logistics complex robotic system. Maximizing the efficiency of the robotic system by allowing the robot(s) to operate autonomously and inspect fuel tanks of varying aircraft in a real-world environment with minimal external safety systems and no manual programming in this is critical.

PHASE III DUAL USE APPLICATIONS: If the Phase II is successful in developing the technology, the government would like to pursue a phase III to refine hardware and software in order to increase accuracy and reliability of developed system. This will create a production-ready state for marketing to the Air Force, other related federal agencies, and private industry.

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2. Mayhugh, 86 MXS crawls into C-130 fuel tank inspection, August 2017 https://www.dla.mil/About-DLA/News/News-Article-View/Article/1275677/86-mxs-crawls-into-c-130-fuel-tank-inspection/
3. Brogaard, R., Boukas, E., "Autonomous GPU-based UAS for inspection of confined spaces: Application to marine vessel classification." February, 2024, Autonomous GPU-based UAS for inspection of confined spaces: Application to marine vessel classification

KEYWORDS: Confined Space Navigation; Path Planning

Version 5

AF254-D0825 TITLE: Smart Electronic System Visualization to Support Depot Sustainment of USAF Systems

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software; Integrated Sensing and Cyber; Trusted AI and Autonomy; Sustainment & Logistics

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: develop an electrical system digital twin (immediate circuit rendering) enabling dynamic electrical system navigation, inspection, documentation, and debug capabilities.

DESCRIPTION: To meet the above objective, the project shall develop an online visualization and debugging solution which renders circuit schematics, wiring harnesses, and component attributes specific to individual development and maintenance situations. The technology here should be capable of taking original electronic computer aided design (ECAD) data, Excel tables, or proprietary data as input, then autonomously render and explore schematics, thereby allowing complex systems to be easily and quickly understood.
The technology should allow for Google-style live search features allowing for precise information to be extracted from large data files and displayed in an easy-to-understand fashion. The technology developed here should allow for views to be modified and transformed as users operate the system, with important information displayed on the schematic in real time. The technology here should also highlight key data to accelerate development and debug capabilities.

PHASE I: FEASABILITY DOCUMENTATION. For this Direct-to-Phase II topic, evaluators are expecting that the submittal firm demonstrate the ability to render online visualization and debugging platforms depicting or representing circuit schematics, wiring harnesses, and component attributes specific to electronic maintenance situations. Evaluators are expecting that the submittal firm demonstrate understanding of electronic maintenance environments and workloads.

PHASE II: Develop technology for electrical system digital twin (immediate circuit rendering) generation enabling dynamic electrical system navigation, inspection, documentation, and debugging operation. Technology should be able to utilize existing technical order documentation to transform products into interactive versions at no cost to legacy data owners. Technology should allow for cloud based interface to be used without modification to existing technical data. Technology should provide for unique Google-style live “search and show” for easy debugging of electrical systems.

PHASE III DUAL USE APPLICATIONS: If the Phase II is successful in developing the technology, transition technology wherever beneficial and of net present value into Air Force and other government electronic maintenance groups and related environments.

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1. Gan, Xing, Zaibao Xiong, Shaofei Du, Zhongcheng Wu, Xiaohong Geng, and Yu Gao. "Three-dimensional visualization of secondary system based on digital twin." In Journal of Physics: Conference Series, vol. 1983, no. 1, p. 012072. IOP Publishing, 2021.

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KEYWORDS: Digital Twin; Schematic; interactive

Version 5

AF254-D0826 TITLE: Automated Scenario Generation for Information Operations Network (ION) Environment

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE:
1. Automate US Army TRADOC's ION software to create a fully functional C2 simulation system to generate complex scenarios at a significantly faster rate than current manual methods.

2. Integrate the system with existing ION infrastructure, ensuring seamless deployment and minimal disruption to ongoing exercises.

3. Conduct user testing to validate the system's performance, usability, and effectiveness in supporting ION exercises.

Desired Outcomes:
1. Reduce the time and effort required for scenario building by at least 90% through automation.
2. Increase the number of unique scenarios that can be generated for ION exercises.
3. Improve the realism and relevance of generated scenarios, resulting in more effective training for military personnel.
4. Advance research in the areas of social media, data analytics, and human factors.

Requirements:
1. The proposed solution must be a mature, innovative technology that has been demonstrated in a relevant environment (e.g. Information Warfare Training Environment - IWTRE).
2. The solution must be capable of generating complex, realistic ION scenarios that meet the Army's training objectives.
3. The solution must be compatible with existing ION infrastructure and must not require significant modifications to the existing system.

Key Performance Parameters (KPPs):
1. Scenario generation time: < 1 hour
2. Scenario quality: ≥ 95% similarity to manually created scenarios
3. User satisfaction: ≥ 90% rating on usability and effectiveness

DESCRIPTION: The US Army's Training and Doctrine Command (TRADOC) has developed the Information Operations Network (ION) environment to simulate social media and digital domains for military exercises. ION provides an immersive environment for training, but scenario building remains a time-consuming and labor-intensive process. The current approach relies on manual content creation, which limits the scalability and adaptability of ION exercises.
This D2P2 topic seeks a mature, innovative solution for the Joint force to automate the scenario building process for ION, enabling rapid generation of realistic and relevant scenarios that can be easily adapted to

various Joint force training objectives and exercises. The proposed solution should leverage artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) techniques to analyze existing ION content, identify patterns, and generate new scenarios that mimic real-world social media, multi-modal sensors, and digital domains.
All changes and additions to the production ION system must fit within the existing cARMY Azure Cloud architecture, ION's security boundary, ION's Risk Management Framework, must be built for mobile responsiveness, deployable on cARMY IL4, TRADOC G2 SIPRnet, and deployable on a Standalone Laptop (disconnected environment).

PHASE I: Demand for this automation comes from operator input from previously conducted exercises. Operators complain that while ION is an excellent platform for simulating an information environment, significant time is needed to prepare the environment before the exercise. Also, ION currently lacks functionality to evaluate tactics, techniques, and procedures used during exercises. A successful D2P2 for ION automation will decrease the barriers for usage and greatly increase the adoption of ION for exercise purposes. ION is widely accepted by the Joint force as a useful capability, but the lack of automation hinders wider adoption.
The qualifications for a small business to complete this D2P2 would be coding ability and an understanding of non-kinetic operations in the information environment enough to see the shortfalls of ION. Adding automation and evaluation functionality would not require heavy S&T but more end-user focus and data science skillsets to come up with appropriate metrics for evaluation of analytics used during ION events.
Requirements Analysis and System Design:
Identify the specific requirements and objectives of the automated scenario generation system for ION, based on the information provided in the proposal.
Analyze existing ION content and identify patterns and characteristics that can be leveraged to generate new scenarios.
Design a prototype system architecture that integrates AI, ML, and NLP techniques to automate scenario generation.
Develop a detailed system design and specifications, including hardware, software, and network components.
Define key performance parameters (KPPs) and evaluation criteria for the prototype system.
*Deliverables:
A comprehensive set of requirements and objectives for the automated scenario generation system for ION based on the information provided in the proposal.
A report detailing the analysis of existing ION content, including identified patterns and characteristics that can be leveraged to generate new scenarios.
A detailed system design and specifications document outlining the hardware, software, and network components of the prototype system.
A set of key performance parameters (KPPs) and evaluation criteria for the prototype system.

PHASE II: Prototype Development and Integration:
Develop a proof-of-concept prototype of the automated scenario generation system for ION using the design and specifications developed in Phase 1.
Test the prototype system in a simulated environment to validate its functionality, performance, and compatibility with existing ION infrastructure.
Integrate the prototype system with existing ION software and infrastructure to ensure seamless deployment and minimal disruption to ongoing exercises.
Perform user testing to validate the system's performance, usability, and effectiveness in supporting ION exercises, using the evaluation criteria defined in Phase 1.
*Deliverables:

A proof-of-concept prototype of the automated scenario generation system for ION, based on the design and specifications developed in Phase 1.
A report detailing the results of testing the prototype system in a simulated environment, including performance, compatibility with existing ION infrastructure, and usability for military personnel.
An integration plan outlining how the prototype system will be integrated with existing ION software and infrastructure without disrupting ongoing exercises.
User testing results and a report evaluating the system's performance, usability, and effectiveness in supporting ION exercises, using the evaluation criteria defined in Phase 1.

PHASE III DUAL USE APPLICATIONS: Validation and Refinement:
Conduct additional validation testing to confirm that the prototype system meets the desired outcomes and KPPs outlined in the proposal.
Analyze the results of the validation testing and make necessary refinements to the system design and specifications.
Conduct a final review of the prototype system, including documentation of its current state and potential future developments.
Prepare a final report, summarizing the results of the prototype development and validation, and providing recommendations for future research and development efforts in the area of automated scenario generation for ION.
*Deliverables:
A validation report confirming that the prototype system meets the desired outcomes and KPPs outlined in the proposal.
A set of recommendations for refining the system design and specifications based on the results of the validation testing.
A final review of the prototype system, including documentation of its current state and potential future developments
A final report summarizing the results of the prototype development, validation, and refinement process, and providing recommendations for future research and development efforts in the area of automated scenario generation for ION.
Dual Use Description:
The proposed solution has potential dual-use applications, as it could be used not only for military training purposes, but also for civilian applications such as crisis management, emergency response, and cybersecurity training. For example, the solution could be used to simulate social media and digital domains during natural disasters, terrorist attacks, or other crises, allowing responders to practice their communication and coordination skills in a realistic environment.
Cybersecurity training: The system could be adapted to generate realistic cyber-attack scenarios for training cybersecurity professionals. By automating the scenario generation process, it would be possible to quickly create a large number of diverse scenarios, improving the scalability and adaptability of cybersecurity training programs.
Emergency management: The system could be used to generate realistic disaster scenarios for emergency management training exercises. By automating the scenario generation process, it would be possible to create a variety of disaster scenarios quickly and easily, improving the effectiveness and efficiency of disaster preparedness training programs.
Social media analysis: The AI, ML, and NLP techniques used in the prototype system could be adapted for social media analysis, generating insights into online conversations and trends. This technology could be used by businesses to identify consumer preferences, track brand sentiment, and monitor for crisis situations.
Virtual reality: The automated scenario generation system could be applied to the development of virtual reality simulations. By using AI and ML techniques to analyze existing content and develop new scenarios, it could be possible to create more realistic and engaging virtual environments for a range of industries, including gaming, education, and healthcare.

Law enforcement: The system could be used to generate realistic scenarios for training law enforcement personnel in various situations, such as hostage negotiations, active shooter response, and crowd control. By automating the scenario generation process, it would be possible to create a variety of scenarios quickly and easily, improving the effectiveness and efficiency of law enforcement training programs.
Intelligence analysis: The AI, ML, and NLP techniques used in the prototype system could be adapted for intelligence analysis, generating insights into complex data sets and identifying patterns and trends. This technology could be used by intelligence agencies to improve their understanding of global events and threats, and to develop more effective strategies for countering them.
Gaming: The automated scenario generation system could be applied to the development of video games, creating more realistic and engaging gaming environments. By using AI and ML techniques to analyze existing content and develop new scenarios, it would be possible to create dynamic and unpredictable gaming experiences that adapt to player behavior.

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KEYWORDS: "Automated Scenario Generation for Military Training"
"Scenario Generation for Simulation-Based Training"
"Intelligent Scenario Generation for Military Training"

AF254-D0827 TITLE: Artificial Intelligence/Machine Learning (AI/ML) Driven Personnel Retention Platform

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

OBJECTIVE: The Air Force District of Washington (AFDW) proposes to adapt an existing project - XEM Retention Project to implement an automated AI/ML platform that proactively analyzes personnel data to identify individuals at high risk of separation. The platform will help transition from manual exit interviews and anecdotal evidence to a data-driven approach that informs effective retention strategies. The platform will leverage its proprietary "Digital Twin" capability to generate predictions and recommend best actions to engage and retain critical personnel. The goal is to streamline the retention process through automated data labeling and analysis to enable faster and more effective interventions. The project seeks to reduce turnover in essential skill positions during a challenging recruitment period to ensure that the Air Force retains its vital talent.

DESCRIPTION: The Air Force District of Washington (AFDW) proposes to adapt the existing XEM Retention Project to implement an automated AI/ML platform that proactively identifies individuals at high risk of separation. The platform will utilize its proprietary "Digital Twin" capability to generate predictions and recommend best actions to engage and retain critical personnel. The goal is to transition from manual exit interviews and anecdotal evidence to a data-driven approach that informs effective retention strategies. The platform aims to reduce turnover in essential skill positions during a challenging recruitment period to ensure that the Air Force retains its vital talent.
The proposed platform will leverage automated data labeling and analysis to enable faster and more effective interventions. The platform will proactively analyze personnel data to identify individuals at high risk of separation, allowing the Air Force to take early action to address their concerns and offer targeted retention incentives. The platform's "Digital Twin" capability will generate predictions and recommend best actions to engage and retain critical personnel. By implementing a data-driven approach to retention, the Air Force can improve its ability to retain critical personnel and ensure that it has the talent it needs to carry out its mission effectively. The platform's automated data labeling and analysis capabilities will enable faster and more effective interventions, improving the Air Force's ability to retain its vital talent during a challenging recruitment period.

PHASE I: This is a Direct-to-Phase-II (D2P2) topic; therefore, no Phase I awards will be made. To be eligible for a D2P2 award, proposers must demonstrate the feasibility and technical maturity of their proposed AI/ML solution for enhancing personnel retention within AFDW. This demonstration must stem from prior "Phase I-type" work completed outside of existing SBIR/STTR funding agreements. Proposals must provide documentation and evidence showcasing a Technology Readiness Level (TRL) of at least 4-6, signifying validation in a relevant environment or lab setting. This evidence may include:
- Proof-of-Concept Data and Prototype Results: Provide concrete data and results from prototypes or pilot programs demonstrating the effectiveness of the proposed AI/ML solution in addressing personnel retention challenges similar to those faced by AFDW.
- Performance Metrics: Present quantifiable metrics that showcase the AI/ML model's performance in areas such as predictive accuracy, employee churn reduction, or identification of key retention factors.
- Integration Readiness: Demonstrate the solution's compatibility and potential for seamless integration with existing AFDW systems or platforms, particularly those related to personnel data management, talent analytics, or workforce planning.
- Cybersecurity Compliance: Provide evidence of adherence to relevant DoD cybersecurity standards, including documentation of any existing security certifications or attestations. Outline a clear plan for obtaining an Authority to Operate (ATO) for deployment within the AFDW environment.

In addition, the proposals should highlight the AI/ML solution's capabilities across Department of Air Force/AFDW personnel retention use-cases. Capabilities may include:
• Data Analysis and Predictive Modeling: Demonstrate the solution's ability to analyze personnel data, identify patterns and trends, and generate predictive insights related to retention risk or potential interventions.
• Stakeholder Engagement and Process Improvement: Showcase how the AI/ML solution can facilitate more effective communication and collaboration between relevant stakeholders (e.g., leadership, HR, individual airmen) to address retention challenges proactively.
• User-Centric Design and Workflow Integration: Provide evidence or examples of how the solution is designed for usability and can be seamlessly integrated into existing workflows within AFDW to minimize disruption and maximize adoption.
A clear and detailed roadmap for Phase II development is crucial. This roadmap should outline milestones, metrics for success, and plans for user testing and evaluation within the AFDW operational environment."
Limited career progression and job satisfaction result from insufficient promotion opportunities and recognition. AI can personalize career development plans and facilitate mentorship. Compensation and benefits are uncompetitive, especially for high-demand roles, highlighting the need for better packages and retention bonuses. AI analysis of market trends can help align these with industry standards. Organizational culture and leadership also impact morale. AI sentiment analysis can help leaders identify improvement areas through anonymous feedback. High deployment frequency and duration add stress, necessitating a balance between mission readiness and personnel well-being; AI can optimize scheduling and predict burnout.
Job location stability is a concern, with AI recommending optimal assignments based on preferences and career goals. Training opportunities are often outdated, and AI can create adaptive learning paths that personalize training. Expanding access to mental health and wellness resources is critical; AI can offer personalized health recommendations and monitor well-being.
Work environment improvements are necessary, with AI enhancing facility management for safe and effective workplaces. Finally, transitioning support for civilian life is often inadequate; AI can provide tailored plans and resources to help service members navigate post-military careers. AI presents significant opportunities to improve retention and enhance workforce satisfaction.

PHASE II: Phase II Technical Objectives and Key Results:
Objective 1: Enhance retention strategies by utilizing AI-driven insights to identify at-risk personnel and recommend targeted interventions.
● Associated Tasks:
1. Develop and refine AI models to analyze retention risks based on operational tempo, duty hours, and deployment schedules.
2. Integrate AI tools to optimize duty rosters and predict stress points, facilitating flexible scheduling and enhanced family support.
3. Implement AI-driven recommendations for personalized career development plans and mentorship opportunities.
● Outcome: AI-driven models that identify personnel at high risk of burnout or attrition, enabling the A1 office to proactively address retention issues through tailored interventions.
● Time: 6 months from award. Task 1: completed month 1, Task 2: completed months 2 to 4, Task 3: completed months 5 to 6.
● Key Results:
1. Reduction in attrition rates (TBD) within the first 6 months.
2. Improved work-life balance through AI-optimized scheduling, resulting in increased job satisfaction and retention.
Objective 2: Improve job satisfaction and career progression by aligning compensation, benefits, and development opportunities with industry standards.

● Associated Tasks:
1. Conduct AI-driven market analysis to assess the competitiveness of current compensation and benefits packages.
2. Develop recommendations for aligning compensation and benefits with industry standards, particularly for high-demand roles.
3. Implement AI tools to personalize career development plans and facilitate mentorship programs.
● Outcome: A comprehensive strategy that ensures AFDW A1's compensation, benefits, and career development offerings are competitive and aligned with industry trends, particularly in high-demand sectors.
● Time: 6-12 months from award. Task 1: completed months 1 to 3, Task 2: completed months 4 to 6, Task 3: completed months 7 to 12.
● Key Results:
1. Enhanced employee satisfaction, with increase in retention among personnel in high-demand roles.
2. Improved promotion rates and job satisfaction through AI-personalized career development plans.
Objective 3: Strengthen organizational culture and leadership effectiveness through AI-driven sentiment analysis and feedback mechanisms.
● Associated Tasks:
1. Develop and deploy AI tools for conducting sentiment analysis on anonymous feedback from personnel.
2. Identify key areas for improvement in organizational culture and leadership practices based on feedback analysis.
3. Implement targeted leadership training and organizational development programs to address identified issues.
● Outcome: A data-driven approach to enhancing organizational culture and leadership within AFDW A1, leading to improved morale and retention.
● Time: 6-12 months from award. Task 1: completed months 1 to 2, Task 2: completed months 3 to 6, Task 3: completed months 7 to 12.
● Key Results:
1. Increased employee engagement and morale by 10% within 6 months.
2. Reduction in leadership-related attrition through targeted interventions.
Objective 4: Enhance training and development programs with AI-driven adaptive learning paths and personalized wellness resources.
● Associated Tasks:
1. Integrate AI tools to create adaptive learning paths that personalize training for each individual.
2. Expand access to mental health and wellness resources through AI-driven recommendations and monitoring tools.
3. Implement AI-driven facility management enhancements to improve work environments.
● Outcome: A personalized and adaptive approach to training and wellness, ensuring that AFDW A1 personnel are well-equipped and supported in their roles.
● Time: 6-18 months from award. Task 1: completed months 1 to 6, Task 2: completed months 7 to 12, Task 3: completed months 13 to 18.
● Key Results:
1. Improved training effectiveness, with a increase in skill acquisition and job readiness.
2. Enhanced overall well-being, with a reduction in stress-related absenteeism.
Objective 5: Optimize assignment stability and transition support for AFDW A1 personnel.
● Associated Tasks:
1. Develop AI tools to recommend optimal assignments based on individual preferences and career goals.
2. Implement AI-driven transition support plans for personnel moving to civilian life.
3. Enhance job location stability and satisfaction through data-driven assignment planning.
● Outcome: A strategic approach to assignment stability and transition support, leading to increased job satisfaction and smoother transitions for personnel leaving the military.

● Time: 6-18 months from award. Task 1: completed months 1 to 6, Task 2: completed months 7 to 12, Task 3: completed months 13 to 18.
● Key Results:
1. Increased job location stability, with a improvement in assignment satisfaction scores.
2. Enhanced transition support, with a increase in successful civilian career placements.

PHASE III DUAL USE APPLICATIONS: The awardee(s) can expect to pursue commercialization of the modified/adapted platform with Air Force and broader DoD J1 retention directorates. The technologies may be transitioned by expanding mission capabilities to a broad range of potential government and civilian users. Direct access with end users and government customers will be provided with opportunities to receive Phase III awards for providing the Government with additional research, development, and diagnostic/performance testing. Additionally, direct procurement of modified/adapted platform will be in the form of licenses/seats. The expected Phase III outcome will be TRL 9.

REFERENCES:
1. United States Government Accountability Office. (2023). DOD Active-Duty Recruitment and Retention Challenges. GAO-23-106551.
2. Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/.
3. National Strategy to Advance Privacy-Preserving Data Sharing and Analytics, https://www.whitehouse.gov/wp-content/uploads/2023/03/National-Strategy-to-Advance-Privacy-Preserving-Data-Sharing-and-Analytics.pdf.
4. National Institute of Standard and Technology (NIST), Draft Guidance on Evaluating a Privacy Protection Technique for the AI Era, https://www.nist.gov/news-events/news/2023/12/nist-offers-draft-guidance-evaluating-privacy-protection-technique-ai-era.
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KEYWORDS: Retention; data analysis; automation; optimization; readiness; talent; predictive analytics; AI, DAF, AFDW

AF254-D0830 TITLE: Directed Energy Mobile Environmental Test Bed

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To utilize an established, modular, and mobile laser propagation test bed for the purpose of demonstrating longer wavelength in relevant environmental conditions. To increase TRL of key components for longer wavelengths and to measure power at targets out to 5km (wavelength to be fixed at contract award but will be between 1-10um).

DESCRIPTION: The USAF desires to modify a mobile test bed that is capable of tracking, targeting, and handling laser power levels from 1-10kW and wavelengths from 1um to 10um. The award winner, will position this open architecture testbed at the KAFB laser propagation test range called the Environmental Laser Test Facility for outdoor testing. It is understood that nearly all testbeds currently operate in the 1 um regime. Consequently, the USAF will work with the award winner(s) to identify alternative wavelengths amplifiers, optics and integration of said components for propagation testing.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. Applicants interested in participating in this topic must include in their response to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and "Phase I-type" effort such as a developed concept for a workable prototype. For example, the vendor shall provide analysis description and design of a mobile laser test bed isolated from the environment a) list of optical and electronic components, beam director and software required to build the prototype
b) theoretical or experimental results or prototypes that meet USAF desired capabilities. Such results may include:
b1) tracking and aimpoint maintenance, test bed and test bed components' ability to handle sustained high peak powers and energies in the multi-kw class
b2) thermal management of optics and electronics
b3) clean room attached to the mobile vehicle for on-site work of high power components and optical bench regardless of field location. Documentation should include all relevant information including, but not limited to, technical reports, test data, prototype designs/models, and performance goals/results for establishing the scientific and economic feasibility of the proposed work. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI).

PHASE II: The USAF is seeking to modify an existing testbed system to enable testing at wavelengths between 1 and 10 microns for field demonstration of lasers in this band. Proposer must identify an existing testbed system for this application and describe what changes will need to be made to accommodate these longer wavelengths including but not limited to coatings, beam projection telescopes, and cameras. The system must be mobile to enable fielding at different locations. The testbed should provide an operations area that will enable test personnel to operate the system in challenging environments. It is preferred that the system have integrated digital data logging, an open architecture for ease of modification, integrated turbulence and weather sensing capability, and a capability for communication with a down-range test site. The system modifications should enable both continuous wave and pulsed laser testing.

PHASE III DUAL USE APPLICATIONS: The USAF will work with the award winner to secure funding for a packaged, mobile multi-kW laser system for real environment testing at a forward deployed base. Upon success, will work with award winner to market technology to one of the major commands as a compliment to existing base defense systems.REFERENCES:

1. M. Helle, "Pulsed Laser Research and Development at the Naval Research Laboratory", DEPS Systems Symposium, November 2023.
2. B. Lynn, "JIFCO Non-Lethal Laser Induced Plasma Effects Roadmap and Portfolio", DEPS Science and Technology Symposium, April 2023.
3. J. Mansell, "Beam Control Test Results from the Mobile Beam Control System Integration Laboratory", DEPS Science and Technology Symposium, March 2021

KEYWORDS: Directed Energy; Laser Weapons System; Testbed; Laser Illuminator; Long Wavelength

AF254-D0831 TITLE: High Power Airborne Optical Relay

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The objective of this Small Business Innovation Research (SBIR) Direct to Phase II topic is to develop an innovative system for a high power airborne optical relay system that will significantly enhance the performance of ground-based lasers being built across the DOD Service and Agencies. Through technology maturation and innovation, we aim to create a reliable and efficient relay system that can transmit high-power laser beams over longer distances and provide more advantageous engagement geometries, thus improving the overall effectiveness of laser-based applications. This project will focus on advancing the state-of-the-art in optical relay technology and developing new techniques to overcome existing challenges in airborne optical systems. Ultimately, this project will contribute to the growth and advancement of laser technology, enabling new applications and solutions in various industries such as communication, sensing, and defense.

DESCRIPTION: Engaging low-altitude airborne targets for area and base defense is challenging from a ground-based platform due to strong amplitude refractive index variations associated with turbulence near the ground. Airborne laser weapons systems are challenging to deploy in part because the laser itself is large, power-hungry, and heavy. One solution for a defending localized area is to leave the laser on the ground and relay the light up to an airborne platform that will engage the target. This approach is beneficial because it circumvents the strong turbulence near the ground, increases the laser weapon range by going around lower altitude obstructions, and enables engaging more of the target area. It also keeps the laser on the ground minimizing the cost and weight of an airborne platform making it possible to deploy on a variety of platforms. This approach has been explored by the Air Force in demonstration experiments with significant success in prior decades. Today, we have developed new beam control technologies that have the potential to make the relay mirror to be even lower cost, lighter, and more compact.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Air Force expects the applicant(s) to demonstrate feasibility by means of a prior “Phase I-type” effort that does not constitute work undertaken as part of a prior or ongoing SBIR/STTR funding agreement. Applicant(s) may demonstrate feasibility in the following manner(s):
1) Development and testing of high energy laser hardware (applicable to system power levels of 1-15kW) for ground-based or airborne power beaming applications. 2) Development of lightweight and compact beam control system components capable supporting uplink to UAS platform, >80% optical throughput, and <20urad beam jitter to target. 3) Development of performance models and associated analysis for power, beaming and optical relay hardware. 4) Scoping and conceptual design of 1/4 to 1/2 scale high power optical relay brassboard.

PHASE II: The long term goal of our relay mirror research is to demonstrate a pod-based relay system on a UAS or similar aircraft. The work done as part of this proposed effort should applicable to reduce risk for a full scale pod-based system design. To ensure scaleability and traceability of the brassboard design to the full-scale optical relay demonstration system should be >= 1/4 scale design. For this phase II, the proposals should include development, installation, integration, demonstration, test and evaluation of a proposed relay mirror beam control solution 1/4 - 1/2 brassboard . This Phase II will seek to implement and demonstrate a relay mirror beam control system using a government furnished ground based HEL with power <= 20 kW.

Efforts will include:

- Perform relevant modeling and simulation to facilitate system design.
- Design, build, and field test a 1/4 - 1/2 scale ground-based demonstration relay brassboard to collaboratively operate with AFRL supplied c-sUAS laser source.
- Demonstrate uplink to surrogate platform, >80% optical throughput of the beam control subsystems, and <20urad beam jitter to target.
- Deliver the system and associated documentation to AFRL

PHASE III DUAL USE APPLICATIONS: Phase III efforts will focus on transitioning operationally ready technology to a commercial sector (for Power beaming applications) or DoD environment. The extension to Phase II effort include system development and integration with additional ground-based sources and deployment on an airborne platform or demonstration of on-the-move up-link to a suspended platform.

REFERENCES:

1. J. Malanify, "Tactical Relay Mirror System Payload Element Critical Design Review (CDR),"tech. rep., Boeing-SVS, Albuquerque, New Mexico, 2006.
2. M. Whiteley, HEL AND E-O Relay Mirror Experiment and Systems (HERMES): Modeling Sim, and Analysis for relay mirror Technology.
3. J. D. Mansell, “Beam shaping for relay mirrors”, Proceedings Volume 6290, Laser Beam Shaping VII; 62900K (2006) https://doi.org/10.1117/12.681269.
4. J. Mansell, J. Jameson, and B. Henderson, “Advanced deformable mirrors for high-power lasers”, Proceedings Volume 9083, Micro- and Nanotechnology Sensors, Systems, and Applications VI; 90830O (2014) https://doi.org/10.1117/12.2050091.
5. Mary Hartman, Sergio Restaino, Jeffrey Baker, Don Payne, Jerry Bukley, “EAGLE: relay mirror technology development”, Proceedings Volume 4724, Laser Weapons Technology III; (2002) https://doi.org/10.1117/12.472368.
6. Marija Scholl, George Lawrence, “Optical Modeling Of A Space Relay Experiment”, Proceedings Volume 892, Simulation and Modeling of Optical Systems; (1988) https://doi.org/10.1117/12.944329.
7. Jeffrey Dierks, Susan Ross, Aaron Brodsky, Paul Kervin, Richard Holm, “Relay Mirror Experiment overview: a GBL pointing and tracking demonstration”, Proceedings Volume 1482, Acquisition, Tracking, and Pointing V; (1991) https://doi.org/10.1117/12.45692.

KEYWORDS: Relay Mirror; High-Energy Laser; Atmospheric-Turbulence; Adaptive Optics, Wave-Optics-Simulation; Scaling-Law Analysis; Directed Energy; Laser Weapons; High-power Optical Relay; optical power beaming

Version 5

AF254-D0832 TITLE: Automating the Risk Management Framework for Hybrid Operational Technology to Information Technology Environments

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Research, evaluate, and ultimately develop a methodology for tailoring and streamlining the Risk Management Framework (RMF) process for industrial automation environments to accelerate technology adoption, improve mission readiness/supply, and greatly reduce time required for certification across all RMF stakeholders.

DESCRIPTION: Organic Industrial Base (OIB) modernization and other engineering initiatives within the Department of Defense (DoD) and United States Air Force (USAF) have changed the way Air Force Sustainment Center (AFSC) Industrial Depot Maintenance (IDM) Shop Floors and similar environments are operating, the types of systems present, and how they need to communicate today and into the future. The Operational Technology (OT) systems and use cases within the IDM are becoming increasingly sophisticated and automated, with consequent need for establishing secure connectivity between these systems to collect data and maintain up-to-date systems. In many cases, data and connectivity even need to cross the boundary into traditional Informational Technology (IT) networks.
The impact, mission importance, and cybersecurity maturity of these systems can also vary widely, making it a challenge to assess the relevant controls. This convergence of OT and IT systems and networks, the wide range of mission impact, and the gaps in understanding for connected OT systems requires a new blueprint for assessing risk in these highly integrated environments to create a layered defense risk management strategy. Authorities to Operate (ATOs) must define how these hybrid OT/ IT systems may connect and communicate. Key drivers for ATO efficiency in Organic Industrial Base (OIB) OT environments include the following: enhanced guidance of system categorization using innovative approaches like model-based systems engineering and artificial intelligence; automating the selection of OT security controls selection and overlays; allowing Security Control Assessors (SCAs), Authorizing Officials (AOs), Authorizing Official Designated Representatives (AODRs), and other security stakeholders to easily align their standards and baselines for this new realm of OT to IT connectivity; and building a fully traceable, auditable models where security risk assessors can see a holistic view of system components within and across boundaries
The ATO process for the Department of Defense (DoD) is often the most costly and time-consuming aspect to delivering a new system to the mission. While these systems are changing rapidly, there has also been an investment by the DoD and National Institute of Standards and Technology (NIST) to address OT specific security concerns. By tailoring and automating currently manual processes such as Enterprise Mission Assurance Support Services (eMASS) artifact generation and auditability, AFSC and other DoD entities will accelerate zero trust OT adoption, improve mission readiness/supply, and greatly reduce time required for certification across all stakeholders.

PHASE I: FEASABILITY DOCUMENTATION: For this D2P2 topic, evaluators are expecting a significant level of automation of RMF Steps 1 and 2, with an ability to support the use of generative AI for Step 3 (e.g., the ability to feed directly into Ask Sage's ATO-in-a-Box). Specifically, the candidate proposal should (1) make use of a widely-used model-based systems engineering (MBSE) tool to fully create the enclave to be authorized, including information flows and PPS, (2) automatically populate an ITCSC template using information from that model, (3) automatically recommend a baseline controls selection, (4) automatically create a HW/SW list, PPSM, and recommended STIGs list, and (5) automatically update (2) through (5) with any changes to (1).

PHASE II: In addition to the requirements listed in the Phase 1 description, the candidate solution must also (1) create an API interface that connects the candidate solution to a DoD-authorized generative ATO solution (e.g., NIPRGPT, Ask Sage), (2) have a GUI, with which the ISSM/ISSO will interact to answer RMF Step 3 questions not covered by the aforementioned SBIR Phase 1 requirements, (3) produce the full complement of eMASS test results, control family artifacts, and evidence recommendations to support an RMF Step 4 assessment, (4) guide assessors through RMF Step 4 by documenting whether controls are fully, partially, or not met, (5) guide authorizers through the development of a succinct but sufficiently comprehensive executive summary, (6) support the change management and continuous monitoring process through GUI interaction with the ISSO/ISSM. Finally, the candidate proposal must *not* require a direct connection to the enclave to be assessed, due to security considerations for some OT systems.

PHASE III DUAL USE APPLICATIONS: Refine the prototype application for great applicability, integration, and efficiency. Achieve production-ready state for delivering at scale to the Air Force, other related federal agencies, and private industry.

REFERENCES:

1. Stouffer, et al. “NIST Special Publication: NIST SP 800-82r3 Guide to Operational Technology (OT) Security” September 2023, https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-82r3.pdf
2. Sherman. “DOD INSTRUCTION 8510.01 RISK MANAGEMENT FRAMEWORK FOR DOD SYSTEMS” July 2022, https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/851001p.pdf
3. Hawkins, et al. “Art of the Possible Handbook AFSCH60-101”, August 2023, https://static.e-publishing.af.mil/production/1/af_sustainment_ctr/publication/afsch60-101/afsch60-101.pdf

KEYWORDS: Risk Management Framework (RMF), Authority to Operate (ATO), Operation Technology (OT), Continuous Cyber-Readiness, Zero Trust

AF254-D0833 TITLE: Modern Low Cost C-UAS Warhead

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop and demonstrate a low-cost for low cost weapon, demonstrating effective performance against UAS targets in a rapid-launched or simultaneous-launched swarming scenario.

DESCRIPTION: Low cost UAS weapons are being put to effective use by US adversaries. US weapons to defeat these threats are effective, but not feasible at scale due to limited quantities and high cost. Commonly, multi-$M munitions are used to defeat targets that cost <$10K. A kinetic option is needed to defeat C-UAS and other threats at the same order of magnitude cost of the threat. Furthermore, an option is needed that can be produced, deployed, and launched at scale. This new capability must be delivered to the battlefield quickly, on a relevant timeframe. Therefore, it is necessary to consider low-cost options that are already in high rate of production and fielded on many platforms, have a reasonable cost, and can be readily modified to achieve the desired launch rate.

The scope of this topic includes any lethality technology to enable the improved probability of kill of UAS from a low-cost C-UAS kinetic weapon and enables improved lethality versus cruise missiles. In particular, the government is interested to review modern warhead designs which include CL-20, advanced fragmentation designs, or other unique design principles that demonstrate improvement over legacy warheads. Additionally, it includes any other associated technologies in this defeat mission, to include fuzes, data links, or any innovative approach the government may not have considered that improves the C-UAS defeat capability of a low-cost C-UAS kinetic effector. Proposals may focus on one specific portion of the need, or aim to achieve a total minimum viable product as quickly as possible. The topic will show preference to those who produce evidence of a viable path to achieve hardware that can be integrated into a kinetic effector and flight-tested (live) to show kinetic defeat against a UAS within the cost/schedule of the SBIR program. If necessary for cost purposes, non-warhead costs (rocket, UAS, test range) can be excluded from the cost of the program. However, projects will be competitively evaluated on their cost-efficiency.

Proposers should be familiar with the C-UAS mission, and show that their lethality enhancement can produce the requisite capability to defeat both large and small aerial objects at relevant range and across the ranges of relevant closing velocities which can produce a variety of guidance and/or fuzing errors.. Assumptions of other system-level capabilities may be includes to support the approach, though preference will be given to those who (in order of precedence) assume already fielded capabilities, already existing capabilities, capabilities currently in development, and finally: reasonable-to-develop capabilities. At the least, proposers should assume a guidance capability and proximity sensing capability consistent with currently-fielded C-UAS kinetic effectors and produce a design improves the probability of kill when compared with currently fielded solutions.

Warhead designs may be focused around 1) a nose mounted design, 2) a mid-body design. Proposers should consider associated system-level considerations such as communication between necessary components and all-up-round performance when determining which approach to focus on.

Concepts which are compatible with the modular Advanced Precision Kill Weapon System (APKWS) rocket system (a guidance conversion to the Hydra-70 unguided rocket) are of particular interest to the government.

The associated performance of the warhead against a variety of targets, to include cruise missiles, is of very high interest. Ground targets are also of interest, but this capability must be considered at the system-level with the types of fuzes available. IE, the limitations of a ground attack with a proximity fuze must be considered or cleverly addressed. Ultimately, proposers should consider the system-level costs/benefits and associated trades of their design with the final capability of the weapon.

Of equal interest is any unknown component of such a system that ought to be designed, or optimized, in participation with a system-level Prime contractor to achieve the above objectives/mission. The topic authors do not wish to overly prescribe a specific solution, and other solutions – even beyond warhead design, are appropriate for this topic insofar as they achieve a meaningful capability for this requirement on the battlefield.

PHASE I: As this is a Direct-to-Phase-II (D2P2) topic, no Phase I awards will be made as a result of this topic. To qualify for this D2P2 topic, the Government expects the applicant to demonstrate feasibility by means of a prior "Phase I-type" effort that does not constitute work undertaken as part of a prior SBIR/STTR funding agreement. Prior work expected to be completed in a Phase- I type effort, in order to qualify for this D2P2, requires demonstrated feasibility which should include work and results in the following areas:
Phase I efforts should include modeling and simulation to show feasibility of performance of a UAS targets and/or other faster aerial threats. Manufacturing, cost, timeline factors should all be established to build confidence that the final product can be tested on a live (inert) rocket in a short-term, relevant, timeframe, and rapidly fielded with additional funding if results are favorable. Early laboratory or field tests showcasing hardware and/or software (sensing capabilities and algorithm detection capabilities) are expected.

PHASE II: Phase II efforts should aim to achieve live (explosive) guided free flight testing of the weapon versus C-UAS targets at a TRL 6. Prior to this point, significant integration work is expected to result in a manufacturable and fieldable design. The hardware should be plug-and-play with the fieldable interceptor solution. Weapon metrics mentioned previously will be evaluated competitively against other solutions to assess useability for a Phase III.

PHASE III DUAL USE APPLICATIONS: Phase III will include both smaller quantities <100 of prototypes for experimentation, and quantities of >1000 if selected for inclusion within a program of record. It is expected that rapid fielding/production will begin in large quantities of multiple thousands if specification goals and met and proven in flight testing.

REFERENCES:

1. https://www.reuters.com/world/europe/ukraine-downs-41-russian-drones-major-overnight-attack-2023-12-06/
2. https://www.cnn.com/2024/01/09/politics/us-navy-houthi-missiles-drones-red-sea/index.html

Version 5

KEYWORDS: Base defense; low-cost interceptor; counter-cruise missile, counter-UAS kinetic kill, CL-20, blast fragmentation warhead, lethality modeling

Version 5

AF254-D0834 TITLE: Autonomous and Adaptive Cold Spray Repair

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Demonstration of autonomous and adaptive CS repair of damaged panel fastener holes via robotic arm incorporating tool changing to: identify damaged areas; pre-machine damaged holes; apply CS, including bookend C633 buttons; and post-machine back to restored dimensions.

DESCRIPTION: Current robotic CS repairs are performed by time-consuming robotic path-planning which has a heavy demand for non-recurring engineering. Development of autonomous and adaptive robotic path planning and tool changing to accommodate varying CS repairs would reduce this workload and associated time and costs and push the State-of-the-Art for CS repair processes.

PHASE I: This topic is intended for technology proven ready to move directly into a Phase II. Therefore, a Phase I award is not required. The offeror 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 the scientific and technical merit and feasibility of ideas appearing to have commercial potential. This feasibility study must include an assessment of the state of the autonomous and adaptive repair processes and how offeror’s innovations contribute to cost and schedule reductions for labor costs, material costs, and non-recurring engineering costs. This assessment should validate the product-market fit between the proposed solution and a potential AF stakeholder. The offeror should have defined a clear, immediately actionable plan with the proposed solution and the AF customer. Phase I-like efforts have been accomplished on damaged Integrally Bladed Rotor (IBR) components. Damaged blades are irregular and inconsistent. Routines were developed to locate areas of damage, blend them out, and perform surface finishing, all requiring minimal support from an operator or engineer.

PHASE II: Eligibility for D2P2 is predicated on the offeror having performed a “Phase I-like” effort predominantly separate from the SBIR Programs. Under the phase II effort, the offeror shall sufficiently develop the technical approach, product, or process in order to conduct a small number of relevant demonstrations. Identification of manufacturing/production issues and or business model modifications required to further improve product or process relevance to improved sustainment costs, availability, or safety, should be documented. These Phase II awards are intended to provide a path to commercialization, not the final step for the proposed solution. The successful Phase 2 effort will deliver at least two manufacturing technology demonstrations resulting in an autonomous and adaptive CS repair process that could feasibly be transitioned for use at DAF installations with potentially different robotic arm and turntable systems/configurations. The Offeror should communicate how their technology approach will result in a credible pathway to production repair. The Phase 2 awardee will build on the current state of the art to advance the Technology Readiness Level in supporting these outcomes of interest by further developing processes that demonstrate enhanced performance in the area above. The awardee will coordinate with the Department of the Air Force technical point of contact (TPOC) via regular

information exchange meetings and technical reports. The final deliverable will be transition of developed autnomous and adaptive CS repair processes to DAF end user, including on-site training and setup for DAF use.
Tasking requirements to include:
1. Procurement of robotic arm
2. Development of routines to identify and perform CS repair and machining
3. Demonstration of simulated autonomous CS process
4. Delivery of routines to AF end-user along with any required setup/installation and training

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded autononmous and adaptive CS repair capability to a broad range of potential government and civilian users and alternate 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.

REFERENCES:
1. Tegler, E. (2021, July 28). Cold Spray Technology Could Allow the Air Force to Repair Instead of Incessantly Replacing Aircraft Parts. Forbes. https://www.forbes.com/sites/erictegler/2021/07/28/cold-spray-technology-could-allow--the-air-force-to-repair-instead-of-incessantly-replacing-aircraft-parts/

KEYWORDS: Cold Spray; adaptive machining; robotic path planning

AF254-D0835 TITLE: Autonomous Flightline Maintainer Supply Vehicle

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

OBJECTIVE: Develop a system capable of working autonomously on a flightline with limited or no active sensing. The system will have a payload capacity of at least 300 lbs and a range of at least 20 miles. Propulsion could be, but is not limited to, electrical powered motors. The system should be able to operate in most weather conditions, with a focus on efficient operations in rain or high heat. A simple and robust user interface should be included, that provides the ability to secure tools and supplies to allow for standard tool control procedures. Weather proof internal storage volume should be at least 12 ft3.

DESCRIPTION: Numerous government and commercial groups have experienced the challenges of providing tools, parts and supplies to maintainers on a timely basis in a cost-effective manner. Often stored in central supply locations near the flightline to allow for appropriate distribution controls and inventory, the inherent nature of long spread out flightlines usually results in long delivery or retrieval times by personnel with other duties.
Many commercial companies have addressed similar problems in last-mile delivery scenarios such as food service or small packages in urban or campus environments albeit usually with smaller payloads. The technical problems presented on a flightline are much simpler than these use cases as they all have strict traffic control rules, limited pedestrian traffic, and a small number of predetermined delivery locations. A key difference is the inability to use detailed active sensing technologies like LIDAR on a military installation. Any system attempting to meet this need must keeping any kind of active sensing or data collection to a minimum for security reasons. Another difference is the system should be designed in a way that minimizes the chances that an adversary can disrupt operations. An autonomous system without any sort of remote control or ability to deviate from preprogrammed courses will mitigate those risks. This will also allow for easier integration into preexisting flightline traffic control regulations.
This system is meant to support mainly maintainers in their normal duties. It needs to be rugged, easily loaded and unloaded while still be secure enroute, and able to carry in both volume and weight most parts and supplies they need to use on a regular basis. It needs to operate fully autonomously from when supply personnel load and launch it to when it parks at the appropriate pad on the flightline for a maintainer to retrieve the delivery as well as autonomous return for the next supply run. A rugged user interface with simple controls that can be taught and learned in less then 10 minutes is desired. Interfacing with other preexisting supply or inventory systems is not desired, this delivery system should stand alone with no need for regular software changes or support.
The system also needs to be easy to integrate into existing bases. Maintenance should be kept to a minimum, with facility requirements like chargers, or required footprints for parking/turning/loading well thought out.

PHASE I: This is a Direct to Phase 2 (D2P2) topic. Phase 1 like proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort via some other means (e.g. IRAD, or other funded work). It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show, as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the proposer has developed a preliminary understanding of the technology to be applied in their Phase II proposal to meet the objectives of this topic. Documentation should include all relevant information including, but not limited to technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Develop a system to deliver parts and supplies from a central location to predetermined places along a flightline that is resilient to weather and easy to use on both the loading and delivery side.
i. Develop and demonstrate a system, compromised of one or more pieces of equipment, that is capable of handling up to 300 lbs of payload
ii. Develop and demonstrate a system that can transport up to 300 lbs of payload up to 3 miles away and return empty of payload
iii. The system should be designed to function in a flightline environment that could include, but is not limited to salt fog, rain, extreme cold and hot temperatures, and airborne dust
iv. Develop matrix of operational tradeoffs relating to employing the new system that includes impacts on career fields including but not limited to maintainers, logistics, and airfield management
v. Generate Interface Control Document (ICD) and overview descriptions in parallel with the system development.
vi. System needs to be easy to use, dispatch, load, unload, and return with a minimum of software interaction
vii. System needs to be rapidly deployable.
viii. System needs to be capable of achieving various approvals including but not limited to Hazards of Electromagnetic Radiation to Ordnance (HERO) testing
Complete the design of the system, demonstrate performance of a prototype system through field testing, and deliver the prototype for subsequent evaluation by the government.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to airfield operations and parts delivery, but offer options for other aerial port operations in both austere and well-supported locations. Solutions may have application to commercial air operations and warehouse material handling operations.

REFERENCES:
1. Department of the Air Force Operational Imperatives, https://www.af.mil/Portals/1/documents/2023SAF/OPERATIONAL_IMPARITIVES_INFOGRAPHIC.pdf
2. NAVAL ORDNANCE SAFETY AND SECURITY ACTIVITY INDIAN HEAD MD; Hazards of Electromagnetic Radiation to Ordnance (HERO) Safety Test, 2013 https://apps.dtic.mil/sti/citations/ADA578915
3. Stanton, Mary, Autonomous Rovers: Flight Line Delivery of Maintenance Tools and Parts, 2020 https://apps.dtic.mil/sti/trecms/pdf/AD1114231.pdf

KEYWORDS: Contested Logistics, aerial port, logistics, cargo handling, tool control, supply, parts supply

AF254-D0836 TITLE: Small UAS MANET Antennas

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

OBJECTIVE: Develop a system capable of increasing the range to up to 50 miles of an air-to-air or air-to ground data connection of 1mb/s while using a mobile ad hoc network (MANET) commercially available radio operating in the S-band on a small (<75lbs) unmanned aerial system (UAS).

DESCRIPTION: Numerous government and commercial groups have experienced the multitude of benefits of MANET radios operating in the S-band to control and communicate with small UAS. Unfortunately, the current range of these types of radios greatly limits their operational capabilities. Currently most operations are conducted at a range of less than five miles, but the capability of air launched small UAS exceed this by orders of magnitude. They are unable to exercise this range because of this limitation and have been mostly relegated to close-in surveillance roles where their loiter time is still useful.
For several existing current and future operations, a greater stand-off between the small UAS and a larger airborne asset it is communicating with is greatly desired. The operational benefits of MANET radios are enough to continue utilizing them, but the government needs to develop a system to increase their range to meet emerging needs. The technical challenges include integration into small form factor UAS which drives both weight and physical size restrictions, as well as easily integrating with existing commercial radios. Most UAS of this class are tube launched from a standard ~6in diameter launch tube, which also drives integration challenges because of the streamlined shape this class of vehicles requires to fit inside and launch from the tube. One of the limitations with most current systems is the difficulty of integrating capable antenna designs into a streamlined tube-launched system. Its also to important to consider the orientation of the airborne assets to each and ways those might limit the capability of an antenna system. A number of larger systems are integrating beyond line-of-sight systems that use other communications networks to pass data between MANET nodes and that could be a technical approach to this problem if the integration challenges were met. For security reasons, any data transmitted must be encrypted to AES 256, but purposefully there are no other restrictions on the transmission method or system to allow for various technologies to be proposed.

PHASE I: This is a Direct to Phase 2 (D2P2) topic. Phase 1 like proposals will not be evaluated and will be rejected as nonresponsive. For this D2P2 topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort via some other means (e.g. IRAD, or other funded work). It must have developed a concept for a workable prototype or design to address at a minimum the basic capabilities of the stated objective above. Proposal must show, as appropriate to the proposed effort, a demonstrated technical feasibility or nascent capability to meet the capabilities of the stated objective. Proposal may provide example cases of this new capability on a specific application. The documentation provided must substantiate that the proposer has developed a preliminary understanding of the technology to be applied in their Phase II proposal to meet the objectives of this topic. Documentation should include all relevant information including, but not limited to technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Develop and demonstrate a system communicate data reliably over a commercial S-band MANET radio air-to-air from a small UAS to another airborne system at a range of at least 50 miles or air-to-ground between ground operators and small UAS.
i. Develop and demonstrate a system, compromised of one or more pieces of equipment, that is capable transmitting data at 1mb/s from a small UAS to a ground-based operator or another larger airborne asset
ii. The system should be designed to be integrated into a small UAS (<75 lbs) that is tube launched (<6in diameter)

iii. The system should account for differing orientations between the small UAS and the ground or air based asset it is communicating with
iv. Develop matrix of operational tradeoffs relating to employing the new system that includes impacts power consumption, cost, weight, and size
v. Generate Interface Control Document (ICD) and overview descriptions in parallel with the system development.
vi. System needs to be encrypted or easily capable of being encrypted using AES 256.
Complete the design of the system, demonstrate performance of a prototype system through field testing, and deliver the prototype for subsequent evaluation by the government.

PHASE III DUAL USE APPLICATIONS: The Government has an interest in transition of the demonstrated concept to current small UAS operations for surveillance and strike. Solutions may have application to commercial crop survey operations as well as disaster response for emergency personnel and firefighters.

REFERENCES:
1. Perez, Mariano Negron, SAR Image Formation with embedded QPSK communications in LFM guardbands and UAV antenna characterization https://apps.dtic.mil/sti/citations/AD1173453
2. Paula Paloma Sanchez Dancausa, Jose Luis Masa-Campos, Pablo Sanchez Olivares, and Eduardo Garcia Marin, "Omnidirectional Conformal Patch Antenna at S-Band with 3D Printed Technology," Progress In Electromagnetics Research C, Vol. 64, 43-50, 2016.
3. J. Peng, W. Tang and H. Zhang, "Directional Antennas Modeling and Coverage Analysis of UAV-Assisted Networks," in IEEE Wireless Communications Letters, vol. 11, no. 10, pp. 2175-2179, Oct. 2022

KEYWORDS: antennas, conformal antennas, directional antennas, S-band, MANET, UAV, communications, command and control, long range, small UAS

SF254-D801 TITLE: Resilient Military Communications (MilCom) – Enhancing MILSATCOM Resilience through Virtualization, Ground Architecture, Situational Awareness, and Data Management

TECHNOLOGY AREAS: Space Technology

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The resilience of military satellite communications (MILSATCOM) is critical in modern contested environments where electronic warfare, cyber threats, and physical disruptions pose persistent challenges. The Department of the Air Force (DAF) seeks advanced, deployable technologies that enhance resilience, flexibility, and efficiency within MILSATCOM networks, ensuring secure and continuous operations under all conditions.
Offerors are encouraged to propose solutions aligned with one or more of the identified focus areas. Proposals must clearly define how their technology contributes to MILSATCOM resilience, integrates within existing or future architectures, and enhances warfighter capability in contested environments. This topic is focused on developing solutions in four key areas:
1. **Network Virtualization**: Enable software-defined, adaptable MILSATCOM architectures to improve scalability, efficiency, and interoperability.
2. **Resilient Ground Architecture**: Develop fault-tolerant, distributed ground architectures to ensure continuity of operations in cyber-contested and degraded environments.
3. **Situational Awareness**: Provide real-time spectrum monitoring, signal intelligence, and predictive analytics to enhance electromagnetic spectrum (EMS) operations.
4. **Resilient Data Management**: Improve secure, adaptive, and efficient data transmission and storage to ensure mission-critical information remains available despite disruptions.
Key Outcomes:
- Increased MILSATCOM survivability through enhanced anti-jam, beyond-line-of-sight (BLOS), and multi-path communication techniques.
- Seamless integration of commercial, allied, and partner SATCOM capabilities to disaggregate vulnerabilities.
- Reduction in hardware dependencies using virtualization and software-defined networking (SDN).
- Enhanced data management and operational continuity across contested environments.
Proposed technologies should align with U.S. Space Force mission priorities, Space Data Network (SDN), Agile Combat Employment (ACE), and Joint All-Domain Command and Control (JADC2). Innovative solutions that address any of these focus areas—individually or in combination—are encouraged. Offerors must clearly define how their proposed technology supports MILSATCOM resilience, integrates within existing architectures, and meets operational needs.

DESCRIPTION: Modern MILSATCOM systems must maintain uninterrupted operational effectiveness despite adversarial interference, degraded networks, and evolving threats. As near-peer adversaries develop increasingly sophisticated electronic warfare (EW) and cyber capabilities, ensuring resilient, secure, and adaptive MILSATCOM has become a critical operational necessity.
This effort seeks to enhance MILSATCOM resilience by developing advanced, deployable technologies that align with U.S. Space Force (USSF) mission objectives and operational imperatives. Solutions should

improve flexibility, survivability, and efficiency, ensuring MILSATCOM systems remain operationally viable under all conditions, including contested, degraded, and denied environments.

FOCUS AREA 1. Network Virtualization

Objective: Enhance MILSATCOM agility, scalability, and resilience by reducing dependency on proprietary hardware through software-defined networking (SDN) and virtualized network functions (VNF). This focus area seeks solutions that enable dynamic, adaptable MILSATCOM architectures capable of seamless interoperability, rapid reconfiguration, and automated network resilience in contested and degraded environments.

Proposed Solutions May Include:

- Multi-waveform, software-defined modems to improve gateway flexibility and adaptability across service providers.
- Dynamic resource allocation that optimizes frequency and bandwidth management to maximize network efficiency.
- Virtualized, hardware-agnostic architectures that allow for rapid service provider transitions without dedicated, proprietary hardware.

Desired Outcomes & Phase II Expectations:

- Seamless multi-waveform, multi-vendor interoperability through SDN- and VNF-enabled architectures.
- Automated failover mechanisms ensuring continuous operations in the presence of cyberattacks, jamming, or network disruptions.
- Real-time network orchestration that provides dynamic diagnostics, optimized bandwidth allocation, and automatic service adaptation to mission conditions.
- Operational testing and demonstrations validating:
    - Reduced latency
    - Enhanced network agility
    - Seamless cross-provider transitions

Success Metrics

- Reduction in hardware dependency through software-driven adaptability.
- Faster service reconfiguration under contested or degraded conditions.
- Quantifiable cost efficiencies in MILSATCOM infrastructure deployment and sustainment.

FOCUS AREA 2. Resilient Ground Architecture

Objective: Enhance the resilience, survivability, and adaptability of MILSATCOM ground infrastructure by developing distributed, software-defined ground networks that ensure mission continuity in degraded, contested, and cyber-threatened environments. This effort seeks fault-tolerant architectures that can withstand disruptions, system failures, and adversarial attacks while maintaining seamless operations across global satellite communication networks.

Proposed Solutions May Include:

- Cloud-native, hardware-agnostic ground station architectures for flexibility, scalability, and rapid deployment.
- Automated failover mechanisms that proactively detect, isolate, and mitigate network disruptions to maintain continuous connectivity.
- Geographically dispersed processing nodes to enhance redundancy, operational survivability, and resilience in the face of physical or cyber threats.
- Distributed Command & Control (C2) architectures that decentralize processing and ensure real-time, failover-ready decision-making.

Desired Outcomes & Phase II Expectations:

- Distributed, automated C2 frameworks that support failover and mission continuity in the event of cyber, kinetic, or natural disruptions.
- Software-defined infrastructure automation that enables rapid recovery, scalability, and adaptable mission execution across global MILSATCOM operations.
- Redundant, geographically dispersed ground networks that mitigate single-node failure risks while

ensuring secure, real-time data processing.
- Operational demonstrations in simulated or live environments that validate:
    - Seamless mission continuity during network failures or contested operations.
    - Infrastructure resilience against cyberattacks, jamming, or adversarial interference
    - Interoperability with multiple MILSATCOM platforms without hardware dependencies.

Success Metrics:
- Proven automated failover capabilities and real-time C2 recovery in contested environments.
- Demonstrated ability to maintain operations across multiple satellite platforms despite disruptions.
- Validated infrastructure resilience through field simulations replicating adversarial scenarios.

FOCUS AREA 3. Situational Awareness for MILSATCOM

Objective: Enhance real-time electromagnetic spectrum (EMS) awareness to improve threat detection, interference mitigation, and operational decision-making. MILSATCOM networks require advanced situational awareness capabilities to detect, analyze, and respond to spectrum interference, jamming, and adversarial activity in contested environments.

Proposed Solutions May Include:
- AI-driven spectrum analysis for real-time detection, classification, and mitigation of signal interference and cyber-electromagnetic threats.
- Multi-source EMS fusion integrating ground, airborne, and space-based sensors to provide a comprehensive RF operating picture.
- Automated spectrum planning and resource allocation that adapts dynamically to mission needs, detected threats, and real-time conditions.
- Machine learning and predictive analytics to forecast adversarial spectrum behaviors, optimize communications pathways, and improve decision-making for MILSATCOM operators.

Desired Outcomes & Phase II Expectations:
- AI-enhanced RF spectrum monitoring to detect, localize, and characterize hostile jamming, interference, and anomalous signals in real time.
- Automated spectrum deconfliction and interference mitigation tools that dynamically re-route communications and optimize EMS resource allocation.
- Predictive analytics and machine learning that provide proactive interference mitigation strategies and battlefield spectrum awareness.
- Integration testing in simulated or live environments to validate multi-source EMS fusion, automated signal detection, and real-time operator decision-support tools.

Success Metrics:
- Real-time visualization of EMS threats and anomalies with actionable insights for operators.
- Reduction in manual spectrum allocation efforts through automation and AI-based tools.
- Increased accuracy in detecting and classifying RF threats, with demonstrated success in contested spectrum environments.
- Successful fusion of multiple spectrum data sources, improving overall situational awareness for MILSATCOM networks.

FOCUS AREA 4. Resilient Data Management

Objective: Ensure secure, adaptable, and efficient data transmission, storage, and processing in MILSATCOM systems to maintain mission-critical operations despite network disruptions, cyber threats, and contested environments. Effective data resilience is essential to ensuring real-time decision-making, operational continuity, and secure communication across MILSATCOM platforms.

Proposed Solutions May Include:
- Forward Error Correction (FEC) and adaptive pathing algorithms to improve packet recovery and network efficiency under degraded conditions.
- Data compression and optimization techniques to maximize bandwidth efficiency, particularly in low-latency and high-interference environments.

- Zero-trust cybersecurity architectures that harden MILSATCOM data storage, transmission, and processing against cyber and electronic warfare threats.
- AI-powered network monitoring and diagnostics to identify anomalous data flow patterns, optimize routing, and ensure resilient data distribution.

Desired Outcomes & Phase II Expectations:
- Dynamic network orchestration and real-time diagnostics optimizing MILSATCOM data flow, bandwidth allocation, and adaptive transmission techniques.
- Resilient packet recovery and Forward Error Correction (FEC) ensuring data integrity, loss prevention, and efficient retransmission in contested environments.
- Implementation of zero-trust cybersecurity frameworks to protect mission-critical data, secure storage environments, and enhance network integrity.
- Field validation and live-environment testing proving secure, scalable, and high-performance MILSATCOM data transport under operationally relevant conditions.

Success Metrics:
- Quantifiable improvements in data integrity, transmission efficiency, and packet recovery rates in degraded and contested SATCOM environments.
- Reduction in latency for mission-critical data transmission, supporting faster decision-making and enhanced operational effectiveness.
- Increased cybersecurity resilience through zero-trust protocols, AI-driven threat detection, and proactive anomaly detection.
- Successful integration with existing and next-generation MILSATCOM architectures, ensuring cross-platform interoperability.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for these focus areas. The applicant is required to provide detail and documentation in the D2P2 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-mission fit between the proposed solution and a potential Air Force and/or Space Force stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the DAF customer and end-user. The feasibility study should have:
1. Clearly identified the potential stakeholders of the adapted solution for solving the Air Force and/or Space Force need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with other relevant systems and/or processes.
3. Describe if and how the solution can be used by other DoD or Governmental customers.

PHASE II: Phase II efforts will focus on the development, integration, and demonstration of prototype technologies that enhance MILSATCOM resilience across the four key focus areas: Network Virtualization, Resilient Ground Architecture, Situational Awareness, and Resilient Data Management. Offerors must clearly align their deliverables with their selected focus area(s) while ensuring interoperability with broader MILSATCOM systems. The goal is to mature technologies to a Technology Readiness Level (TRL) of 7, demonstrating their effectiveness in operationally relevant environments.

General Phase II Deliverables (Applicable to All Focus Areas)
Offerors must propose a technology maturation plan with clear milestones and tailored deliverables based on their focus area(s). General requirements include:
- Prototype Development: Develop a functional prototype capable of operating in contested, degraded, or cyber-threatened environments.
- Operational Demonstrations: Validate system performance through live or simulated testing in

MILSATCOM-relevant conditions.
- Performance Metrics & Validation: Quantify improvements over existing solutions in key areas, such as:
    - Reduced latency and improved network agility (Network Virtualization).
    - Increased infrastructure redundancy and failover capabilities (Resilient Ground Architecture).
    - Enhanced spectrum awareness and automated interference mitigation (Situational Awareness).
    - Improved secure data transmission and storage under adversarial conditions (Resilient Data Management).
- Interoperability & Scalability Testing: Ensure compatibility with current and future MILSATCOM architectures, including software-defined networking (SDN), cloud-based ground infrastructure, and multi-waveform communications.
- Automated & Adaptive Features: Demonstrate AI-driven automation, self-healing capabilities, or intelligent network adaptation that enhance resilience and reduce manual operator workload.
- Cybersecurity & Compliance: Implement zero-trust architectures, secure data transport, and real-time threat mitigation aligned with DoD cybersecurity frameworks and Risk Management Framework (RMF) requirements.
- Transition Planning: Develop a clear integration strategy outlining how the technology will transition into operational DoD use, aligning with existing programs of record, USSF initiatives, or future MILSATCOM investments.
Success Criteria for Phase II
- Technical Feasibility: The prototype must demonstrate measurable improvements in resilience, efficiency, and security compared to current capabilities.
- Operational Validation: Successful testing in a relevant DoD or MILSATCOM environment, proving real-world applicability.
- Path to Phase III & Commercialization: A well-defined transition plan showing how the solution can scale to full deployment within MILSATCOM systems and commercial applications.
By the end of Phase II, selected technologies should be ready for Phase III follow-on funding, including Strategic Funding Increase (STRATFI), Tactical Funding Increase (TACFI), or direct integration into DoD programs of record.

PHASE III DUAL USE APPLICATIONS: Beyond military applications, solutions should be scalable for commercial markets, such as:
- Next-generation SATCOM networks (e.g., 5G, software-defined satellites).
- Emergency and disaster response communications for first responders and humanitarian efforts.
- Critical infrastructure and secure enterprise networking and government communication.
- Cloud-based defense applications supporting AI, cybersecurity, and autonomous systems.
Solutions that demonstrate strong transition potential may qualify for follow-on contracts, including STRATFI, TACFI, or direct integration into major DoD programs.

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mobile-communication-integration.pdf.

II. Resilient Ground Architecture Focus Area References

1. DoD Digital Modernization Strategy – Cleared July 12, 2019. https://media.defense.gov/2019/Jul/12/2002156622/-1/-1/1/DOD-DIGITAL-MODERNIZATION-STRATEGY-2019.PDF.
2. SATELLITE CONTROL NETWORK, GAO report to Congressional Committees – April 2023. https://www.gao.gov/assets/820/818921.pdf.
3. THE PRESIDENT'S NATIONAL SECURITY TELECOMMUNICATIONS ADVISORY COMMITTEE – May 6, 2021. https://www.cisa.gov/sites/default/files/publications/NSTAC%20Report%20to%20the%20President%20on%20Communications%20Resiliency_0.pdf.
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2. Department of Defense Electromagnetic Spectrum Superiority Strategy (October 2020). https://media.defense.gov/2020/Oct/29/2002525927/-1/-1/0/electromagnetic_spectrum_superiority_strategy.pdf.
3. Riad Hussein et al, R., "Spectrum Sensing and Management using Orthogonal Frequency Division Multiplexing based on Cognitive Radio Networks with Cooperative Spectrum Sensing," IEEE 2024 4th International Conference on Mobile Networks and Wireless Communications (ICMNWC) 2025. https://ieeexplore.ieee.org/document/10872397.
4. Sabir, B et al, "Systematic Literature Review of AI-enabled Spectrum Management in 6G and Future Networks," arXiv.org, submitted 12 June 2024. https://arxiv.org/pdf/2407.10981v1.

IV. Resilient Data Management Focus Area References

1. Department of Defense Electromagnetic Spectrum Superiority Strategy (October 2020). https://media.defense.gov/2020/Oct/29/2002525927/-1/-1/0/electromagnetic_spectrum_superiority_strategy.pdf.
2. "Department of Defense (DoD) Zero Trust Reference Architecture", prepared by the Defense Information Systems Agency (DISA) and National Security Agency (NSA) Zero Trust Engineering Team, version 2.0 July 2022. https://dodcio.defense.gov/Portals/0/Documents/Library/%28U%29ZT_RA_v2.0%28U%29_Sep22.pdf.
3. Introduction to Forward Error Correction Coding, NASA Reference Publication 1367, December 1996. https://ntrs.nasa.gov/api/citations/19970009858/downloads/19970009858.pdf.
4. Joint All-Domain Command and Control (JADC2) Strategy (March 2022). https://media.defense.gov/2022/Mar/17/2002958406/-1/-1/1/SUMMARY-OF-THE-JOINT-ALL-DOMAIN-COMMAND-AND-CONTROL-STRATEGY.pdf.

KEYWORDS: Game Theory; Nonlinear Dynamics; Network Virtualization; Military Satellite Communication (MILSATCOM); Software-Defined Networking (SDN); Virtualized Network Functions (VNF); Digital Intermediate Frequency (IF) Transport; Digital Radio Frequency (RF) Transport; Multi-Waveform Modem; IF Converter; Virtualized Computing Resources; Waveform Processing Efficiency; Software-Defined Components; Distributed Aperture Architecture; Gateway Flexibility; Resilient Communication Systems; Adaptable architecture; Distributed data processing; Configuration management; Diversified ground architecture; Hardware-agnostic; Geographic dispersal; Satellite Control Network (SCN); Data path diversity; Agile communication systems; Open/nonproprietary capabilities;

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Electromagnetic Spectrum (EMS); RF Environment Monitoring; Spectrum Ingestion & Fusion; Signals Characterization; Real-Time Spectrum Analysis; Battlefield Planning & Decision-Making; Spectrum Insights Distillation; Predictive Analytics; Spectrum Utilization Optimization; Communications Resilience; Automated Spectrum Monitoring; Space Data network (SDN); Data Management; Dynamic Network Orchestration; Real-time Diagnostics; Application-Aware Quality of Service (QoS); Guaranteed Packet Recovery; Transmit Path Diversity; Forward Error Correction (FEC); Latency Tolerance; Data Compression; Secure Data Transport; Resilient Data Management; Network Resilience; Fault-Tolerant Communications; Cybersecurity in Satellite Communications; Adaptive Network Protocols; Degraded Communication Environments; Mission-Critical Data Transfer; Command and Control (C2) Data Resilience; Reliable Storage and Retrieval; Operational Continuity

SF254-D802 TITLE: Space-Based Environmental Monitoring (SBEM) in Very Low Earth Orbit (VLEO)

TECHNOLOGY AREAS: Space Technology

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: This topic will examine new low-cost "attritable" platforms capable of hosting various dedicated sensor technologies that advance the ability to perform SBEM in VLEO space operations. The primary intent is to gain significant development in VLEO SBEM technologies and capabilities enabling persistent space operations in VLEO. Leveraging these emerging VLEO attritable platforms and sensor technologies will infuse innovation into the traditional space operations framework and unlocking lower altitude space operations.

DESCRIPTION: The US Space Force (USSF) looks to accelerate emerging technologies as it pertains to Space-Based Environmental Monitoring (SBEM) in Very Low Earth Orbit (VLEO). By advancing these core capabilities, this topic will meet the Department of Air Force's (DAF) Operational Imperative 1 "Defining Resilient and Effective Space Order of Battle and Architectures," and 7 "Readiness of the Department of the Air Force to transition to a wartime posture against a peer competitor." As the space operational environment evolves, there is a need for new technologies and capabilities in non-traditional orbital regimes that allow for a more sustainable and resilient environment. Understanding the space environment's impact on satellite operations and anomalies, communications, positioning, navigation, and timing (PNT) signals is critical to both U.S. national security and commercial space operations. Currently space weather specification and forecast rely on a limited set of observational assets, and there is a lack of standardized solutions for capturing global ionospheric and thermospheric data. This program aims to develop a low-cost method to collect and analyze environmental data that will enhance space weather specification and forecasting capabilities. The method could span the range from a low-cost low SWAP sensor to be hosted on a space-based platform to an expendable self-contained sensor similar to the dropsondes used to collect data for terrestrial weather prediction. Relevant measurements include the total density and composition of both neutral and plasma species, electric fields, and wind. Novel concepts involving systems as a sensor concepts or remote sensing of embedded objects are encouraged.
The Space Force is a large and complex organization consisting of many functions with similar counterparts in the commercial sector. The Space Force in partnership with the Air Force Research Laboratory (AFRL/RV) aims to explore innovative technology domains with demonstrated commercial value in the non-Defense sector, i.e., through existing products/solutions, in order to obtain Space Force applications, i.e. Dual-Purpose Technologies/Solutions. It is important that potential solutions have a high probability of keeping pace with technological change. Thus, solutions should be closely tied to commercial technologies and solutions supporting the solution's development. Proposals for this topic should demonstrate a high probability of identifying a product-market fit between a Space Force end user and the proposed solution through a non-Defense commercial solution's adaptation. This topic seeks to explore potential commercial products enabling SBEM in VLEO through either the development of a low-cost attritable platform or further development of state-of-the-art sensors for operations in VLEO.
PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for this topic. The applicant is required to provide detail and

documentation in the D2P2 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-mission fit between the proposed solution and a potential Air Force and/or Space Force stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the DAF customer and end-user. The feasibility study should have:
1. Clearly identified the potential stakeholders of the adapted solution for solving the Air Force and/or Space Force need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with other relevant systems and/or processes.
3. Describe if and how the solution can be used by other DoD or Governmental customers.

PHASE II: Space environmental impacts (specifically on communications & PNT signals) are of interest to both US national security and industrial base. The region of space above the Earth, at approximately 100-400 km, offers unique opportunities for in-situ measurements of space weather data. Space weather forecasting involves the combination of various data sources within the ionosphere and thermosphere as well as implementing detailed physics-based models. Currently, there are minimal standardized solutions that capture global space environmental data in the 100-400 km range (such as electric field measurements, molecular data, temperature, density, winds, etc.).
This project focuses on developing a low-cost, small satellite platform specifically designed for VLEO operations to conduct in-situ measurements of the various layers within the thermosphere and ionosphere. Past efforts in lower thermosphere-ionosphere research have primarily relied on sounding rockets, ground-based radar systems, and sparse satellite measurements. While these methods have provided valuable snapshots of various data such as electron density, plasma temperature, and electric field dynamics, they lack the ability to deliver continuous, real-time data required for accurate space weather forecasting. This platform should provide a persistent, standardized solution to address space weather gaps in specification and forecast by augmenting traditional research conducted through ground-based observations, sounding rocket campaigns and other traditional space-based observation platforms with continuous, high-resolution data collection.
The proposed solution could be optimized to host Langmuir Probes and Electric Field Probes (EFPs), which are critical for studying electron density, plasma temperature, electric fields, and ionospheric dynamics in the 100-400 km altitude range. Non-conventional specialty sensors that may provide benefits in the 100-400 km range are also of interest, to include innovative low-cost solutions to measuring even one of the critical parameters.
Successful Phase-II proposals should emphasize innovative concepts such as rapid prototyping, drop-sounds like concepts that might be monitored remotely, and onboard AI-driven data processing for efficient data downlink and real-time analysis. Project scope should also include an end-to-end capability ready for demonstration in a relevant operational environment, including initial development of potential design reference missions.

PHASE III DUAL USE APPLICATIONS: Some solutions may go from Phase II to Phase III as soon as the product-market fit is verified. Potential Phase III awardees will transition the adapted non-Defense commercial solution to provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications.

REFERENCES:
1. Technology Readiness Assessment Best Practice Guide - https://ntrs.nasa.gov/api/citations/20205003605/downloads/%20SP-20205003605%20TRA%20BP%20Guide%20FINAL.pdf.
2. TRL Guide - https://www.gao.gov/assets/gao-20-48g.pdf.

3. https://esamultimedia.esa.int/docs/EarthObservation/ENLoTIS_Report_ISSUED_2024.pdf.
4. https://spacewerx.us/.

KEYWORDS: Very Low Earth Orbit (VLEO); Space-Based Environmental Monitoring (SBEM); Military Application of the Space Environment (MASE); Expandable; Remote Sensing Platform

SF254-D803 TITLE: Novel Propulsion Solutions for the Very Low Earth Orbit (VLEO) Regime

TECHNOLOGY AREAS: Space Technology

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: As the space operational environment evolves, there is a need for new technologies and capabilities in non-traditional orbital regimes that allow for a more sustainable and resilient environment. This topic will examine new propulsion technologies and associated mission designs that advance the ability to perform VLEO space operations. The primary intent is to gain significant development in propulsion technologies and capabilities enabling persistent space operations in VLEO. Leveraging these emerging VLEO propulsion technologies will infuse innovation into the traditional space operations framework by reducing reliance on space mission operations in Low Earth Orbit (LEO) and unlocking lower altitude space operations.

DESCRIPTION: The US Space Force (USSF) looks to accelerate emerging technologies and mature concepts of operations (CONOPs) as it pertains to novel propulsion solutions for the VLEO regime. By advancing these core capabilities, this topic will meet the Department of Air Force's (DAF) Operational Imperative 1 "Defining Resilient and Effective Space Order of Battle and Architectures," and 7 "Readiness of the Department of the Air Force to transition to a wartime posture against a peer competitor."

The Space Force wishes to explore innovative technologies with demonstrated commercial value in the non-Defense sector, i.e., through existing products/solutions, which apply to Space Force applications, i.e. dual-purpose, commercial and military technologies/solutions. It is important that potential solutions have a high probability of keeping pace with technological change.

This topic seeks to explore potential commercial products enabling sustained space operations in the emerging VLEO market for potential use in a variety of Space Force missions. Traditional propulsion technologies are not optimized for sustained operations in this regime due to high atmospheric drag, increased atomic oxygen exposure, and dynamic orbital variations. This topic solicitation aims to advance the state of the art in VLEO propulsion, enabling extended mission lifetimes, novel orbit maneuvering concepts, and discovery of future operations in non-traditional orbits.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for this topic. The applicant is required to provide detail and documentation in the D2P2 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-mission fit between the proposed solution and a potential Air Force and/or Space Force stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the DAF customer and end-user. The feasibility study should have:

1. Clearly identified the potential stakeholders of the adapted solution for solving the Air Force and/or Space Force need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with

other relevant systems and/or processes.
3. Describe if and how the solution can be used by other DoD or Governmental customers.

PHASE II: Operations in the VLEO regime have potential to be a “game changing” opportunity that creates the ability to fight through any perturbations that may occur in other orbits during or following a conflict. The project scope will investigate transformative technologies aimed at the development and maturation of propulsion technologies tailored for the VLEO domain. To accomplish this, the topic will focus on the following core technology areas:
(1) Enhance Drag Compensation Capabilities: Developing propulsion systems that counteract atmospheric drag at altitudes between 100-400 km, allowing for allowing for an improvement in mission duration over the current state of the art for the selected propulsion concept and space platform in VLEO.
(2) Improve Propulsion Efficiency: Advancing VLEO propulsion systems that provide high specific impulse with minimal power consumption to support small satellite and large constellation architectures.
(3) Enable Persistent VLEO Operations: Supporting mission requirements for intelligence, surveillance, reconnaissance (ISR), communications, and space domain awareness through sustained low-altitude station-keeping.
(4) Leverage Nontraditional Propellant Sources: Investigating air-breathing or other innovative in-situ propellant collection methods to support continuous thrust without onboard propellant limitations, in addition to non-traditional propellants within volume constrained space platforms.
Proposals should focus on developing scalable propulsion architectures that allow for precise altitude control, station-keeping, and responsive maneuvering, while also considering the value proposition trade space for low-cost, expendable system designs for rapid response missions with limited-lifetime platforms. Successful Phase II proposals and awards will provide evidence of market fit in a detailed business plan, including total available market (TAM) and served available market (SAM); revenue model and plan; and scaling plan, including supply chain and manufacturing. The successful Phase II capability shall achieve TRL-3 or higher, as documented in a final report with laboratory and/or field demonstrations.

PHASE III DUAL USE APPLICATIONS: Some solutions may go from Phase II to Phase III as soon as the product-market fit is verified. Potential Phase III awardees will transition the adapted non-Defense commercial solution to provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications.

REFERENCES:
1. A Breath of Fresh Air: Air-Scooping Electric Propulsion in Very Low Earth Orbit - https://csps.aerospace.org/sites/default/files/2021-08/Spektor-Jones_AirBreathing_20210318.pdf.
2. Technology Readiness Assessment Best Practice Guide - https://ntrs.nasa.gov/api/citations/20205003605/downloads/%20SP-20205003605%20TRA%20BP%20Guide%20FINAL.pdf.
3. TRL Guide - https://www.gao.gov/assets/gao-20-48g.pdf.
4. https://spacewerx.us/.

KEYWORDS: Very Low Earth Orbit (VLEO); Electric Propulsion (EP); Air-Breathing Electric Propulsion (ABEP); Ion Propulsion; Drag Compensation; Propellent Efficiency

SF254-D804 TITLE: Magnetically Clean Remote Sensing Satellite for VLEO mapping mission

TECHNOLOGY AREAS: Space Technology

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: As the air and space operational environment evolves, there is an increased demand for navigation solutions that can operate independent of traditional PNT solutions provided by Global Navigation Satellite Systems (GNSS). MagNav provides unjammable navigation when other signals are unavailable, including over water, in inclement weather, and during long missions.
The USSF, in partnership with the National Geospatial-Intelligence Agency (NGA) Research and Development Directorate, aims to advance MagNav by providing a dedicated satellite to operate in VLEO to collect high-resolution magnetic field data. This project will develop a magnetically clean space-based observing system or systems, to operate at extremely low-orbiting altitudes (100-300 km), capable of performing a mapping mission investigating the Earth's crustal magnetic field. The primary goal is to acquire the necessary high-accuracy, high-resolution global data to map Earth's crustal magnetic field at the highest possible resolution and improve geomagnetic models for advanced navigation applications.

DESCRIPTION: The US Space Force (USSF) looks to accelerate emerging technologies and mature alternative map-based navigation techniques that can provide part of the solution for alternative positioning, navigation and timing (PNT) systems. Specifically, this project aims to further develop and enhance the magnetic navigation (MagNav) techniques by developing a space-based remote sensing platform to operate in very low earth orbit (VLEO), capable of collecting the data necessary to map the Earth's crustal magnetic field. By advancing these core capabilities, this topic will meet the Department of Air Force's (DAF) Operational Imperative 1 "Defining Resilient and Effective Space Order of Battle and Architectures."
Recognizing the increasing vulnerability of systems dependent on GNSS, this VLEO Magnetic Mapper (VMM) project aims to develop magnetic navigation as a robust alternative navigation capability for use in GNSS-denied environments. This project will research, design, and plan a demonstration magnetic mapping mission using a remote sensing satellite to operate in VLEO. This space-based mapping will provide a crucial foundation for augmenting and calibrating localized magnetic navigation maps currently generated from air and ground-based surveys. By collecting data across the globe from altitudes between 100km and 350km, this project will address critical limitations in current magnetic navigation map making capabilities, including access in highly contested areas, air and ground sensor limitations, algorithmic challenges, and the presence of inconsistent or missing map data, particularly in strategically important military areas.
The project's scope encompasses strong collaboration across strategic partnering agencies as well as ties to various international partners as part of the Responsive Space Capabilities (RSC) Memorandum of Understanding (MOU). This work will support ongoing effort within the RSC MOU which initiates, conducts, and manages research, development, test, and evaluation cooperation related to responsive space capabilities and aims to validate and execute the feasibility of a VLEO satellite-based mapping mission. This collaboration will be essential for conducting comprehensive mission analysis, optimizing mission design, and executing the build, test, and launch phases of the demonstration mission. The ultimate objective is to generate usable global magnetic field data that can be directly applied in

subsequent testing and development of MagNav applications. This data will not only improve the accuracy and reliability of MagNav systems but also contribute to the development of advanced algorithms and sensor technologies for future magnetic navigation systems

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for this topic. The applicant is required to provide detail and documentation in the D2P2 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-mission fit between the proposed solution and a potential Air Force and/or Space Force stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the DAF customer and end-user. The feasibility study should have:
1. Clearly identified the potential stakeholders of the adapted solution for solving the Air Force and/or Space Force need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with other relevant systems and/or processes.
3. Describe if and how the solution can be used by other DoD or Governmental customers.

PHASE II: The proposed solutions should demonstrate design concepts to define a very low altitude satellite for a demonstration mission. Proposed solutions should consider shorter life spans (<12 months) for the initial demonstration mission and heavily factor in size, weight, power and costs (SWaP-C) limitations associated with the development of operating at very low altitudes. This project aims to rapidly advance the state of what is possible and use the cost value proposition of operating in a VLEO environment for shorter periods vs. larger, bespoke systems that have exquisite capabilities. A successful proposal should also consider future designs for a satellite constellation or a set of extremely low-orbiting satellites to be launched in succession, to support crustal magnetic field mapping. The end goal of the demonstration mission will prove viability to perform mapping of the crustal magnetic field from space with a target half-wavelength resolution less than or equal to 80 km at the equator.
Proposed solutions should consider the impact of operating in multiple orbit configurations (polar, near-polar, circular, elliptical). Design reference missions (DRM) and final orbit configurations will be worked jointly with NGA and USSF based on independent assessments and analysis completed for this effort. The satellite design should consider various complications that may arise from operating in lower altitudes (<300km) such command and control (C2) operations for short contact windows, propulsion needed to maintain very low altitude orbits, platform interference with magnetometer payloads, platform stability, etc. The nominal payload suite includes vector and scalar magnetometers, star cameras, GPS receiver, etc. Proposed solutions should consider the full spectrum of what is possible to achieve the desired data from this demonstration mission. Alternative payload designs may incorporate the state-of-the-art sensing techniques for magnetic anomaly detection such as the use of quantum magnetometers (e.g. Diamond Nitrogen-Vacancy, Optically Pumped, etc). Importantly, the satellite bus should be tightly integrated with the instruments needed to enable high-accuracy, scientific measurements. In particular, a successful proposed solution will minimize payload interactions with the platform (such as magnetic field instruments deployed on booms) and enable accurate measurements of magnetic fields, to ensure that highest quality data are obtained.
The final outcome of this effort should be a VLEO satellite capable of a demonstration mission to perform low altitude remote sensing of Earth’s magnetic field. Proposed work should detail subsystem needs and offer trade space solutions for capabilities and performance associated with payloads, cost, power, orbital life span.
PHASE III DUAL USE APPLICATIONS: Some solutions may go from Phase II to Phase III as soon as the product-market fit is verified. Potential Phase III awardees would focus on adapting technology developed for larger missions supporting DoD and other government agencies. Successful Phase II efforts

are expected to be ready to complete a demonstration in a relevant operating environment (TRL 7) prior to any potential Phase III efforts.

REFERENCES:
1. Crustal Filed Study - http://www.spacecenter.dk/%7Enio/papers/GJI-22-0442.pdf.
2. Lower Thermosphere-Ionosphere Science - https://esamultimedia.esa.int/docs/EarthObservation/ENLoTIS_Report_ISSUED_2024.pdf.
3. Magnetic Navigation - https://www.gps.gov/governance/advisory/meetings/2018-12/canciani.pdf.
4. SWARM Satellite Mission - https://earth.esa.int/eogateway/missions/swarm.
5. Technology Readiness Assessment Best Practice Guide - https://ntrs.nasa.gov/api/citations/20205003605/downloads/%20SP-20205003605%20TRA%20BP%20Guide%20FINAL.pdf.
6. TRL Guide - https://www.gao.gov/assets/gao-20-48g.pdf.
7. https://spacewerx.us/.

KEYWORDS: Very Low Earth Orbit (VLEO); Magnetic Navigation; Magnav; Remote Sensing; Magnetic Navigation; Magnetic Anomally Map; Lithospheric Magnetic Field

SF254-D805 TITLE: Digital Transformation of Space Force Human Resource Presentation Layer

TECHNOLOGY AREAS: Advanced Computing and Software

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The U.S. Space Force (USSF) Directorate of Manpower, Personnel and Services (USSF/S1) seeks dual-use solutions to investigate existing commercial solutions and innovative approaches to enterprise-wide Human Resource (HR) systems and provide a framework to evaluate and compare industry solutions. To ensure the USSF has the most effective and scalable human resource solutions, this work will conduct comprehensive market research and an analysis of alternatives for UX/UI platforms supporting the system integration of a presentation layer into the data layer utilized for USSF HR management. This effort will assess the current landscape of enterprise HR solutions, identifying platforms that align with USSF's unique workforce management needs. This topic will meet the Department of Air Force's (DAF) Operational Imperative 7 "Readiness of the Department of the Air Force to transition to a wartime posture against a peer competitor."

DESCRIPTION: USSF/S1 Directorate of Manpower, Personnel and Services requires innovative solutions to assist with the design, configuration, implementation, migration, integration, security, and operations for applications related to human resources. This effort will directly support USSF/S1 in defining, testing and evaluating commercial applications with the intent to transform current USSF HR business practices and workforce development. The proposed solution will utilize industry best practices to effectively support USSF personnel with a modern management and technology system. This effort will replace or integrate with existing systems to create a secure, scalable, and flexible enterprise resource planning platform capable of managing the full lifecycle of Guardian personnel.

PHASE I: This topic is intended for technology proven ready to move directly into Phase II. Therefore, Phase I awards will not be made for this topic. The applicant is required to provide detail and documentation in the D2P2 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-mission fit between the proposed solution and a potential Air Force and/or Space Force stakeholder. The applicant should have defined a clear, immediately actionable plan with the proposed solution and the DAF customer and end-user. The feasibility study should have:
1. Clearly identified the potential stakeholders of the adapted solution for solving the Air Force and/or Space Force need(s).
2. Described the pathway to integrating with DAF operations, to include how the applicant plans to accomplish core technology development, navigate applicable regulatory processes, and integrate with other relevant systems and/or processes.
3. Describe if and how the solution can be used by other DoD or Governmental customers.

PHASE II: Proposed solutions will gather industry data, evaluate platform capabilities, and provide a detailed comparative analysis of potential solutions, focusing on adaptability, configurability, and long-term sustainability supporting HR data management applications being developed within USSF/S1. To do this, the project scope will conduct a test and evaluation campaign of available commercial HR management systems that could be fielded as the presentation layer (UI/UX) to deliver process automation capabilities that will enable the implementation of modern HR practices and bring innovative tools and applications to the USSF.

Following the market research phase, proposed solutions will design and orchestrate a structured evaluation competition to assess the performance and suitability of selected HR platforms. This competition will simulate real USSF HR processes to evaluate how each solution meets critical criteria, including rapid configurability, technical capabilities, interoperability with legacy DoD systems (e.g., MILPDS), security and audit compliance, and overall feasibility for long-term implementation. The evaluation will provide data-driven insights to support a final down-selection of solutions, ensuring the Space Force adopts a modern, secure, and mission-ready HR management system. Phase II project scope should also include an end-to-end capability demonstration for a down selection of desired HR software and platform that meets the USSF needs. Proposed solutions should evaluate 2-3 user experience (UX) prototypes at once with the intent to reduce significant pain points felt by both Guardians and Human Resource practitioners brought forth by current human capital systems. Proposed solutions will focus on executing the evaluation competition and focus on four key criteria to ensure the selected solution meets USSF's operational and security requirements.
- Functionality will assess the balance between out-of-the-box capabilities and necessary customization, as well as the speed of deployment.
- Flexibility and scalability will evaluate the ability to adjust workflows with minimal downtime, prioritize configuration over complex development, and rapidly implement changes.
- Security and compliance will ensure solutions meet Authorization to Operate (ATO) and Risk Management Framework (RMF) standards while incorporating robust security measures.
- User experience will focus on intuitive design, ease of use for Guardians and leadership, and real-time adaptability.

Following the competition, successful proposals may have the opportunity to lead follow-on work as system integrators, ensuring seamless interoperability with existing USSF and DoD legacy systems while facilitating a smooth transition to a modernized HR platform. Proposed solutions should target work plans that align with a multi staged approach as outlined below.
Stage 1. Market analysis and discovery: Development and research into criteria development, evaluation, and acquisition support for up to 2-3 prototypes.
Stage 2. Documentation Evaluation Phase: Proposers generate criteria and evaluation factors for potential HCM solutions and lead effort to discover multiple prototype systems. Outline test and evaluation criteria based on government needs for HR capabilities, and support during review of prototype solutions.
Stage 3. Demonstration Phase: Define scenario-based evaluations for potential HR solutions. Deliverables in this stage are documented test and evaluation criteria scenarios based on government needs for HR capabilities, and support during review of HR Vendor demonstrations.
Stage 4. System T&E/integration: Proposer should include plans to assist USSF/S1 with creating respective Business Capability Acquisition Cycle (BCAC), compliance, and acquisition documentation as well as system integrator support for research, test and evaluation.

PHASE III DUAL USE APPLICATIONS: Phase III efforts would entail ongoing support for system integration. Potential Phase III awardees will transition the adapted commercial solution to provide expanded mission capability for a broad range of potential Governmental and civilian users and alternate mission applications.

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REFERENCES:
1. Space Force Personnel Management Act (PMA) – https://www.spaceforce.mil/Portals/2/Documents/Foundational_Documents/PMA_Tranche_1_Announcement.pdf.
2. https://spacewerx.us/.

KEYWORDS: Human Resources (HR); Information Technology (IT) Services; Manpower Personnel; User Interface (UI)/User Experience (UX)

SF254-D806 TITLE: United States Space Force Human Capital Management Modernization

TECHNOLOGY AREAS: 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. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with section 3.5 of the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: The U.S. Space Force (USSF) seeks innovative research-driven human capital management (HCM) technologies to modernize its personnel systems in alignment with the Space Force Personnel Management Act (PMA) through AI-enhanced automation, predictive analytics, and cloud-based architectures. This effort aims to develop, prototype, and validate novel approaches to workforce management that dynamically adapt to Space Force personnel needs and operational requirements.

DESCRIPTION: USSF operates in a highly dynamic environment that demands real-time personnel tracking, predictive talent analytics, and rapid force mobilization. However, legacy HR systems create bottlenecks in assignments, promotions, and payroll processing which negatively impacts Gurdian readiness. This effort will explore next-generation, dual-use HCM solutions that integrate with DoD networks while leveraging commercial advancements in AI-powered workforce analytics, blockchain-secured personnel records, and cloud-native architectures. The desired solution should:
- Develop Next-Generation Personnel Tracking: Implement a system that provides real-time status updates on all Guardians to support rapid force realignment and operational planning.
- Advance AI-Driven Workforce Agility: Enable automated workforce modeling and scenario analysis to optimize personnel distribution and readiness based on mission-critical needs.
- Eliminate Administrative Delays via Automation: Utilize natural language processing (NLP) and robotic process automation (RPA) to streamline HR workflows and eliminate chokepoints in career transitions.
- Ensure Cybersecurity & Compliance at DoD IL-4+: Develop a solution that meets Zero Trust security principles, complies with DoD standards, and supports encrypted personnel data exchange.
- Enhance Interoperability with Existing DoD Systems: Develop APIs and integration layers that facilitate seamless data sharing across HR, payroll, and operational command platforms.
- Leverage Predictive Analytics & AI for Talent Optimization: Utilize AI/ML to forecast personnel requirements, analyze workforce trends, and recommend proactive reskilling initiatives to ensure mission continuity.
- Deliver a User-Centric, Mobile-Enabled Platform: Ensure full mobile accessibility for Guardians, enabling secure self-service HR capabilities from any location.

The office of the Assistant Secretary for Space Acquisition and Integration (SAF/SQ) is seeking innovative solutions to deploy a dual-use technology solution on a government network to support the initial tranche of the Space Force PMA. This project will work directly with the SAF/SQ team for rapid software development with the intent to transform current USSF HR business practices and workforce development.

PHASE I: This topic is Direct-to-Phase II (D2P2), requiring offerors to demonstrate prior R&D work that validates the feasibility of a Defense-adapted HCM solution. The following feasibility criteria must be met:
- Technical Maturity: Prior work should demonstrate at least TRL 5-6, with functional prototypes or early-stage pilot deployments.

- Scientific and Technical Merit: Documentation should provide evidence of novel methodologies, AI-enhanced automation, or cloud-based architectures that improve upon existing HCM solutions.
- Commercial and Defense Use Validation: Offerors must provide evidence of prior market testing, user validation, or dual-use potential in both commercial and military HR applications.
- Integration Feasibility: Proposals should outline technical integration strategies, projected costs, and roadmap alignment with existing DoD enterprise systems.

Offerors should provide supporting technical reports, test data, performance benchmarks, and prototype demonstrations as part of their feasibility package.

PHASE II: The project scope will investigate a cloud-based, configurable solution with robust analytics and workflow automation will streamline HR processes, improve agility, and enhance data-driven decision-making. Current legacy systems are rigid, outdated, and unable to support the dynamic workforce needs of the future Space Force, which demands real-time personnel tracking, automated talent management, and seamless integration across multiple organizations. The system must also adapt to changing mission parameters, regulatory updates, and emerging technologies while ensuring security and compliance with Department of Defense (DoD) standards.

This effort seeks an innovative HCM solution that minimizes development time, maximizes configurability, and integrates securely with existing and future DoD systems. Proposed solutions should aim to implement industry best practices and replace fragmented HR platforms with a scalable, interoperable system. This project will follow a phased approach to ensure a structured implementation, from defining requirements to full-scale deployment. Key objectives include designing a flexible and interoperable system, integrating with existing DoD infrastructure, maintaining compliance with cybersecurity standards, and ensuring user adoption through training and testing.

- Requirements Finalization– Define project scope, develop a detailed implementation plan, engage stakeholders to finalize requirements, procure initial licenses for 300 users, and initiate cybersecurity planning, including drafting the Body of Evidence (BOE) and Risk Management Framework (RMF) package to include identifying all key stakeholders and paths to production, leveraging multiple DoD pathways.
- Architecture Development – Design system architecture, map data flows, establish security controls, document technical specifications, and conduct stakeholder reviews to validate the solution before integration.
- Connectivity and Data integrity– Configure secure network access, integrate the HCM solution with existing DoD systems, enable seamless data synchronization, and implement security measures with comprehensive testing and risk assessments.
- Pilot Deployment – Execute a pilot rollout that includes coordinating with and providing documentation to a DoD Authorizing Official (AO) to obtain an Interim Authorization To Test (IATT) for up to 300 users, conduct training and onboarding, perform system validation through functional and performance testing, refine based on user feedback, and submit the final ATO package for approval.

The proposed work should leverage industry best practices for platform development, integration, and interoperability across multiple systems while incorporating automation to streamline historically manual processes. Successful proposed solutions will leverage commercial, modular, and cloud-agnostic systems that can be delivered via mobile platforms. Specifically, the project aims for innovative solutions that produce the below characteristics:

- Modularity: The system should be designed with a modular architecture to allow for easy updates, scalability, and integration with other systems.
- Cloud-Agnostic: The solution must be capable of operating on any cloud platform, ensuring flexibility and avoiding dependency on a single cloud provider.
- Support Mobile Platforms: The system should be accessible via mobile devices, providing Guardians with the ability to manage their information and access services on-the-go.

Deploy at DoD Impact Level (IL) IL-4: The solution must be capable of being deployed at Impact Level 4 (IL-4) to handle Controlled Unclassified Information (CUI) and meet all DoD Cloud Computing Security Requirements Guidelines (DoD CC SRG).

PHASE III DUAL USE APPLICATIONS: Successful Phase II solutions may transition into Phase III for full operational deployment across the USSF and broader DoD enterprise. Potential applications include:
- Enterprise-Wide USSF HCM Modernization: Deployment as the primary personnel management system for all Guardians, replacing legacy DoD HR systems.
- Cross-DoD Personnel Analytics Expansion: Extending AI-powered workforce analytics to predict and manage personnel needs across multiple military branches.
- Commercial Workforce Management Spin-Offs: Adapting the AI-driven talent management solution for civilian and industry applications, including aerospace, defense, and government sectors.

Phase III work may also involve scaling the solution to additional mission areas, integrating enhanced automation, AI-driven decision support, and blockchain-based workforce credentialing to future-proof DoD-wide human capital management.

REFERENCES:
1. Space Force Personnel Management Act (PMA) – https://www.spaceforce.mil/Portals/2/Documents/Foundational_Documents/PMA_Tranche_1_Announcement.pdf.
2. https://spacewerx.us/.

KEYWORDS: Human Capital Management; Platform Integration; Cloud Computing; Computer Information Systems; Artificial Intelligence

Defense Advanced Research Projects Agency (DARPA)
DoD 25.4 Small Business Innovation Research (SBIR)
Annual Broad Agency Announcement (BAA)
Proposal Submission Instructions
Release 8

INTRODUCTION

DARPA's mission is to make strategic, early investments in breakthrough science and technology that will have long-term positive impacts on our national security. As part of this mission, DARPA makes high-risk, high-reward investments in science and technology that have the potential to disrupt current understandings and/or approaches. The pace of discovery in both science and technology is accelerating worldwide, resulting in new fields of study and the identification of scientific areas ripe for small business utilization through the SBIR and Small Business Technology Transfer (STTR) programs. Small businesses are critical for developing technology to support national security. Proposers are encouraged to consider whether the Research/Research and Development (R/R&D) being proposed to Department of Defense (DoD) Components also has private sector potential, either for the proposed application or as a base for other applications. The topics below focus on technical domains important to DARPA's mission, pursuing innovative research concepts that fall within one of its technology offices. More information about DARPA's technical domains and research topics of interest can be found at https://www.darpa.mil/research. DARPA offers free resources through DARPAConnect to help potential performers navigate DARPA, including "Tips for DARPA Proposal Success." Join DARPAConnect at www.DARPAConnect.us to leverage on-demand learning and networking resources.

Proposers responding to a topic in this BAA must follow all general instructions provided in the DoD SBIR Program BAA. DARPA requirements, in addition to or deviating from the DoD SBIR Program BAA, are provided in the instructions below. All DARPA SBIR and STTR proposals must be submitted electronically through the Defense SBIR/STTR Innovation Portal (DSIP) as described in the Proposal Preparation and Submission sections of these instructions. It is recommended that firms register as soon as possible upon identification of a proposal opportunity to avoid delays in the proposal submission process. Proposers are encouraged to submit proposals as early as possible to avoid unexpected delays due to a high volume of traffic during the final hours before a BAA closes. *DARPA will not accept any late proposals.*

Proposers are encouraged to thoroughly review the DoD SBIR Program BAA and register for the Defense SBIR/STTR Innovation Portal (DSIP) Listserv to remain apprised of important programmatic and contractual changes.

- The DoD SBIR Program BAA is located at: https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations. Please select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at https://www.dodsbirsttr.mil/submissions/login.

Specific questions on the administration of the DARPA Program and these proposal preparation instructions should be directed to DARPA Small Business Programs Office at SBIR_BAA@darpa.mil. DSIP Topic Q&A will NOT be available for these DARPA topics. Technical questions related to improving the understanding of a topic's requirements must be submitted to SBIR_BAA@darpa.mil by June 18, 2025. Proposals are due by 12:00 pm ET on the date listed in the DoD preface for Release 8.

PHASE I PROPOSAL GUIDELINES

The Defense SBIR/STTR Innovation Portal (DSIP) is the official portal for DoD SBIR/STTR proposal submission. Proposers are required to submit proposals via DSIP; proposals submitted by any other means will be disregarded. Detailed instructions regarding registration and proposal submission via DSIP are provided in Appendix A.

Current Release Award Structure by Topic

White Paper & Slide Deck Proposal

Topic Number	Phase I			
	Technical Volume		Award Amount	Period of Performance (PoP)
	White Paper	Slide Deck		
HR0011SB20254-05	10 pages	5 pages	$250,000	6 months
HR0011SB20254-06	10 pages	5 pages	$250,000	8 months

Technical Volume (Volume 2) – White Paper & Slide Deck Format
The white paper shall not exceed 10 pages, and the slide deck shall not exceed five (5) pages. For information on the content of each of these elements of the Technical Volume and the commercialization strategy, please see Appendix A: DARPA PHASE I PROPOSAL INSTRUCTIONS.

Cost Volume (Volume 3)
Please see the chart above for award amounts listed by topic. Proposers are required to use the Phase I – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided on the DARPA Small Business site (https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics).

Content of the Cost Volume
Proposers should refer to the DARPA Phase I Proposal Instructions, provided in Appendix A, and use the template found on the DARPA Small Business site (https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics).

Company Commercialization Report (CCR) (Volume 4)
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 DARPA during proposal evaluations.

Supporting Documents (Volume 5)
In addition to the documents required by DoD, small businesses may also submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5. See Appendix A for required certifications that must be included in Volume 5. For additional information, see the SBIR 25.4 Annual Program Broad Agency Announcement (BAA) at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations.

DIRECT TO PHASE II PROPOSAL GUIDELINES
Proposers should refer to the DARPA Direct to Phase II (DP2) Proposal Instructions provided in Appendix B.

Current Release Award Structure by Topic

Standard Proposal Format

Topic Number	Direct to Phase II				
	Technical Volume	Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
HR0011SB20254-06	35 pages	$1,200,000	18 months	$600,000	8 months
HR0011SB20254-07	35 pages	$1,800,000	18 months	N/A	N/A

Technical Volume (Volume 2) –Standard Format (35 pages)
If a proposer can provide adequate documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications, the Direct to Phase II (DP2) authority allows the Department of Defense (DoD) to make an award to a small business concern under Phase II of the SBIR program without regard to whether the small business concern was provided an award under Phase I of an SBIR program. This topic is accepting DP2 proposal submissions.

DP2 Feasibility Documentation shall not exceed 10 pages. DP2 Technical Proposal shall not exceed 20 pages. Phase II commercialization strategy shall not exceed five (5) pages. This should be the last section of the Technical Volume.

White Paper & Slide Deck Proposal Format

Topic Number	Direct to Phase II					
	Technical Volume		Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
	White Paper	Slide Deck				
HR0011SB20254-08	20 pages	15 slides	$1,300,000	18 months	$500,000	6 months
HR0011SB20254-09	20 pages	15 slides	$1,300,000	18 months	$500,000	12 months

Technical Volume (Volume 2) – White Paper & Slide Deck Format (35 pages)
If a proposer can provide adequate documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications, the Direct to Phase II (DP2) authority allows DoD to make an award to a small business concern under Phase II of the SBIR program without regard to whether the small business concern was provided an award under Phase I of an SBIR program. This topic is accepting DP2 proposal submissions.

The white paper shall not exceed 20 pages, and the slide deck shall not exceed 15 pages. For information on the content of each of these elements of the Technical Volume and the commercialization strategy, please see Appendix B: DARPA DIRECT TO PHASE II (DP2) INSTRUCTIONS

Content of the Technical Volume
Proposers should refer to the DARPA DP2 Proposal Instructions provided in Appendix B. The DARPA SBIR/STTR DP2 Technical Volume template is available on the DARPA Small Business site (https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics).

Cost Volume (Volume 3)
Please see the chart above for award amounts listed by topic. Proposers are required to use the Direct to Phase II – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided on the DARPA Small Business site (https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics).

NOTE: Subcontractors are highly encouraged to submit unsanitized costs using this template directly to DARPA at SBIR_BAA@darpa.mil.

Content of the Cost Volume
Proposers should refer to the DARPA DP2 Proposal Instructions, provided in Appendix B and in the Cost Template found on the DARPA Small Business site (https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics).

Company Commercialization Report (CCR) (Volume 4)
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. DARPA will not consider information contained in the CCR during proposal evaluations.

Supporting Documents (Volume 5)
In addition to the documents required by DoD, small businesses may submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5. See Appendix B for required certifications that must be included in Volume 5. For additional information, see the SBIR 25.4 Annual Program Broad Agency Announcement (BAA) at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations.

PHASE II PROPOSAL GUIDELINES
Phase II proposals may only be submitted by Phase I awardees. Should DARPA have funding available and decide to proceed with a Phase II proposal, proposers awarded a Phase I contract will be eligible to submit a proposal for Phase II and will be contacted to do so by the DARPA Small Business Programs Office at the appropriate time during their Phase I period of performance. Phase II proposals will be evaluated in accordance with the applicable DoD or DARPA SBIR BAA. Phase II selection(s) are at the sole discretion of the Government and are subject to funding availability and Phase I performance. Phase II Instructions are available at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics.

Current Release Award Structure by Topic

Topic Number	Phase II				
	Technical Volume	Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
HR0011SB20254- 05	25 pages	$1,200,000	18 months	$600,000	6 months
HR0011SB20254- 06	25 pages	$1,200,000	18 months	$600,000	8 months

Technical Volume (Volume 2)
The technical volume is not to exceed 25 pages. The Phase II commercialization strategy shall not exceed five (5) pages. This should be the last section of the Technical Volume and is included in the 25-page total. Any pages in the technical volume over 25 pages will not be considered in proposal evaluations.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

DARPA does not offer TABA funding.

MAJORITY OWNERSHIP IN PART BY MULTIPLE VENTURE CAPITAL, HEDGE FUND, AND PRIVATE EQUITY FIRMS
Proposers that are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF), or any combination of these as set forth in 13 C.F.R. § 121.702, are eligible to submit proposals in response to DARPA topics advertised within this BAA.

For proposers that are a member of this ownership class, the following must be satisfied for proposals to be accepted and evaluated:

a. Prior to submitting a proposal, firms must register with the SBA Company Registry Database.
b. The proposer, within its submission, must submit the Majority-Owned VCOC, HF, and PEF Certification. A copy of the SBIR VC Certification can be found on https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics. Include the SBIR VC Certification in the Supporting Documents (Volume 5).
c. Should a proposer become a member of this ownership class after submitting its proposal and prior to any receipt of a funding agreement, the proposer must immediately notify the Contracting Officer, register in the appropriate SBA database, and submit the required certification which can be found at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics.

EVALUATION AND SELECTION
All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD SBIR Program BAA. DARPA will conduct an evaluation of each conforming proposal. Proposals that do not comply with the requirements detailed in this BAA and the research objective(s) of the corresponding topic are considered non-conforming and, therefore, are not evaluated nor considered for award.

Using the evaluation criteria, the Government will evaluate each proposal in its entirety, documenting the strengths and weaknesses relative to each evaluation criterion. Based on these identified strengths and weaknesses, determine the Government will determine the proposal's overall selectability for funding. Proposals will not be evaluated against each other during the evaluation process but rather evaluated on their own individual merit to determine how well the proposal meets the criteria stated in this BAA and the corresponding DARPA topic.

Awards will be made to proposers whose proposals are determined to be the most advantageous to the Government, consistent with instructions and evaluation criteria specified in the DoD SBIR Program BAA and availability of funding.

For the purposes of this proposal evaluation process, a selectable proposal is defined as follows:

<u>Selectable</u>: A selectable proposal is a proposal that the Government has evaluated against the evaluation criteria listed in the BAA and topic, and the strength of the overall proposal outweigh its weaknesses.

Additionally, there are no accumulated weaknesses that would require extensive negotiations and/or a resubmitted proposal.

For the purposes of this proposal evaluation process, a non-selectable proposal is defined as follows:

Non-Selectable: A proposal is considered non-selectable when the Government has evaluated the proposal against the evaluation criteria listed in the BAA and topic, and the strengths of the overall proposal do not outweigh its weaknesses.

Proposing firms will be notified of selection or non-selection status for a Phase I or Direct to Phase II award within 90 calendar days of the closing date of the BAA. The Corporate Official (CO) indicated on the Proposal Cover Sheet will be notified by e-mail regarding proposal selection or non-selection. In accordance with the Small Business Administration (SBA) Policy Directive, Appendix I, paragraph 4, Method of Selection and Evaluation Criteria, subparagraph (d) Release of Proposal Review Information, DARPA will provide a technical evaluation narrative to the proposer for each proposal submitted in response to a topic. An informal feedback session may be requested by the proposing firm via e-mail at sbir@darpa.mil. The informal feedback is provided at the sole discretion of DARPA.

It is the policy of DARPA to treat all proposals as source selection information and to disclose their contents only for the purpose of evaluation. Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for administrative purposes and/or to assist with technical evaluation. All DARPA support contractors are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements. Input on technical aspects of the proposals may be solicited by DARPA from other Government and/or non-Government consultants/experts who are strictly bound by the appropriate nondisclosure requirements. No submissions in response to the BAA will be returned. Upon completion of the evaluation and selection process, an electronic copy of each proposal received will be retained at DARPA.

Proposal titles, abstracts, anticipated benefits, and keywords of proposals that are selected for contract award will undergo a DARPA Policy and Security Review. Proposal titles, abstracts, anticipated benefits, and keywords are subject to revision and/or redaction by DARPA. Final approved versions of proposal titles, abstracts, anticipated benefits, and keywords may appear on the DoD SBIR/STTR awards website and/or the SBA's SBIR/STTR award website (https://www.sbir.gov/awards).

Refer to the DoD SBIR Program BAA for procedures to protest this BAA.
As further prescribed in the Federal Acquisition Regulation (FAR(33.106(b), FAR 52.233-3, protests regarding the selection decision should be submitted to:

DARPA
Contracts Management Office (CMO)
675 N. Randolph Street
Arlington, VA 22203
E-mail: CMO_SBIRProtests@darpa.mil and sbir@darpa.mil

AWARD AND CONTRACT INFORMATION

1. General Award Information

Multiple awards are anticipated. DARPA may award FAR-based Government contracts (Firm- Fixed Price or Cost-Plus Reimbursement) or Other Transactions (OT) for Prototype agreements under the authority of 10 U.S.C. § 4022, subject to approval of the Contracting Officer or Agreements Officer, respectively. The resources made available for each topic issued under this BAA will depend on the quality of the proposals received and the availability of funds.

The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this BAA and to make awards with or without communications with proposers. Additionally, the Government reserves the right to award all, some, one, or none of the options on the contract(s)/agreement(s) based on available funding and the performer's technical performance. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work, as applicable.

The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. The Government reserves the right to remove a proposal from award consideration should the parties fail to reach an agreement on award terms, conditions, and price within a reasonable time and/or the proposer fails to provide requested additional information within three (3) business days.

In all cases, the Government Contracting Officer reserves the right to select the award instrument type, regardless of the instrument type proposed, and to negotiate all instrument terms and conditions with selectees. DARPA will apply publication or other restrictions, as necessary, if it determines that the research resulting from the proposed effort will present a high likelihood of disclosing performance characteristics of military systems or manufacturing technologies that are unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program. For more information on publication restrictions, see the DoD SBIR 25.4 BAA.

Because of the desire to streamline the award negotiation and program execution process, proposals identified for negotiation will result in negotiating a type of instrument for award that is in the best interest of the Government. In the case of an OT for Prototype agreement under DARPA's authority to award OTs for prototype projects, 10 U.S.C. § 4022, use of an OT provides significant opportunities for flexible execution to assist in meeting DARPA's aggressive SBIR/STTR program goals.

All proposers that wish to consider an OT award should carefully read the following information:
The flexibility of the OT award instrument is beneficial to the program because the performer will be able to apply its commercial best practices as required to carry out the research project that may be outside of the Federal Acquisition Regulation (FAR) process-driven requirements. Streamlined practices will be used, such as milestone-driven performance, intended to reduce time and effort on award administration tasks and permit performers to focus on the research effort and rapid prototyping. Because of this ability, OTs provide the Agreements Officer the flexibility to create an award instrument that contains terms and conditions that promote commercial transition, reduce some administratively burdensome acquisition regulations, and meet SBIR/STTR program goals.

Proposers must only propose an OT agreement with fixed payable milestones. Fixed payable milestones are fixed payments based on successful completion of the milestone accomplishments agreed to in the milestone plan. Refer to the Other Transactions for Prototypes Fact Sheet and Other Transactions for Prototype Agreement, available at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-participate. Specific milestones will be based upon the research objectives detailed in the topic.

Please see https://acquisitioninnovation.darpa.mil/what-are-ots for more information on OTs.

2. Transition and Commercialization Support Program (TCSP)

DARPA will provide services to Phase II or DP2 awardees upon contract execution through TCSP at no cost to awardees. The TCSP goal is to maximize the potential for SBIR/STTR companies to move their technology beyond Phase II and into other research and development programs for further maturity or into solutions or products for DoD acquisition programs, other Federal programs, and/or the commercial market. Please visit https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued for more information on DARPA TCSP.

3. Embedded Entrepreneurship Initiative

Awardees of SBIR funding pursuant to this BAA may be eligible to participate in the DARPA Embedded Entrepreneurship Initiative (EEI). An invitation to participate in EEI is at the sole discretion of the Government based on evaluation of technical and commercial factors and is subject to program balance and the availability of funding. EEI is a limited scope program offered by DARPA, at the Agency's discretion, to a small subset of awardees. The goal of DARPA's EEI is to increase the likelihood that DARPA-funded technologies take root in the U.S. and provide new capabilities for national defense. EEI supports DARPA's mission "to make pivotal investments in breakthrough technologies and capabilities for national security" by accelerating the transition of innovations out of the lab and into new capabilities for the Department of Defense (DoD). EEI investment supports development of a robust and deliberate Go-to-Market strategy for DARPA-funded advanced technology, into high-value products and capabilities for the government and commercial markets, and positions DARPA awardees to attract U.S. private investment. The following is for informational and planning purposes only and does not constitute solicitation of proposals to EEI.

There are three elements to DARPA's EEI: (1) A Senior Commercialization Advisor (SCA) from DARPA who works with the Program Manager (PM) to examine the business case for the awardee's technology and uses commercial methodologies to identify steps toward achieving a successful transition of technology to the government and commercial markets; (2) Connections to potential U.S. industry and private investor partners via EEI's Investor Working Groups; and (3) Additional funding to hire an embedded entrepreneur to achieve specific milestones in a Go-to-Market strategy for transitioning the technology into products that serve both defense and commercial markets. This embedded entrepreneur's qualifications should include business experience within the target industries of interest, experience in commercializing early-stage technology, and the ability to communicate and interact with technical and non-technical stakeholders, and customers. Funding for EEI is typically no more than $310,000 per awardee over the duration of the award. An awardee will attend one commercialization workshop, and also may apportion EEI funding to hire more than one embedded entrepreneur, if achieving the milestones requires a unique expertise that can be obtained without exceeding the awardee's total EEI funding.

EEI Application Process:

After receiving an SBIR/STTR Phase II award, awardees interested in being considered for EEI should notify their DARPA PM during the period of performance. If the DARPA PM determines that EEI could be of benefit to transition the technology to product(s) the Government needs, the PM will refer the performer to the DARPA Commercial Strategy Team. The SCA will then contact the performer, assess fitness for EEI and determine, in consultation with the PM, and Commercial Strategy Team, whether or not to invite the performer to participate in the EEI. Factors that are considered in determining fitness for EEI include DoD/Government need for the technology; competitive approaches to enable a similar capability or product; risks and impact of the Government's being unable to access the technology from a sustainable source; Government and commercial markets for the technology; cost and affordability; manufacturability and scalability; supply chain requirements and barriers; regulatory requirements and timelines; intellectual property and Government use rights, and available funding.

After SCA review, the Commercial Strategy Team may request the SBIR/STTR awardee to submit additional tasks for review.

EEI awards are at the sole discretion of DARPA and are subject to program balance and the availability of funding. For more information, please refer to the EEI website https://eei.darpa.mil/.

ADDITIONAL INFORMATION

DARPA intends to use electronic mail for all correspondence regarding these topics. Questions related to the technical aspect of the research objectives and awards specifically related to a topic should be e-mailed to SBIR_BAA@darpa.mil. Please reference the topic number in the subject line. All questions must be in English and must include the name, e-mail address, and the telephone number of a point of contact.

DARPA will attempt to answer questions in a timely manner; however, questions submitted within seven (7) calendar days of the proposal due date listed herein may not be answered. DARPA will post a consolidated Frequently Asked Questions (FAQ) document. To access the posting please visit: https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics. Under the topic number summary, there will be a link to the FAQ. The FAQ will be updated on an ongoing basis until one week prior to the proposal due date.

Technical support for the Defense SBIR/STTR Innovation Portal (DSIP) is available Monday through Friday, 9:00 a.m. – 5:00 p.m. ET. Requests for technical support must be emailed to DoDSBIRSupport@reisystems.com with a copy to SBIR_BAA@darpa.mil.

Appendix A: DARPA PHASE I PROPOSAL INSTRUCTIONS

I. Introduction

A complete proposal submission consists of:

Volume 1: Proposal Cover Sheet
Volume 2: Technical Volume
Volume 3: Cost Volume
Volume 4: Company Commercialization Report
Volume 5: Supporting Documents
- a. Verification of Eligibility of Small Business Joint Ventures (Attachment 3), if applicable
- b. Data Rights Assertions (if applicable)
- c. Other supporting documentation

Volume 6: Fraud, Waste and Abuse Training
Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

The Defense SBIR/STTR Innovation Portal (DSIP) provides a structure for building the proposal volumes and submitting a consolidated proposal package. If this is your first time submitting an SBIR proposal using DSIP, please review detailed training guides at https://www.dodsbirsttr.mil/submissions/learning-support/training-materials. It is the responsibility of the proposing firm to ensure that a complete proposal package is certified and submitted by the close date listed in the topic to which they are responding. ***DARPA will not accept late proposals.***

To assist in proposal development, templates for Volume 2: Technical Volume and Volume 3: Cost Volume have been provided as attachments on the DARPA Small Business websites at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program. Use of the DARPA Cost Proposal template is mandatory.

Proposers should ensure that they have an accurate and active entity registration on SAM.gov, and a complete NIST SP 800-171 DoD Assessment. The portal and instructions on how to complete the NIST assessment is located at https://www.sprs.csd.disa.mil/nistsp.htm

II. Proprietary Information

Proposers that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall follow instructions in the DoD SBIR 25.4/STTR 25.D BAA regarding marking propriety proposal information.

III. Phase I Proposal Instructions

a. Proposal Cover Sheet (Volume 1)

The Cover Sheet must include a brief technical abstract of no more than 3000 characters that describes the proposed research and development project with a discussion of anticipated benefits and potential commercial applications. **Do not include proprietary or classified information in the Proposal Cover Sheet**. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits may be publicly released.

b. Format of the Technical Volume (Volume 2) – White Paper & Slide Deck

1. The Technical Volume must include two parts, PART ONE: white paper, and PART TWO: slide deck, combined as a single Portable Document Format (PDF) for upload to DSIP.

2. Type of File: The Technical Volume must be a single PDF file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document.

3. Length: The length of the white paper shall not exceed 10 pages, and the slide deck shall not exceed five (5) pages/slides. The Government will not consider pages in excess of the page count limitations.

4. Layout: Number all pages of your proposal consecutively. Font size should not be smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP when the Cover Sheet was created. The header may be included in the one-inch margin.

c. Content of the Technical Volume (Volume 2) – White Paper & Slide Deck

See **Section II** of the Phase I Template – Volume 2: Technical Volume at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics for the slide deck and white paper template.

White Paper (not to exceed 10 pages). Provide the following information:
Goals and Impact: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively), including a brief discussion on how this directly relates to the topic.

1. Technical Plan: Provide an explicit, detailed description of the Phase I approach. The Statement of Work should indicate what tasks are planned, how and where the work will be conducted, a schedule of major events, and the final product(s) to be delivered. The Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail.

2. Management and Capabilities: Designate key personnel who will be involved in the Phase I effort. Provide a summary of expertise of the team, including subcontractors and key personnel. Describe the organizational experience in this technology area, previous work not directly related to the proposed effort but similar, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available. Describe any specialized facilities to be used as part of the project, the extent of access to these facilities, and any biological containment, biosafety, and certification requirements.

3. Transition and Commercialization Plan (not to exceed five (5) pages):
    a) Describe the commercial product or DoD system to be developed.
    b) Discuss the potential end users – DoD, Federal, and/or private sector customers. Discuss your business model for this technology (i.e., how do you anticipate generating revenue with this technology?). Who are you selling to, directly or indirectly, a supplier, an integrator, or an end user?

c) Describe your company's funding history. Discuss how much additional funding above this proposed effort (include additional required technology development, staffing requirements, infrastructure requirements, intellectual property (IP) strategy costs, etc.) will be required to bring this technology to market and how you anticipate going about getting that funding (e.g., Government S&T contracts, investment).
d) Describe the timeline to maturity for sales or transition to an end user. Describe your IP strategy.
e) Describe the technology, market, team and business risks associated with this proposed effort and your plan to mitigate these risks.

Slide Deck (not to exceed five (5) slides). Provide the following information (convert the completed deck to a PDF and attach it to the white paper):

1. What are you trying to do and how does this directly relate to the topic?

2. Technology and commercial product: Specifically, what are you proposing to produce – software, system, application? Be specific on what your proposed technology development is targeting as an end state.

3. How is the technology approached today? Who is doing the research, development and delivering products/services? What are the current limitations in the technology and commercial marketplaces?

4. Management: Overview of team, facilities and qualifications.

5. Technical summary quad chart: Use template provided at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics
NOTE: All letters of recommendation, CVs, and Data Rights Assertions can be loaded in Volume 5: Supporting Documents.

Advocacy Letters (OPTIONAL)* Feedback received from potential Commercial and/or DoD customers and other end-users regarding their interest in the technology to support their capability gaps. Advocacy letters that are faxed or e-mailed separately will NOT be accepted.

Letters of Intent/Commitment (OPTIONAL)* Relationships established, feedback received, support and commitment for the technology with one or more of the following: Commercial customer, DoD Program Management (PM)/Program Executive Office (PEO), a Defense Prime, or vendor/supplier to the Primes and/or other vendors/suppliers identified as having a potential role in the integration of the technology into fielded systems/products or those under development. Letters of Intent/Commitment that are faxed or e-mailed separately will NOT be accepted.

*Advocacy Letters and Letters of Intent/Commitment are optional, and should ONLY be submitted to substantiate any transition or commercialization claims made in the commercialization strategy. Please DO NOT submit these letters just for the sake of including them in your proposal. These letters DO NOT count against any page limit.

In accordance with section 3-209 of DOD 5500.7-R, Joint Ethics Regulation, letters from Government personnel will NOT be considered during the evaluation process.

d. Format of Cost Volume (Volume 3)

Proposers are required to use the Phase I – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics.

e. Content of the Cost Volume (Volume 3)

Some items in the Cost Breakdown Guidance below may not apply to the proposed project. If such is the case, there is no need to provide information on every item.

For Phase I proposals, proposers should NOT provide documentation to substantiate how all proposed costs were derived. However, proposers should be prepared to provide such documentation should the Contracting Officer request this documentation. If any substantiating documentation is requested by the Contracting Officer, it is important to respond as quickly as possible to the request as to not delay contract negotiation.

Examples of substantiating documentation are as follows, if you proposed travel cost to attend a project-related meeting or conference, and used a travel website to compare flight costs, include a screen shot of the comparison. Similarly, if you proposed to purchase materials or equipment, and used the internet to search for the best source, include your market research for those items. You do not necessarily have to propose the cheapest item or supplier, but you should be able to explain your decision to choose one item or supplier over another. It's important to provide enough information to allow contracting personnel to understand how the proposer plans to use the requested funds.

Cost Breakdown Guidance:

- List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
- Special tooling and test equipment and material costs may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with DARPA; unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DARPA.
- Cost sharing is permitted for proposals under this BAA; however, cost sharing is not required, nor will it be an evaluation factor in the consideration of a proposal.
- If Subcontractors will be performing Fundamental Research under the effort please incorporate the following into proposal: 1) a separate statement of work (SOW) outlining the specific work that the proposer finds to qualify as Fundamental Research; OR 2) Within Prime contractor SOW identify which tasks are to be performed that are fundamental research.
- Proposers should complete both tabs within the Cost Proposal Spreadsheet (Cost Model & Milestone Chart)

For more information about cost proposals and accounting standards associated with contract awards, see the Defense Contract Audit Agency (DCAA) publication titled "Audit Process

Overview – Information for Contractors" at http://www.dcaa.mil.
Please note, a separate, more detailed cost proposal spreadsheet will be provided for any Phase II Proposals.

f. Company Commercialization Report (Volume 4)

The Company Commercialization Report (CCR) allows companies to report funding outcomes resulting from prior SBIR and STTR awards. The Company Commercialization Report (CCR) is required for Phase I and Direct to Phase II proposals. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by DARPA during proposal evaluations.

g. Supporting Documents (Volume 5)

In addition to required DoD documentation and certifications, small businesses may also submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5. See Appendix A Introduction for required certifications that must be included in Volume 5. For additional information, see the SBIR 25.4 Annual Program Broad Agency Announcement (BAA) at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations

h. Fraud Waste and Abuse (Volume 6)

The Fraud, Waste and Abuse (FWA) training is required for Phase I and Direct to Phase II proposals. FWA training provides information on what represents FWA in the SBIR/STTR program, the most common mistakes that lead to FWA, as well as the penalties and ways to prevent FWA in your firm. This training material must be thoroughly reviewed once per year. Plan ahead and leave ample time to complete this training based on the proposal submission deadline. Knowingly and willfully making any false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both. Understanding the indicators and types of fraud, waste, and abuse that can occur is critical for the SBIR/STTR awardees' role in preventing the loss of research dollars.

i. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7)

In accordance with Section 4 of the SBIR and STTR Extension Act of 2022 and the SBA SBIR/STTR Policy Directive, the DoD will review all proposals submitted in response to this BAA to assess security risks presented by small business concerns seeking a Federally funded award. Small business concerns must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission (NOTE: PDF uploads will no longer be accepted). Full proposal submissions cannot be certified and submitted by the Corporate Official until Volume 7 is fully completed and the webform is submitted.

Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5.

For additional details, please refer to the DoD SBIR Program BAA.

APPENDIX B: DARPA DIRECT TO PHASE II (DP2) PROPOSAL INSTRUCTIONS

I. Introduction

A complete proposal submission consists of:

Volume 1: Proposal Cover Sheet
Volume 2: Technical Volume (feasibility documentation and technical proposal)
Volume 3: Cost Volume
Volume 4: Company Commercialization Report
Volume 5: Supporting Documents
  a. Subcontract Pricing Considerations (if applicable)
  b. Data Rights Assertions (if applicable)
  c. Verification of Eligibility of Small Business Joint Ventures (Attachment 3), if applicable
  d. Other supporting documentation
  A completed proposal submission in DSIP does NOT indicate that the mandatory supporting documents have been uploaded. It is the responsibility of the proposing small business concern to ensure that the mandatory documents listed above have been uploaded and included with the proposal submission.
Volume 6: Fraud, Waste and Abuse Training
Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

The Defense SBIR/STTR Innovation Portal (DSIP) provides a structure for building the proposal volumes and submitting a consolidated proposal package. If this is your first time submitting an SBIR or STTR proposal using DSIP, please review detailed training guides at https://www.dodsbirsttr.mil/submissions/learning-support/training-materials. It is the responsibility of the proposing firm to ensure that a complete proposal package is certified and submitted by the close date listed in the topic to which they are responding. ***DARPA cannot accept late proposals.***

To assist in proposal development, templates for Volume 2: Technical Volume and Volume 3: Cost Volume have been provided as attachments to the announcement posted at https://www.dodsbirsttr.mil/submissions/login. Use of these templates is mandatory.

Proposers should ensure that they have an accurate and active entity registration on SAM.gov, and a complete NIST SP 800-171 DoD Assessment. The portal and instructions on how to complete the NIST assessment are located at https://www.sprs.csd.disa.mil/nistsp.htm.

II. Proprietary Information

Proposers that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall follow instructions in the DoD BAA regarding marking propriety proposal information.

III. DP2 Proposal Instructions

a. Proposal Cover Sheet (Volume 1)
The Cover Sheet must include a brief technical abstract of no more than 3000 characters that describes the proposed R&D project with a discussion of anticipated benefits and potential commercial applications.

Do not include proprietary or classified information in the Proposal Cover Sheet. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits may be publicly released.

b. Format of Technical Volume (Volume 2) – Standard Proposal Format

1. The Technical Volume must include two parts, PART ONE: Feasibility Documentation and PART TWO: Technical Proposal. See **Sec I** of the Direct to Phase II Template – Volume 2: Feasibility Documentation and Technical Proposal at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics.

2. Type of file: The Technical Volume must be a single Portable Document Format (PDF) file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. **Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document**.

3. Length: The length of each part of the technical volume (Feasibility Documentation and Technical Proposal) will be specified by the corresponding topic. The Government will not consider pages in excess of the page count limitations.

4. Layout: Number all pages of your proposal consecutively. Font size should not be smaller than 10-point on standard 8-1/2” x 11” paper with one-inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP when the Cover Sheet was created. The header may be included in the one-inch margin.

c. Content of the Technical Volume (Volume 2) – Standard Proposal Format

PART ONE: Feasibility Documentation

1. Provide documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describe the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.
2. Maximum page length for feasibility documentation will be specified by the topic. If you have references, include a reference list or works cited list on the last page of the feasibility documentation. This will count towards the page limit.
3. Work submitted within the feasibility documentation must have been substantially performed by the proposer and/or the Principal Investigator.
4. If technology in the feasibility documentation is subject to Intellectual Property (IP), the proposer must either own the IP, or must have obtained license rights to such technology prior to proposal submission, to enable it and its subcontractors to legally carry out the proposed work. Documentation of IP ownership or license rights shall be included in the Technical Volume of the proposal.
5. Include a one-page summary on Commercialization Potential addressing the following:
   a) Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
   b) Describe the potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

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

PART TWO: Standard Technical Proposal [Topics HR0011SB20254-06 and HR0011SB20254-07]
Significance of the Problem. Define the specific technical problem or opportunity addressed and its importance.

1. **Phase II Technical Objectives.** Enumerate the specific objectives of the Phase II work and describe the technical approach and methods to be used in meeting these objectives.

2. **Phase II Statement of Work.** The statement of work should provide an explicit, detailed description of the Phase II approach, indicate what is planned, how and where the work will be carried out, a schedule of major events, and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal.
    a. Human/Animal Use: Proposers proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal to avoid potential delay of contract award.
    b. Phase II Option Statement of Work (if applicable, specified in the corresponding topic). The statement of work should provide an explicit, detailed description of the activities planned during the Phase II Option, if exercised. Include how and where the work will be carried out, a schedule of major events, and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail.

3. **Related Work.** Describe significant activities directly related to the proposed effort, including any conducted by the PI, the proposer, consultants or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must persuade reviewers of the proposer's awareness of the state of the art in the specific topic. Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number), and (3) date of completion.

5. **Relationship with Future Research or Research and Development.**
    a. State the anticipated results of the proposed approach if the project is successful.
    b. Discuss the significance of the Phase II effort in providing a foundation for Phase III research and development or commercialization effort.
    c. Identify the applicable clearances, certifications and approvals required to conduct Phase II testing and outline the plan for ensuring timely completion of said authorizations in support of Phase II research or research and development effort.

6. **Key Personnel.** Identify key personnel who will be involved in the Phase II effort including information on directly related education and experience. A concise resume of the PI, including a list of relevant publications (if any), must be included. All resumes count toward the page limitation. Identify any foreign nationals you expect to be involved on this project.

7. **Foreign Citizens.** Identify any foreign citizens or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. Refer to DoD SBIR 25.4/STTR 25.D BAA for more information.

Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. § 552a), if applicable, and the Freedom of Information Act (5 U.S.C. § 552(b)(6)).

8. **Facilities/Equipment.** Describe available instrumentation and physical facilities necessary to carry out the Phase II effort. Items of equipment to be purchased (as detailed in the cost proposal) shall be justified under this section. Also state whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name) and local Governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices and handling and storage of toxic and hazardous materials.

9. **Subcontractors/Consultants.** Subcontractor means any supplier, distributor, vendor, firm, academic institution, research center, or other person or entity that furnishes supplies or services pursuant to a subcontract, at any tier. Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be identified and described according to the Cost Breakdown Structure at https://www.dodsbirsttr.mil/submissions/learning-support/firm-templates. Please refer to DoD SBIR 25.4/STTR 25.D BAA for detailed eligibility requirements as it pertains to the use of subcontractors/consultants.

10. **Prior, Current or Pending Support of Similar Proposals or Awards.** If a proposal submitted in response to this topic is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, or another or the same DoD Component, you must reveal this on the Proposal Cover Sheet and provide the following information:
    a. Name and address of the Federal Agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.
    b. Date of proposal submission or date of award.
    c. Title of proposal.
    d. Name and title of the PI for each proposal submitted or award received.
    e. Title, number, and date of BAA(s) or solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.
    f. If award was received, state contract number.
    g. Specify the applicable topics for each proposal submitted or award received.

    Note: If this does not apply, state in the proposal "No prior, current, or pending support for proposed work."

11. **Transition and Commercialization Strategy.** DARPA is equally interested in dual use commercialization of SBIR/STTR projects that result in products sold to the U.S. military, the private sector market, or both. DARPA expects explicit discussion of key activities to achieve this result in the transition and commercialization strategy part of the proposal. The Technical Volume of each Direct to Phase II proposal must include a transition and commercialization strategy section. The Phase II transition and commercialization strategy shall not exceed five (5) pages and will NOT count against the proposal page limit.

    Information contained in the commercialization strategy section will be used to determine suitability for participation in EEI. Selection for participation in EEI will be made independently following selection for SBIR/STTR award. Please refer to item 3 of the Award and Contract

Information section of these Instructions for more information on the DARPA EEI and additional proposal requirements.

The transition and commercialization strategy should include the following elements:

a) **A summary of transition and commercialization activities conducted during Phase I, and the Technology Readiness Level (TRL) achieved.** Discuss the market, competitive landscape, potential stakeholders and end-users, and how the preliminary transition and commercialization path or paths may evolve during the Phase II project. Describe key proposed technical milestones during Phase II that will advance the technology towards product such as prototype development, laboratory and systems testing, integration, testing in operational environment, and demonstrations.
b) **Problem or Need Statement.** Briefly describe what you know of the problem, need, or requirement, and its significance relevant to a Department of Defense application and/or a private sector application that the SBIR/STTR project results would address. Is there a broader societal need you are trying to address? Please describe.
c) **Description of Product(s) and/or System Application(s).** Identify the commercial product(s) and/or DoD system(s), or system(s) under development, or potential new system(s). Identify the potential DoD end-users, Federal customers, and/or private sector customers who would likely use the technology.
d) **Business Model(s)/Procurement Mechanism(s).** Discuss your current business model hypothesis for bringing the technology to market. Describe plans to license, partner, or self-produce your product. How do you plan to generate revenue? Describe the resources you expect will be needed to implement your business models. Discuss your plan and expected timeline to secure these resources. Understanding DARPA's goal of creating and sustaining a U.S. military advantage, describe how you intend to develop your product and supply chains to enable this differentiation.
e) **Target Market.** Describe the market and addressable market for the innovation. Describe the customer sets you propose to target, their size, their growth rate, and the key reasons they would consider procuring the technology. Discuss the business economics and market drivers in the target industry. Describe competing technologies existent today on the market as well as those being developed in the lab. How has the market opportunity been validated? Describe the competition. How do you expect the competitive landscape may change by the time your product/service enters the market?
f) **Funding Requirements.** Describe your company's funding history. How much external financing have you raised? Describe your plans for future funding sources (internal, loan, angel, venture capital, etc.).
g) **Transition and Commercialization Risks.** Describe the major technology, market and team risks associated with achieving successful transition of the DARPA funded technology. DARPA is not afraid to take risks but we want to ensure that our awardees clearly understand the risks in front of them. What are the key risks in bringing your innovation to market? What actions do you plan to undertake to mitigate these risks?
h) **Expertise/Qualifications of Team/Company Readiness.** Describe the expertise and qualifications of your management, marketing/business development and technical team that will support the transition of the technology from the prototype to the commercial market and into Government operational environments. Has this team previously taken similar products/services to market? If the present team does not have this needed expertise, how do you intend to obtain it? What is the financial history and health of your company (e.g., availability of cash, profitability, revenue growth, etc.)?
i) **Anticipated Transition and Commercialization Results.** Include a schedule showing the anticipated quantitative transition and commercialization results from the Phase II

project at one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.). After Phase II award, the company is required to report actual sales and investment data in its Company Commercialization Report at least annually.

j)

12. **Data Rights Assertions**
    See Direct to Phase II Template – Volume 2: Technical Volume at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics, for details on data rights assertions.

Advocacy Letters (OPTIONAL)* Feedback received from potential Commercial and/or DoD customers and other end-users regarding their interest in the technology to support their capability gaps. Advocacy letters that are faxed or e-mailed separately will NOT be accepted.

Letters of Intent/Commitment (OPTIONAL)* Relationships established, feedback received, support and commitment for the technology with one or more of the following: Commercial customer, DoD PM/PEO, a Defense Prime, or vendor/supplier to the Primes and/or other vendors/suppliers identified as having a potential role in the integration of the technology into fielded systems/products or those under development. Letters of Intent/Commitment that are faxed or e-mailed separately will NOT be accepted.

*Advocacy Letters and Letters of Intent/Commitment are optional and should ONLY be submitted to substantiate any transition or commercialization claims made in the commercialization strategy. Please DO NOT submit these letters just for the sake of including them in your proposal. These letters DO NOT count against any page limit.

In accordance with section 3-209 of DOD 5500.7-R, Joint Ethics Regulation, letters from Government personnel will NOT be considered during the evaluation process.

d. Format of the Technical Volume (Volume 2) – White Paper & Slide Deck

1. The Technical Volume must include two parts, PART ONE: white paper and PART TWO: slide deck, combined as a single Portable Document Format (PDF) for upload to DSIP. See **Sec II** of the Direct to Phase II Template – Volume 2: Feasibility Documentation and Technical Proposal at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics.

2. Type of file: The Technical Volume must be a single PDF file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document.

4. Length: The length of each part of the technical volume (white paper and slide deck) will be specified by the corresponding topic. The Government will not consider pages in excess of the page count limitations.

5. Layout: Number all pages of your proposal consecutively. Font size should not be smaller than 10-point on standard 8-1/2” x 11” paper with one-inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP when the Cover Sheet was created. The header may be included in the one-inch margin.

e. Content of the Technical Volume (Volume 2) – White Paper & Slide Deck

White Paper (NTE 20 pages). Provide the following information:
Goals and Impact: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively), including a brief discussion on how this directly relates to the topic.

1. Phase I Feasibility: This topic is accepting Direct to Phase II proposals ONLY. To be eligible, proposers must demonstrate that the documented feasibility work as required in the topic has been achieved outside of the SBIR program.

2. Technical Plan: Outline and address all technical areas and challenges inherent in the approach and possible solutions for overcoming potential problems. Provide specific objectives, metrics, and milestones at intermediate stages to demonstrate a plan for accomplishment of the project objectives. Propose additional appropriate qualitative and quantitative metrics specific to the approach, as needed. Intermediary milestones should occur at no greater than 1-month increments.

3. Management and Capabilities: Designate key personnel who will be involved in the Phase II effort. Provide a summary of expertise of the team, including subcontractors and key personnel. Describe the organizational experience in this technology area, previous work not directly related to the proposed effort, but similar, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available. Describe any specialized facilities to be used as part of the project, the extent of access to these facilities, and any biological containment, biosafety, and certification requirements.

4. Transition and Commercialization Plan:
   a) Describe the commercial product or DoD system to be developed.
   b) Discuss the potential end users – DoD, Federal, and/or private sector customers. Discuss your business model for this technology (i.e., how to you anticipate generating revenue with this technology?). Who are you selling to directly or indirectly, a supplier, an integrator, or an end user?
   c) Describe your company's funding history. Discuss how much additional funding above this proposed effort (include additional required technology development, staffing requirements, infrastructure requirements, IP strategy costs, etc.) that will be required to bring this technology to market and how you anticipate going about getting that funding (e.g., Govt S&T contracts, investment).
   d) Describe the timeline to maturity for sales or transition to an end user. Describe your IP strategy.
   e) Describe the technology, market, team and business risks associated with this proposed effort and your plan to mitigate these risks.

Slide Deck (not to exceed 15 slides). Provide the following information (convert the completed deck to a PDF and attach it to the white paper):

1. What are you trying to do and how does this directly relate to the topic?

2. Technology and commercial product: Specifically, what are you proposing to produce – software, system, application? Be specific on what your proposed technology development is targeting as an end state.

3. How is the technology approached today? Who is doing the research, development and delivering products/services? What are the current limitations in the technology and commercial marketplaces?

4. Technical and commercial value proposition: How have you substantiated the feasibility of your approach? What is innovative in your approach and how does it compare to the state-of-the-art? Why do you think it will be successful both from a technical and commercial perspective? If you are successful, what difference will it make? Discuss your proposed business model – how do you expect to generate revenue from your technology?

5. Technical and commercial risks: What are the key technical and commercial challenges and how do you plan to address/overcome these?

6. Technical and commercial market analysis: Who will care and what will the impact be if you are successful? What/who are the markets/industries/integrators/stakeholders that would/should care?

7. Cost, schedule and milestones: Provide a summary of your cost volume. Provide a summary of your schedule and milestones. How much will your proposed effort cost in total? How long will it take? What are your technical milestones for achieving the proposed efforts? What are your transition and commercialization plan milestones? Discuss how much funding will be required to bring your proposed technology to market and execute your proposed transition and commercialization plan. Include any funding raised to date and expected plans for raising any additional required funding (Government contracting revenue, product sales, internal R&D investment, loan, angel or Venture Capital investment, etc.). Describe timeline to maturity for operational use or commercial sales.

8. Management: Overview of team, facilities and qualifications.

9. Technical summary quad chart: Use template provided at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program.

10. Commercialization summary quad chart: Use the DARPA Transition and Commercialization Strategy Plan (TCSP) template, located at https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued.

NOTE: All letters of recommendation, CVs, and Data Rights Assertions (see Direct to Phase II Template – Volume 2: Technical Volume at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program under SBIR/STTR BAA Forms & Templates for details on data rights assertions) can be loaded in Volume 5: Supporting Documents.

f. Format of Cost Volume (Volume 3)

Proposers are required to use the Direct to Phase II – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided at https://www.darpa.mil/work-with-us/communities/small-business/sbir-sttr-topics. The Cost Volume (and supporting documentation) DOES NOT count toward the page limit of the Technical Volume.
Subcontractors should use this document for unsanitized cost proposals and send them to SBIR_BAA@darpa.mil.

g. Content of the Cost Volume (Volume 3)

Some items in the Cost Breakdown Guidance below may not apply to the proposed project. If such is the case, there is no need to provide information on every item.

ALL proposed costs should be accompanied by documentation to substantiate how the cost was derived. For example, if contractors:

- Propose direct labor costs, contractors could provide current paystubs for proposed employees, or a rate agreement with DCMA, etc.
- Propose consultant costs, contractors could provide historical invoices, current contract with consultant, etc.
- Propose to purchase materials or equipment; you could provide historical invoices, current quotes, market research for those items, etc.

The above list is purely for informational purposes and does not limit the proposer from proposing other costs. Again, however, all costs must be accompanied by substantiating documentation.

Proposers do not necessarily have to propose the cheapest item or supplier, but you should explain your decision to choose one item or supplier over another. It is important to provide enough information to allow contracting personnel to understand how the proposer plans to use the requested funds. If selected for award, failure to include the documentation with your proposal will delay contract negotiation, and the proposer will be asked to submit the necessary documentation to the Contracting Officer to substantiate costs (e.g., cost estimates for equipment, materials, and consultants or subcontractors). It is important to respond as quickly as possible to the Contracting Officer's request for documentation.

Cost Breakdown Guidance:

- List all key personnel by name as well as by number of hours dedicated to the project as direct labor. Special tooling and test equipment and material cost may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with DARPA; unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DARPA.
- Cost sharing is permitted for proposals under this announcement; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a proposal.
- All subcontractor costs and consultant costs must be detailed at the same level as prime contractor costs in regard to labor, travel, equipment, etc. All subcontractor costs must be substantiated with Subcontractor Pricing Considerations. Enter this information in the Explanatory Material section of the online cost proposal form. **NOTE: If proposing subcontractors, contractors must satisfy the requirement of FAR Part 15.404-3(b), Subcontract Pricing Considerations, stated below:**

  (b) The prime contractor or subcontractor shall-

  (1) Conduct appropriate cost or price analyses to establish the reasonableness of proposed subcontract prices;
  (2) Include the results of these analyses in the price proposal

  The Supporting Documents Volume (Volume 5) may be used for this documentation.

- If Subcontractors will be performing Fundamental Research under the effort please incorporate the following into proposal: 1) a separate SOW outlining the specific work that the proposer finds to qualify as Fundamental Research; OR 2) Within Prime contractor SOW identify which tasks are to be performed that are fundamental research.

For more information about cost proposals and accounting standards, see the DCAA publication titled "Audit Process Overview – Information for Contractors" available at http://www.dcaa.mil.

h. Company Commercialization Report (Volume 4)

The Company Commercialization Report (CCR) allows companies to report funding outcomes resulting from prior SBIR and STTR awards. The Company Commercialization Report (CCR) is required for Phase I and Direct to Phase II proposals. Please refer to the DoD SBIR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by DARPA during proposal evaluations.

i. Supporting Documents (Volume 5)

In addition to required DoD documentation and certifications, small businesses may also submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5. See Appendix B Introduction and the SBIR 25.4 Annual Program Broad Agency Announcement (BAA) at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations for **required** certifications that must be included in Volume 5.

j. Fraud Waste and Abuse (Volume 6)

The Fraud, Waste and Abuse (FWA) training is required for Phase I and Direct to Phase II proposals. FWA training provides information on what represents FWA in the SBIR/STTR program, the most common mistakes that lead to FWA, as well as the penalties and ways to prevent FWA in your firm. This training material must be thoroughly reviewed once per year. Plan ahead and leave ample time to complete this training based on the proposal submission deadline. Knowingly and willfully making any false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal False Statement Act (18 U.S.C. § 1001), punishable by a fine of up to $10,000, up to five years in prison, or both. Understanding the indicators and types of fraud, waste, and abuse that can occur is critical for the SBIR/STTR awardees' role in preventing the loss of research dollars.

k. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7)

In accordance with Section 4 of the SBIR and STTR Extension Act of 2022 and the SBA SBIR/STTR Policy Directive, the DoD will review all proposals submitted in response to this BAA to assess security risks presented by small business concerns seeking a Federally funded award. Small business concerns must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission (NOTE: PDF uploads will no longer be accepted). Full proposal submissions cannot be certified and submitted by the Corporate Official until Volume 7 is fully completed and the webform is submitted.

Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5.

For additional details, please refer to the DoD SBIR Program BAA.

DARPA SBIR 25.4 Topic Index
Release 8

HR0011SB20254-05 TITLE: ON-CHIP WAVELENGTH GENERATION FOR DWDM PHOTONIC TRANSCEIVERS

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing, Microelectronics

OBJECTIVE: Develop and demonstrate prototype integrated photonic Dense Wavelength Division Multiplexing (DWDM) transceivers with on-chip wavelength generation. Such integrated photonic transceivers are critical for co-packaged optical interconnect solutions, advanced data processing, sensors, and other emerging multi-wavelength photonics applications.

DESCRIPTION: The DARPA Photonics in the Package for Extreme Scalability (PIPES) program seeks to enable next-generation microelectronics with co-packaged optical I/O for future high-performance DoD and commercial systems. Short reach optical interconnects have historically utilized a small portion of the optical spectrum, with current architectures using only one to a few wavelengths per fiber. Under the PIPES program, DARPA has developed systems utilizing 16-, 32-, and 64-wavelength WDM. However, external multi-wavelength laser sources are highly customized, require complex stabilization control and suffer from low reliability and high cost. Moreover, the laser-to-transceiver optical coupling adds significant losses to the system link budget. The lack of commercial availability of efficient and robust WDM sources presents a significant barrier for adoption of co-packaged optical interconnect solutions.

This SBIR program seeks on-chip co-integration of multi-wavelength comb generation with the photonic transceiver. The preferred optical solution is monolithic photonic integrated circuit (PIC). Both externally pumped wavelength comb generators residing on-chip and on-chip integrated laser arrays will be considered. If die-to-die bonding is proposed, the optical coupling losses cannot exceed 0.5 dB. A separate die for the electronic functions is anticipated in the form of an electronic integrated circuit (EIC) and it must be packaged with the PIC using commercially available microelectronics packaging. Specifically excluded are any approaches utilizing comb-to-PIC fiber coupling or photonic wire-bonding, as well as any optical amplification that is not directly integrated on the same PIC. The only external component, coupled by fiber is expected to be a pump laser (if applicable). The development of a pump laser is excluded on this SBIR and shall be sourced as an individually packaged, commercially available off-the-shelf component. Proprietary pump laser solutions that cannot be procured on the open market will not be considered.

The technical approaches to on-chip multi-wavelength sources shall be compatible with chip-scale fabrication and integration methods. Solutions developed under this topic shall deliver multiple laser channels (= 16 wavelengths) on a regular frequency grid (nominally 100-400 GHz spacing) in the O-band and/or C-band of the spectrum. The multi-wavelength sources are expected to provide power levels per wavelength channel sufficient to meet the end-to-end optical link budget with margin, as specified in Table 1 below.

PHASE I: Proposers must show a feasible path for DWDM photonic transceivers with on-chip wavelength generation architecture that addresses Phase II program metrics listed in Table 1. Scalability of the architecture for achieving 4T aggregate bandwidth per photonic die in a follow-on effort should be discussed as a part of the Phase I report. Documentation in support of the architecture feasibility should include all relevant information including, but not limited to technical reports, characterization data from hardware demonstrations of multi-wavelength lasers with similar characteristics, and detailed modeling/fabrication results that delineate a direct path from prior experimental results to the program metrics. Phase I fixed payable milestones shall include:

Phase I Schedule/Milestones/Deliverables

- Month 1: Report on initial architectures and approaches to Photonics Integrated Circuit (PIC), Electronic Integrated Circuit (EIC).
- Month 3: Interim report describing the prototype system details with fabrication, integration and assembly strategies developed.
- Month 6: Final Phase I Report summarizing approach; prototype architectures and integration strategy; quantification of expected performance based on detailed system modeling; results from initial test structures characterization; comparison with alternative state-of-the-art methodologies.

PHASE II: The focus of the Phase II effort is to exploit concepts and technologies for co-integration of multi-wavelength comb generation with the transmitter/receiver PIC and transform them into robust, manufacturable DWDM modules. The transceiver modules delivered at the end of Phase II must be self-contained, environmentally robust, and meet the following minimum performance metrics:

Table 1. On-chip wavelength generation for DWDM photonic transceivers SBIR, Phase II Metrics

Metric	Target*
operating wavelength	O-band and/or C-band
number of wavelength channels	≥ 16†
wavelength channel spacing	regular grid, multiple of 100 GHz spacing
data rate per wavelength	≥ 32 Gbps†
link bit-error rate (BER)	10^{-12}
aggregate bandwidth per fiber	≥ 512 Gbps†
number of fibers per module	1 TX, 1 RX, 1 pump laser (if applicable)
link budget, point-to-point	2 fiber couplers, 100 meters of standard single mode fiber, 2 dB link margin
link efficiency	3 pJ/bit
data interface	UCIe compliant§

* Performance metrics are measured for an end-to-end link operating at all wavelength channels

† Proposals exceeding the minimum 16 channels and/or 32 Gbps/channel are encouraged

§ Fully implemented data interface is not required. However, design and simulation of the proposed interface is required.

Target characteristics of the proposed transceiver components (EIC, PIC, fiber connectors, pump laser, thermal management, etc.) shall be specified by the Proposer. Proposals shall highlight the technical path to reach the performance metrics described above.

Schedule/Milestones/Deliverables

In the Phase II Base effort (18 months), the expected emphasis is on component design, fabrication, and characterization. The Phase II Option effort (6 months), if awarded, shall be focused on packaging and characterization of the deliverables. Given the aggressive schedule, Proposers must outline a clear path to deliver hardware prototypes within 24 months. By program end, Performers must deliver ten (10) transceiver prototype units with electronic control and optical fiber outputs. In addition to monthly reporting and quarterly reviews with DARPA, Phase II fixed milestones for this program shall include:

Phase II Base

- Kickoff: System Requirements Review (SRR), to include risk analysis.
- Month 3: Report detailing the design specifics of multi-wavelength transceiver system, including PIC and EIC device layout, detailed fabrication flow, and test plan.

- Month 6: Documented completion of finalized device design and component layouts; PIC and EIC tapeout report.
- Month 9: Market Study Report on application requirements, potential customers, and commercialization strategy.
- Month 12: Electronics Report describing control electronics requirements, post-tapeout simulation results, and assembly plan.
- Month 15: Photonics Report detailing requirements, post-tapeout simulation results, and package design.
- Month 18: Demonstration of multi-wavelength transceiver module meeting program metrics; Final Report for Phase II Base Period to include characterization data for the integrated multi-wavelength transceiver. Preliminary design of UCIe compliant data interface.

Phase II Option
- Kickoff: Design Review of packaged prototypes.
- Month 21: Prototype Design Report documenting the design specifics of hardware deliverables (Photonics + Electronics + Packaging).
- Month 24: Delivery of 10 packaged devices to DARPA or US Government Partner*; Final Program Report including fabrication process details and characterization data for delivered prototypes.

* All prototypes shall be provided with adequate instructions to support government testing and evaluation using standard laboratory equipment. The components included are expected to meet the program metrics.

PHASE III DUAL USE APPLICATIONS: Phase III work is typically oriented towards commercialization of SBIR/STTR research or technology with funding obtained from either the private sector, a non-SBIR/STTR Government source, or both, to develop the technology into a viable product for sale in military or private sector markets. It is envisioned that the technology developed under the SBIR program will have dual-use commercial and DoD applications. In the commercial space, the transceiver platform will be a foundational building block for data center and high-performance computing optical interconnect. Multi-wavelength interconnects are expected to be critical enablers for optical transport in datacom, computing, and electronic processing systems. In the DoD, the multi-wavelength transceivers are anticipated to be a key building block for high-throughput interconnect in high-performance computing, edge processing, emerging artificial intelligence (AI) and machine learning (ML) systems, and sensors.

REFERENCES:
1. Photonics in the Package for Extreme Scalability (PIPES) BAA: https://sam.gov/opp/cef3dbb0bc42985449ccc8b89a39e93c/view

KEYWORDS: Optical interconnect, photonic integrated circuit, optical frequency comb, microcomb, solid-state laser sources, heterogeneous integration, nanofabrication, wavelength division multiplexing, silicon photonics, nonlinear optics

HR0011SB20254-06 TITLE: Cooperative Heuristics for Additive Manufacturing Processing (CHAMP)

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

OBJECTIVE: Design, develop, and demonstrate a proof-of-concept slicer, tool path algorithm, and production system which demonstrates non-linear increases in production rates for directed energy additive manufacturing (AM) for N>1 deposition heads.

DESCRIPTION: The Department of Defense (DoD) has identified additive manufacturing (AM) as a key enabler for supply chain agility and enhanced warfighter capability [1]. To date, multiple proofs-of-concept have been demonstrated, however significant infiltration into the industrial base and supply chain remains elusive. While agile in component design and near-net shape fabrication, AM remains a much slower process than conventional manufacturing approaches (e.g. casting, forging, machining), particularly when volumes >10 or sizes >40cm are needed. CHAMP seeks to break this paradigm and enable a step change (>10X rate) in metallic production capacity for large >50cm and medium volume >25 DoD critical components.

Directed energy deposition (DED) offers the greatest opportunity for high deposition rate and large parts due to the unconstrained volume, variety of feedstock available (e.g. wire and powder), and readily available energy sources (e.g. laser and arc). Currently, most DED systems contain one deposition head, however experimentation to increase rate with additional deposition heads is underway (e.g. ORNL MedUSA). In both cases, a major rate limiting step is the ability to efficiently structure tool paths to enable the most time efficient production route [2]. While adaptive strategies have been investigated [3], the complexity increases significantly in 3D geometries due to thermal build up and stresses, and even further when contending with multi-head spatial awareness.

DARPA is seeking innovative approaches to solving the tool path problem for multi-deposition head DED AM leveraging heuristic informed cooperative learning. Applying cooperative and collaborative learning to robotics is a relatively new field but has shown significant promise in optimizing multi-system interactions [4,5]. Additional work on reduced order modeling of processing [6,7] can provide a heuristic framework for decision making, while requiring minimal computational power. CHAMP performers will combine these approaches to demonstrate >10X production rate on components >50cm. Proposers should consider the full implication of existing and future modeling and in situ monitoring capabilities to inform heuristics and provide a solution that can adapt and improve in future materials and manufacturing improvements. This effort should focus on developing collaborative approaches to multi-head manufacturing while leveraging heuristic knowledge of the manufacturing process to inform tool path. Proposers should include background in the areas of interest, testing capabilities (virtual and experimental), and proposed path to demonstration. Developing new additive manufacturing approaches or new DED deposition technology is not in scope for this effort. Software only proposal for phase 2 is not in scope for this effort. Iterative computational trial and error is not in scope for this effort.

PHASE I: This topic is soliciting both Phase I and Direct to Phase II (DP2).

DP2 Proposals:
Phase I feasibility must be demonstrated through evidence of: a completed proof of concept/principal or basic prototype; definition and characterization of properties/capabilities desirable for DoD/government and civilian/commercial use; and capability/performance comparisons with existing state-of-the-art technologies/methodologies (competing approaches).

Entities interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific/technical merit and feasibility described above has been achieved and describe the potential commercial applications. DP2 Phase I feasibility documentation should include, at a minimum:

- technical reports describing results and conclusions of existing work, particularly regarding the commercial opportunity or DoD insertion opportunity, risks/mitigations, and technology assessments
- presentation materials and/or white papers/technical papers
- test and measurement data
- prototype designs/models
- performance projections, goals, or results in various use cases

The collection of Phase I feasibility material will verify mastery of the required content for DP2 consideration.

Phase I proposals:
Phase I consists of a base period of 8 months that will result in the development and demonstration of a computational framework capable of leveraging N>=2 DED deposition heads and demonstrating >2X increase in production rate over state of the art (SOA) single head production.

Successful proposals for this SBIR must offer significant arguments supporting the ability to rapidly iterate and execute to meet the timelines laid out in this solicitation, while addressing three key aspects of the program goals: (1) how multiple deposition heads work collaboratively to increase total production rate, (2) how to efficiently use of heuristic data to rapidly make decisions on efficient production pathways, (3) how the system will be integrated and tested in Phase II. Successful proposals will also demonstrate an in-depth knowledge of manufacturing optimization and should illustrate how their method might be expected to meet the envisioned metrics.

The Phase I effort is expected to center on building the computational foundation for further exploration and demonstration in Phase II. Emerging AI and ML methods are suitable for investigation. Integration of commercial off the shelf (COTS) software may be applicable, however successful proposers should demonstrate how their approach will significantly advance SOA and satisfy Phase I metrics. A successful Phase I program should clearly identify a path to successful completion of Phase II metrics.
Phase I fixed payable milestones for this program should include:
Phase I Base Period (required): 8 months

- Month 2: Concept Design Review (CoDR) on computational approach, selection of baseline test geometry, and baseline production rate
- Month 4: Preliminary Design Review (PDR). Initial report on feasibility to meet Phase I metrics
- Month 8: Critical Design Review (CDR). Interim report on TRL status, status of Phase I metrics, and path to successful demonstration of Phase II metrics.

Performers may perform experimental or virtual testing to validate Phase 1 metrics. Performers will work with DARPA to identify potential transition partners for demonstration in Phase II. Performers will present plans to design and manufacture prototypes in Phase II.
Phase I Metrics:

- >2X increase in production rate for N=2 deposition heads
- Collaborative approaches to 0% chance of head collision during processing
- Optimized tool path based on >=1 heuristic input (e.g. Stress, thermal buildup, resolution)

PHASE II: The Phase II effort consists of a base period of 18 months and an Option period of 8 months. The base period should focus on rapid integration of the computational framework developed in Phase I into testable hardware. Experimental validation of virtual testing will be required. While demonstrating experimental validation, performers should continue improving the computational framework for cooperative heuristic tool pathing, with a focus on introducing additional heads (N>=3) and variable feedstocks or energy sources (N>=2). Introducing varying feedstocks and energy sources will introduce additional heuristic analysis (N>=2) but provides a path to increased resolution and rate in future system manifestations. Successful proposals should consider how to efficiently incorporate the growing number of deposition technologies.

Phase II fixed payable milestones for this program should include:

Base Period: 18 months
•Month 3: Bench Testing Review (BTR). First demonstration of >2X increase in production rate for N=2 deposition heads using selected baseline test geometry from Phase II. Identify, 3 additional components with increasing geometric complexity for further validation ((1)first >50 cm in single direction, (2)second >60 cm in two directions, (3)third, >70 cm in three directions)
•Month 6: Initial report on incorporation of >=2 heuristic inputs in computational framework (virtual testing is acceptable)
•Month 9: Initial report on incorporation of N>=3 deposition heads and N>=2 heuristic inputs in computational framework. Experimental validation to newly selected component (1)
•Month 12: Initial report on experimental validation of selected component (2) utilizing N>=3 deposition heads and N>=2 heuristic inputs.
•Month 15: Initial report on experimental validation of selected component (3) utilizing N>=3 deposition heads, N>=2 feedstock or energy sources, and N>=2 heuristic inputs.
•Month 18: Interim report evaluating path to >10X increase in production rate for N>=2 deposition heads.

Option 1 (Component Testing): 8 Months
•Month 19: Selection of DoD relevant component for production and testing
•Month 20: N=1 deposition head production for baseline validation (3 parts) (external geometry, 5 tensile coupons in each X, Y, and Z direction)
•Month 24: N>=3 deposition head production for cross validation of performance versus baseline (3 parts) (external geometry, 5 tensile coupons in each X, Y, and Z direction)
•Month 26: Update Phase 2 report documenting comparative results and future work required to close performance gap (if present). Present future commercialization plans.

PHASE III DUAL USE APPLICATIONS: Increased production rate of AM has wide ranging applications for commercial and DoD applications via reduced cost and supply chain agility. Multiple applications are envisioned after successful demonstration of a cooperative heuristic informed, multi-head DED system:
1. DoD use for deployable manufacturing. The ability to produce components as needed, in the field for both repair and mission enhancement will provide significant warfighter advantage. Deployable manufacturing as thus far been limited to small components; however, this ability will enable distributed, large-scale repair and manufacturing.
2. Commercial use by US Oil and Gas industry, and other large processing industries. Large pumps typically require extensive casting facilities or machining of very large billets which can create lead times of months to years. Increasing the capability of large-scale AM can break the cost paradigm to enable expanded industrial use, enabling more distributed production capacity.

REFERENCES:

1. “Department of Defense Additive Manufacturing Strategy”, January 2021
2. M. Murua, et al. “Tool-path problem in direct energy deposition metal additive manufacturing: sequence strategy generation”, IEEE Access, May 2020

3. F. Kaji, et al. “Robotic laser directed energy deposition-based additive manufacturing of tubular components with variable overhang angles: Adaptive trajectory planning and characterization”, Additive Manufacturing, Vol. 61, 2023
4. H.M. La, et al., “Multirobot cooperative learning for predator avoidance”, IEEE transactions on control systems technology, Vol 23. No 1. Jan 2015
5. Ferranti, et al., “Distributed nonlinear trajectory optimization for multi-robot motion planning”, IEEE transactions on control systems technology, Vol 31. No 2. March 2023
6. V. Perumal, et al., “Temporal convolutional networks for data driven thermal modeling of directed energy deposition”, Journal of Manufacturing Processes, Vol 85, January 2023 7
7. D.S. Ertay, et al., “Thermomechanical and geometry model for directed energy deposition with 2D/3D toolpaths”, Additive Manufacturing, Volume 35, October 2020

KEYWORDS: Additive Manufacturing, fabrication process, manufacturing efficiency, adaptive control, artificial intelligence, computer-aided manufacturing, decision theory, intelligent manufacturing

HR0011SB20254-07 TITLE: Improving Battle Planning through AI

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software,Human-Machine Interfaces,Integrated Sensing and Cyber,Trusted AI and Autonomy

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: To develop innovative technologies for federated course of action (COA) planning and accelerated COA adjudication using customized reduced order models (ROMs). These ROMs will enable efficient estimation of the modes and eigenvalues of the composition operator, minimizing a physics-informed, objective-based, loss functions for COA evaluation and supporting rapid decision-making in complex battlespace scenarios as well as advanced war-gaming capabilities.

DESCRIPTION: This SBIR topic seeks proposals for developing novel technologies that decouple course of action (COA) adjudication from COA planning through the use of reduced-order models (ROMs). The goal is to construct customized ROMs that generate principal components from simulated and real data sources for estimating the modes and eigenvalues of the composition operator defining the evolution the common operating picture in response to an executed COA. This will enable the development of surrogate models for simulation and war-gaming environments, significantly accelerating the adjudication process. This approach will allow for rapid assessment of numerous COAs generated by potentially disparate planning systems, and advanced war-gaming capabilities for concept development and evaluation.

The proposed technologies should be composable with other similar system models, focusing on the physics of platform movers and effectors, as well as objectives within the battlespace. This composability is crucial for enabling federated planning, where multiple models representing different aspects of the battlespace can be integrated to provide a comprehensive and adaptable planning capability.

A central challenge of this SBIR topic lies in the development of a robust and adaptable methodology for constructing customized ROMs. These ROMs must be tailored to the specific characteristics of diverse battlespace scenarios and objectives. Proposals should detail the specific techniques employed for ROM generation, including the selection of basis functions, discretization methods, and model order reduction algorithms. The proposed methodology should address the challenge of incorporating heterogeneous data sources and varying levels of model fidelity into the ROM construction process. Crucially, the construction process should be demonstrably adaptable, allowing for rapid generation of ROMs specific to new scenarios, platforms, and effectors without requiring extensive retraining or recalibration. The ultimate goal is a ROM construction pipeline that can efficiently produce physics-informed ROMs capable of supporting COA adjudication five orders of magnitude faster than real-time, enabling near-instantaneous evaluation of potential courses of action in dynamic operational environments. This rapid ROM construction capability is essential for maintaining responsiveness and adaptability in the face of evolving threats and objectives.

A critical requirement for the proposed ROM-based adjudication technology is its ability to seamlessly integrate within a federated planning architecture. Proposed solutions must demonstrate how the developed ROMs can be composed with other models, representing diverse aspects of the battlespace, such as enemy behavior, environmental effects, and friendly force capabilities. This composability should enable federated planning across disparate systems and data sources, fostering collaborative decision-making in complex operational environments. A key challenge in federated planning is ensuring data fusion and consistency across different models. Proposals should address how the ROM-based system will handle inconsistencies in data representation, resolution, and timeliness. This includes outlining mechanisms for data validation, conflict resolution, and maintaining a shared understanding of the battlespace across federated models. Furthermore, proposals should describe the interfaces and communication protocols that will facilitate interoperability between the ROM-based adjudication system and other planning components. The end goal is a demonstrably composable ROM technology that seamlessly integrates within a federated planning framework, enabling robust and adaptable COA adjudication across diverse models and data sources, contributing to a more comprehensive and effective planning process. Responsive proposals will address the full DIMEFIL (Diplomatic, Informational, Military, Economic, Financial, Intelligence, and Law Enforcement) spectrum of potential federated ROMs.

PHASE I: This SBIR topic is open to Direct-to-Phase II proposals only. Offerors must demonstrate existing technical maturity and feasibility of their approach through preliminary results, prototypes, or prior work. Proposals should clearly articulate the innovation and potential impact of the proposed technology for accelerated COA adjudication and federated planning. A clear transition path to Phase II should be outlined, including existing modeling and simulation environments that would support the rapid development of ROMs for COA adjudication.

PHASE II: Phase II efforts will focus on developing and demonstrating a functional prototype of the proposed technology. Offerors will be expected to demonstrate the performance of their ROM-based COA adjudication system using realistic scenarios and data sets. Key performance indicators will include adjudication speed, accuracy of COA evaluation, and scalability in complex, multi-domain environments. Demonstration of composability and integration with existing planning systems will be a critical component of Phase II success. The specific scenarios and evaluation metrics will be finalized in consultation with the Program Manager.

Phase II Base
Kickoff: Systems requirements review, implementation plan, including identified risks and risk mitigation.

- Month 3: Report on initial prototype, including end-to-end steel thread demonstration and proposed plan for continued implementation. Proposed inventory for initial models and full architectural details including proposed API, and test and evaluation plan.
- Month 6: Documented completion of finalized architecture and planned model development; Detailed continued testing and evaluation plan.
- Month 9: Mid-term performance metrics and demonstration of initial scenario including full federation of planning and adjudication and DIMEFIL effects.
- Month 12: Proposal for extension to full federated system, additional scenario development and current planning and modeling challenges, risks, and mitigation.
- Month 15: Testing and Evaluation Report detailing outcomes in both planning and adjudication including multiple scenarios, DIMEFIL, and multiple domains.
- Month 18: Demonstration of full federated system over multiple scenarios meeting program metrics; Final Report for Phase II to include documentation of current models, limitations, and federated architecture.

All prototypes shall be provided with adequate instructions to support government testing and evaluation using standard equipment and containerized architecture. The components included are expected to meet the program metrics.

PHASE III DUAL USE APPLICATIONS: Phase III work is typically oriented towards commercialization of SBIR/STTR research or technology with funding obtained from either the private sector, a non-SBIR/STTR Government source, or both, to develop the technology into a viable product for sale in military or private sector markets. It is envisioned that the technology developed under the SBIR program will have dual-use commercial and DoD applications. In the commercial space, AI-driven model reduction techniques can be applied to improve the performance of simulations, accelerate decision-making, and optimize resource allocation for complex systems. Federated planning and adjudication with reduced order models can be used in healthcare for distributed data analysis, enabling hospitals or research centers to share patient data securely across institutions for more accurate diagnoses or research outcomes. The core technology developed could also allow real-time data processing at the source, optimizing logistics, traffic management, and energy consumption while reducing the reliance on cloud infrastructure.

REFERENCES:

1. DARPA Broad Agency Announcement, Strategic Chaos Engine for Planning, Tactics, Experimentation and Resiliency (SCEPTER), STO, HR001122S0013

KEYWORDS: Battlefield planning, Course of Action planning, Data Ingest, course of action adjudication, advanced war-gaming, reduced-order models

HR0011SB20254-08 TITLE: Inertially Scaled Aircraft (ISaAc)

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

OBJECTIVE: Develop and flight test a small (55 to 300 lbs.) unmanned air vehicle (UAV) that is inertially scaled to a tactically relevant target aircraft. The proposal must identify the target aircraft and if relevant data must be provided by the Government. The proposed approach to developing an inertially scaled UAV must show direct scaling and application to the target aircraft such that the flight control laws, and performance can be correlated to the target aircraft.

DESCRIPTION: DARPA seeks proposals for an inertially scaled UAV for the purposes of demonstrating the utility of flight testing a subscale vehicle for high-risk flight controls development. Conventional aircraft development programs are forced to delay detailed flight control development until late in the program, requiring significant resources and adding risk to the overall execution of the program. Any challenges encountered during the flight controls development that require design updates are expensive and time consuming to accommodate. Learning flight control challenges early in the aircraft development cycle results in cheaper and less time-consuming solutions, which can be accomplished through development and testing of a small, inertially scaled UAV.

Many modern aircraft designs have unique configurations (delta wings, tailless, high wing sweep, etc.) that demand more significant modeling efforts to predict full scale aircraft dynamics but continue to lack accurate full dynamic modeling throughout the flight envelope. A dynamically scaled sub-scale prototype is a risk reducing and cost-effective tool to provide significant flight data to accurately predict the full-scale aircraft behaviors. With an accurate full scale vehicle design to include the predicted mass distribution that defines the full-scale moments of inertia, an inertially scaled vehicle can be designed to execute open-air flight tests that accurately mimic the full-scale vehicle dynamics.

The component and material selections for the UAV must consider the higher wing loading and takeoff/landing speeds expected to be encountered. Conventional hobby grade equipment may not be designed to these operating conditions so a plan to balance low-cost hardware and test processes with more expensive and traditional aircraft hardware and flight test processes must be proposed. Because the model’s angular motions will be much faster than those of the target aircraft, the models may be difficult to operate and control. Unique approaches to piloting and operating the aircraft are encouraged to maximize the utility of the UAV, which may require some degree of automation to simplify the workload of a remote pilot or include an autonomous flight control system. DARPA does not envision the proposed UAV leaving direct line of sight of the control station to simplify UAV flight control methodologies.

PHASE I: This topic is soliciting Direct to Phase II (DP2) proposals only. Phase I feasibility must be demonstrated through evidence of completed fixed wing aircraft design and flight testing of similarly sized vehicles (55 to 300 lbs.). The aircraft designs must be of configuration types that are of interest to DoD and commercial use cases and must have recorded adequate flight test data to validate predicted design performance capabilities. Additionally, the proposal should describe the overall approach to inertial scaling such that the size and development time is appropriate to support a large aircraft program.

Entities interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific/technical merit and feasibility described above has been achieved and describe the potential commercial applications. DP2 Phase I feasibility documentation should include, at a minimum:

- technical reports describing results and conclusions of existing work, particularly regarding the commercial opportunity or DoD insertion opportunity, risks/mitigations, and technology assessments
- presentation materials and/or white papers/technical papers

- test and measurement data
- prototype designs/models
- performance projections, goals, or results in various use cases

The collection of Phase I feasibility material will verify mastery of the required content for DP2 consideration.

PHASE II: DP2 proposals are expected to show a viable path to flight testing an inertially scaled aircraft with direct connection to a target fixed wing aircraft of relevance to DoD and/or commercial applications.

Phase II fixed payable milestones for this program should include:

- Month 1: Identification of relevant target aircraft to facilitate UAV design and performance assessments with achievable path to obtain necessary target aircraft data to evaluate utility of an inertially scaled aircraft.
- Month 4: Preliminary design of inertially scaled aircraft (55 to 300 lbs) with a viable path to complete fabrication and flight test within the available program resources.
- Month 9: Detailed design of inertially scaled aircraft as well as a flight simulation model for flight controller development and testing.
- Month 12: Completed fabrication of inertially scaled aircraft including installation of major subsystem components.
- Month 14: Completed ground test activities to verify functionality of the aircraft.
- Month 16: Complete flight test campaign with sufficient flight test data to validate predicted performance and allow for application to target aircraft. Flight tests should assess controllability and overall vehicle performance throughout the flight envelope.
- Month 18: Documentation of sub-scale vehicle performance with direct comparisons and assessment of relevance to target aircraft flight controls and maneuverability data to evaluate utility of the dynamically scaled testing approach.

6 Month Option fixed payable milestones for this program should include:

- Month 21: Validation of models of vehicle performance using data collected in flight test and confirmation relative to those models.
- Month 24; Prediction of flight maneuvers using validated models, and flight test validation of correlation between modelled and actual performance.

PHASE III DUAL USE APPLICATIONS: Follow-on opportunities will include continued testing of the developed sub-scale aircraft as well as implementing the process for designing and testing an inertially scaled aircraft on future developmental efforts. It is anticipated that significant flight control design and software development can be accomplished sooner in aircraft development programs through the use of an inertially scaled testbed aircraft. Once proven, the approach developed under this effort can be applied to future large-scale military and commercial aircraft development programs. Trade space exploration of candidate configurations can be evaluated early in the design process with inertially scaled aircraft flight testing. Flight control laws and the associated software can be developed much earlier in the program when design changes can be made faster and cheaper than during large scale flight testing at the end of traditional aircraft programs.

REFERENCES:

1. Chambers, Joseph R. Modeling Flight: The Role of Dynamically Scaled Free-Flight Models in Support of NASA's Aerospace Programs. NASA SP 2009-575.
2. Turpak, John, Air and Space Forces Magazine, "Why USAF's New T-7 Trainer Won't Start Production for 2 More Years", April 13, 2023.

KEYWORDS: unmanned air vehicle (UAV), inertially scaled, tactically relevant, target aircraft

HR0011SB20254-09 TITLE: Turbulent Boundary Layer Drag Reduction via Surface Actuators

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Renewable Energy Generation and Storage

OBJECTIVE: Develop and flight test turbulent boundary layer drag reduction using surface actuators. The proposal must identify an actuator system that can be verified to reduce turbulent boundary layer drag in flight. The proposed approach to a flight demonstration must clearly outline an achievable path from actuator development to wind-tunnel and flight test validation at relevant conditions.

DESCRIPTION: DARPA seeks proposals for the purpose of demonstrating turbulent boundary layer drag reduction in flight using active modification of turbulent flows. Drag is a fundamental force that can limit the capabilities (e.g., range, endurance, speed, payload, etc.) of aerospace vehicles and weapon systems. Even a slight drag reduction can significantly improve system performance. Many drag reduction methods have a weight or energy penalty that offsets their benefit but approaches such as plasma-based drag reduction techniques show promise to simultaneously reduce drag and provide net power savings. Extensive research and experimentation have demonstrated that devices like plasma actuators can induce controlled perturbations in the boundary layer of simplified wind-tunnel configurations. We seek to extend these techniques to flight.

Proposed approaches should seek to actively intervene in the autonomous cycle involving the lift-up and break-up of coherent streamwise vorticity that is associated with the wall "streak structure" first observed by Kline et al. (1967). Since this structure is linearly correlated with the wall skin friction, DARPA envisions innovative solutions that provide a net system performance benefit. Research has shown that the introduction of a mean spanwise velocity component in the near-wall region of the boundary layer can have a dramatic effect on drag. Flush, surface-mounted plasma actuators designed to produce either unidirectional spanwise near-wall velocity component or spanwise opposed wall jets have been shown to be effective.

Proposals should demonstrate an understanding of boundary-layer-based scaling relations for the design of actuator array parameters to influence performance (e.g. spanwise spacing and induced velocity).

PHASE I: This topic is soliciting Direct to Phase II (DP2) proposals only. Phase I feasibility must be demonstrated through evidence of having demonstrated DBD drag reduction at laboratory scale. Proposers must establish their credibility in understanding the physics of drag reductions using such devices. They should be able to show that they can conduct such tests at scale in flight. They must make a convincing case that they understand how to transition laboratory research to a flight test environment.

PHASE II: DARPA envisions an approach which includes:
1. Design optimization of an actuator array for a selected test article/aircraft
2. Development of closed-loop actuator control based on vehicle flight characteristics
3. Integration of actuators and drag measurement methodology on test article
4. Evaluate flight demonstration opportunities for candidate technology
5. Complete initial flight-testing validation
6. Conduct extended flight test campaign and fully document actuator performance

Phase II milestones for this program should include:
- Month 1: Identification of relevant target aircraft to enable a flight test of the actuator array.
- Month 4: Design of actuator array to enable fabrication and flight test within the available program resources.
- Month 9: Fabrication of candidate DBD array and document functionality in the lab.

- Month 12: Install DBD array and provide initial documentation of ability to operate it on test aircraft.
- Month 14: Complete ground test activities to verify functionality of the DBD array on the test aircraft.
- Month 16: Complete of initial flight test campaign with sufficient flight test data to validate predicted performance. Flight tests should assess drag reduction throughout the selected flight envelope.
- Month 18: Documentation of DBD performance with direct comparisons and assessment of relevant to aircraft without drag reduction technology.

6 Month Option milestones for this program should include:

- Month 22: Conduct flight test extension to explore DBD performance over an extended flight envelope.
- Month 24; Fully document actuator performance across the extended flight envelope.

PHASE III DUAL USE APPLICATIONS: Follow-on opportunities will include continued testing of the developed test article as well as implementing the process for designing and testing a system on a full-scale transport aircraft. It is anticipated that significant fuel saving can be achieved with an appropriately designed system. Once proven, the approach developed under this effort can be applied to a wide range of future commercial and military applications.

REFERENCES:

1. F. Thomas, T. Corke, and A. Duong. Airfoil friction drag reduction with net power savings using pulsed direct-current plasma actuation. AIAA J., 61(9):4045-4055, 2023.

KEYWORDS: drag reduction, fuel efficiency, transport aircraft

MISSILE DEFENSE AGENCY
DoD 25.4 Small Business Innovation Research (SBIR)
Annual Broad Agency Announcement (BAA)
Direct to Phase II Component-specific Proposal Instructions
Release 8

Introduction

The Missile Defense Agency's (MDA) mission is to develop and deploy a layered Missile Defense System (MDS) to defend the United States, its deployed forces, allies, and friends from missile attacks in all phases of flight.

The MDA Small Business Innovation Research (SBIR) Program is implemented, administered, and managed by the MDA SBIR/Small Business Technology Transfer (STTR) Program Management Office (PMO), located within the Innovation, Science, & Technology directorate.

The topic published in the MDA SBIR 25.4 Release 8 Broad Agency Announcement (BAA) is a Direct to Phase II (DP2). Offerors responding to the topic in this BAA must follow all general instructions provided in the Department of Defense (DoD) SBIR Program BAA. MDA requirements in addition to or deviating from the DoD Program BAA are provided in the instructions below.

Proposers are encouraged to thoroughly review the DoD Program BAA and register for the Defense SBIR/STTR Innovation Portal (DSIP) Listserv to remain apprised of important programmatic and contractual changes.

- Full component-specific instructions and topic descriptions are available on DSIP at https://www.dodsbirsttr.mil/submissions/solicitation-documents/active-solicitations. Be sure to select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at: https://www.dodsbirsttr.mil/submissions/login.

Specific questions pertaining to the administration of the MDA SBIR Program and these proposal preparation instructions should be directed to:

Missile Defense Agency
SBIR/STTR Program Management Office
MDA/AC
Bldg. 5224, Martin Road
Redstone Arsenal, AL 35898
Email: sbirsttr@mda.mil

PLEASE NOTE: Please read the following MDA DP2 proposal instructions carefully prior to submitting your proposal. Proposals not conforming to the terms of this announcement will not be considered for negotiation and/or award. MDA reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality as determined by MDA will be funded. MDA reserves the right to withdraw from negotiations at any time prior to contract award. The Government may withdraw from negotiations at any time for any reason to include, but not limited to, matters of national security (foreign persons, foreign influence or ownership, inability to clear the firm or personnel for security clearances, or other related issues).

Please read the entire DoD Announcement and MDA instructions carefully prior to submitting your proposal. Please go to https://www.sbir.gov/about/policies to read the SBIR/STTR Policy Directive issued by the Small Business Administration.

Federally Funded Research and Development Centers (FFRDCs) and Support Contractors

Only Government personnel with active non-disclosure agreements will evaluate proposals. Non-Government technical support contractors and FFRDCs (consultants) to the Government may review and provide support in proposal evaluations during source selection. Consultants may have access to the offeror's proposals, may be utilized to review proposals, and may provide comments and recommendations to the Government's decision makers. Consultants will not establish final assessments of risk and will not rate or rank offerors' proposals. They are also expressly prohibited from competing for MDA SBIR/STTR awards in the SBIR/STTR topics they review and/or on which they provide comments to the Government.

All consultants are required to comply with procurement integrity laws. Consultants will not have access to proposals that are labeled by the offerors as "Government Only." Pursuant to FAR 9.505-4, the MDA contracts with these organizations include a clause which requires them to (1) protect the offerors' information from unauthorized use or disclosure for as long as it remains proprietary and (2) refrain from using the information for any purpose other than that for which it was furnished. In addition, MDA requires the employees of those support contractors that provide technical analysis to the SBIR/STTR Program to execute non-disclosure agreements. These agreements will remain on file with the MDA SBIR/STTR PMO.

Non-Government consultants will be authorized access to only those portions of the proposal data and discussions that are necessary to enable them to perform their respective duties. In accomplishing their duties related to the source selection process, employees of the aforementioned organizations may require access to proprietary information contained in the offerors' proposals.

Offeror Small Business Eligibility Requirements

Each offeror must qualify as a small business at time of award per the Small Business Administration's (SBA) regulations at 13 CFR 121.701-121.705 and certify to this in the Cover Sheet section of the proposal. Small businesses that are selected for award will also be required to submit a Funding Agreement Certification document and be registered with Supplier Performance Risk System https://www.sprs.csd.disa.mil/ prior to award.

Ownership Eligibility

Prior to award, MDA may request business/corporate documentation to assess ownership eligibility as related to the requirements of SBIR/STTR Program Eligibility. These documents include, but may not be limited to, the Business License; Articles of Incorporation or Organization; By-Laws/Operating Agreement; Stock Certificates (Voting Stock); Board Meeting Minutes for the previous year; and a list of all board members and officers. If requested by MDA, the offeror shall provide all necessary documentation for evaluation prior to SBIR award. Failure to submit the requested documentation in a timely manner as indicated by MDA may result in the offeror's ineligibility for further consideration for award.

SBA Company Registry

Per the SBIR/STTR Policy Directive, all applicants are required to register their firm at SBA's Company Registry prior to submitting a proposal. Upon registering, each firm will receive a unique control Identification number to be used for submissions at any of the participating agencies in the SBIR or STTR program. For more information, please visit the SBA's Firm Registration Page: https://app.www.sbir.gov/company-registration/overview.

Organization Conflicts of Interest (OCI)

The basic OCI rules for Contractors that support development and oversight of SBIR topics are covered in 9.505-1 through FAR 9.505-4 as the means of avoiding, neutralizing, or mitigating organizational conflicts of interest.

All applicable rules under the FAR 9.5 apply.

If you, or another employee in your company, developed or assisted in the development of any SBIR requirement or topic, please be advised that your company may have an OCI. Your company could be precluded from an award under this BAA if your proposal contains anything directly relating to the development of the requirement or topic. Before submitting your proposal, please examine any potential OCI issues that may exist with your company to include subcontractors and understand that if any exist, your company may be required to submit an acceptable OCI mitigation plan prior to award.

In addition, FAR 3.101-1 states that Government business shall be conducted in a manner above reproach and, except as authorized by statute or regulation, with complete impartiality and with preferential treatment for none. The general rule is to avoid strictly any conflict of interest or even the appearance of a conflict of interest in Government-contractor relationships. An appearance of impropriety may arise where an offeror may have gained an unfair competitive advantage through its hiring of, or association with, a former Government official if there are facts indicating the former Government official, through their former Government employment, had access to non-public, competitively useful information. (See Health Net Fed. Svcs, B-401652.3; Obsidian Solutions Group, LLC, B-417134, 417134.2). The existence of an unfair competitive advantage may result in an offeror being disqualified and this restriction cannot be waived.

It is MDA policy to ensure all appropriate measures are taken to resolve OCIs arising under FAR 9.5 and unfair competitive advantages arising under FAR 3.101-1 to prevent the existence of conflicting roles that might bias a contractor's judgment and deprive MDA of objective advice or assistance, and to prevent contractors from gaining an unfair competitive advantage.

Use of Foreign Nationals (also known as Foreign Persons), Green Card Holders, and Dual Citizens

See the "Foreign Nationals" section of the DoD SBIR Program announcement for the definition of a Foreign National (also known as Foreign Persons).

ALL offerors proposing to use foreign nationals, green-card holders, or dual citizens, MUST disclose this information regardless of whether the topic is subject to export control restrictions. Identify any foreign nationals or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. You may be asked to provide additional information during negotiations in order to verify the foreign citizen's eligibility to participate on a SBIR contract. Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)).

Proposals submitted to export control-restricted topics and/or those with foreign nationals, dual citizens, or green card holders listed will be subject to security review during the contract negotiation process (if selected for award). MDA reserves the right to vet all un-cleared individuals involved in the project, regardless of citizenship, who will have access to Controlled Unclassified Information (CUI) such as export controlled information. If the security review disqualifies a person from participating in the proposed work, the contractor may propose a suitable replacement. In the event a proposed person and/or firm is found ineligible by the Government to perform proposed work, the Contracting Officer will advise the offeror of any disqualifications but is not required to disclose the underlying rationale. MDA may require offerors to address follow-up questions in order to determine eligibility.

Export Control Restrictions

The technology within most MDA topics is restricted under export control regulations including the International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). ITAR controls the export and import of listed defense-related material, technical data and services that provide the United States with a critical military advantage. EAR controls military, dual-use and commercial items not listed on the United States Munitions List or any other export control lists. EAR regulates export controlled items based on user, country, and purpose. The offeror must ensure that their firm complies with all applicable export control regulations. Please refer to the following URLs for additional information: https://www.pmddtc.state.gov/ and https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear.

The MDA SBIR Direct to Phase II topic is subject to ITAR and/or EAR. If selected for award negotiations, your company will be required to submit a Technology Control Plan (TCP) during the contracting negotiation process.

Flow-Down of Clauses to Subcontractors

The clauses to which the prime contractor and subcontractors are required to comply include, but are not limited to the following clauses: MDA clause H-08 (Public Release of Information) (see Attachment), DFARS 252.204-7000 (Disclosure of Information), DFARS clause 252.204-7012 (Safeguarding Covered Defense Information and Cyber Incident Reporting), DFARS clause 252.204-7020 (NIST SP 800-171 DoD Assessment Requirements), MDA clause H-09 (Organizational Conflict of Interest) (see Attachment), MDA clause H-27 (Foreign Persons) (see Attachment), and MDA clause H-28 (Distribution of Control Technical Data) (see Attachment). Your proposal submission confirms that any proposed subcontract is in accordance to the clauses cited above and any other clauses identified by MDA in any resulting contract. All proposed universities will need to provide written acceptance of the Flow-Down Clauses in both SBIR and STTR proposals.

Ownership Eligibility

If selected for award, MDA may request business/corporate documentation to assess ownership eligibility as related to the requirements of SBIR program eligibility. These documents include, but may not be limited to, the Business License; Articles of Incorporation or Organization; By-Laws/Operating Agreement; Stock Certificates (Voting Stock); Board Meeting Minutes for the previous year; and a list of all board members and officers. If requested by MDA, the contractor shall provide all necessary documentation for evaluation prior to award. Failure to submit the requested documentation in a timely manner as indicated by MDA may result in the offeror's ineligibility for further consideration for award.

Rights in Noncommercial Technical Data and Computer Software – SBIR Program (DFARs 252.227-7018 Class Deviation 2020-O0007 Revision 1)

Use this link for full description of Data Rights:
https://www.acq.osd.mil/dpap/policy/policyvault/USA001352-23-DPC.pdf

Fraud, Waste, and Abuse

All offerors must complete the fraud, waste, and abuse training (Volume 6) that is located on the Defense SBIR/STTR Innovation Portal (DSIP) (https://www.dodsbirsttr.mil). Please follow guidance provided on DSIP to complete the required training.

To report fraud, waste, or abuse, please contact:

MDA Fraud, Waste & Abuse
Hotline: (256) 313-9699
MDAHotline@mda.mil

DoD Inspector General (IG) Fraud, Waste & Abuse
Hotline: (800) 424-9098
hotline@dodig.mil

DP2 Proposal Submission Guidelines and Requirements

Proposal Submission

The MDA SBIR 25.4 Release 8 DP2 proposal submission instructions are intended to clarify the Department of Defense (DoD) instructions (https://www.dodsbirsttr.mil) as they apply to MDA requirements. This announcement is for MDA SBIR 25.4 Release 8 DP2 topics only. The offeror is responsible for ensuring that DP2 proposals comply with all requirements. Prior to submitting your proposal, please review the latest version of these instructions as they are subject to change before the submission deadline.

All proposals MUST be submitted online using DSIP (https://www.dodsbirsttr.mil). Any questions or technical issues pertaining to DSIP should be directed to the DoD SBIR/STTR Help Desk: DoDSBIRSupport@reisystems.com. It is recommended that potential offerors email the topic author(s) to schedule a time for topic discussion during the pre-release period.

Classified Proposals

Classified proposals ARE NOT accepted under the MDA SBIR/STTR Program. The inclusion of classified data in an unclassified proposal MAY BE grounds for the Agency to determine the proposal as non-responsive and the proposal not to be evaluated. Contractors currently working under a classified MDA SBIR/STTR contract must use the security classification guidance provided under that contract to verify new SBIR/STTR proposals are unclassified prior to submission. In some instances work being performed on Phase II contracts will require security clearances. If a Phase II contract will require classified work, the offeror must have a facility clearance and appropriate personnel clearances in order to perform the classified work. For more information on facility and personnel clearance procedures and requirements, please visit the Defense Counterintelligence and Security Agency Web site at: https://www.dcsa.mil.

Use of Acronyms

Acronyms must be spelled out the first time they are used within the technical volume (Volume 2), the technical abstract, the anticipated benefits/potential commercial applications, and the keywords section of the proposal. This will help avoid confusion when proposals are evaluated by technical reviewers.

Proposal titles, abstracts, anticipated benefits, and keywords of proposals that are selected for contract award will undergo an MDA Policy and Security Review. Proposal titles, abstracts, anticipated benefits, and keywords are subject to revision and/or redaction by MDA. Final approved versions of proposal titles, abstracts, anticipated benefits, and keywords may appear on DSIP and/or the SBA's SBIR/STTR award site (https://www.sbir.gov/sbirsearch/award/all). Acronyms that are not spelled out in the abstracts, anticipated benefits, and keywords will be removed.

Communication

All communication from the MDA SBIR/STTR PMO will originate from the "sbirsttr@mda.mil" email address. Please white-list this address in your company's spam filters to ensure timely receipt of communications from our office. In some instances, the MDA SBIR/STTR PMO may utilize the DoD Secure Access File Exchange (SAFE) website (https://safe.apps.mil) to provide information and/or documentation to offerors.

Proposal Status

Proposing firms will be notified of selection or non-selection status for a DP2 award within 90 days of the closing date of the BAA. The email will be distributed to the "Corporate Official" and "Principal Investigator" listed on the proposal coversheet and will originate from the sbirsttr@mda.mil email address. MDA cannot be responsible for notification to a company that provides incorrect information or changes such information after proposal submission.

Proposal Layout

For MDA DP2 proposals, MDA has provided a template that may be used to create the technical volume, Volume 2, of the DP2 proposal. The Volume 2 template can be found here: https://www.mda.mil/global/documents/pdf/MDA%20SBIR%20phase%20II.pdf

All pages within the technical volume (Volume 2) must be numbered consecutively. Proposals may not exceed 25 pages, may not have a font size smaller than 10-point, must use a font type of Times New Roman, and must be submitted on standard 8-1/2" x 11" paper with one-inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP. The header must be included in the one-inch margin.

Proposal Feedback

MDA will provide written feedback to unsuccessful offerors regarding their proposals upon request. Requests for feedback must be submitted in writing to the MDA SBIR/STTR PMO within 30 calendar days of non-selection notification. Non-selection notifications will provide instructions for requesting proposal feedback. Only firms that receive a non-selection notification are eligible for written feedback.

Technical and Business Assistance (TABA)

The SBIR/STTR Policy Directive allows agencies to enter into agreements with suppliers to provide technical assistance to SBIR/STTR awardees, which may include access to a network of scientists and engineers engaged in a wide range of technologies or access to technical and business literature available through on-line databases.

All requests for TABA must be completed using the MDA SBIR/STTR Phase II TABA Form (https://www.mda.mil/global/documents/pdf/SBIR_STTR_PHII_TABA_Form.pdf) and must be included as a part of Volume 5 of the proposal package using the "Other" category. MDA WILL NOT accept requests for TABA that do not utilize the MDA SBIR/STTR Phase II TABA Form or are not uploaded using the DSIP "Other" category as part of Volume 5 of the Phase II proposal package. The maximum TABA request is $20,000.

An SBIR/STTR firm may acquire the technical assistance services described above on its own. Firms must request this authority from MDA and demonstrate in its SBIR/STTR proposal that the individual or entity selected can provide the specific technical services needed. In addition, costs must be included in the cost volume of the offeror's proposal. The TABA provider may not be the requesting firm, an affiliate of the requesting firm, an investor of the requesting firm, or a subcontractor or consultant of the requesting firm otherwise required as part of the paid portion of the research effort (e.g. research partner or research institution).

If the awardee supports the need for this requirement sufficiently as determined by the Government, MDA will permit the awardee to acquire such technical assistance, in an amount up to $20,000. This will be an allowable cost on the SBIR/STTR award. The amount will be in addition to the award and is not subject to any burden, profit or fee by the offeror. The amount is based on the original contract period of performance and does not apply to period of performance extensions and/or enhancements. Requests for TABA funding outside of the base Phase II period of performance (24 months) will not be considered.

The purpose of this technical assistance is to assist SBIR/STTR awardees in:
1. Making better technical decisions on SBIR/STTR projects;
2. Solving technical problems that arise during SBIR/STTR projects;
3. Minimizing technical risks associated with SBIR/STTR projects; and
4. Developing and commercializing new commercial products and processes resulting from such projects including intellectual property protections.

SBIR/STTR Proposal Funding
All MDA SBIR/STTR contracts are funded with 6.2/6.3 funding which is defined as:

1. Applied Research (6.2), Systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

2. Advanced Technology Development (6.3), Includes all efforts that have moved into the development and integration of hardware for field experiments and tests.

As stated in Section VI "CLAUSE H-08 PUBLIC RELEASE OF INFORMATION", MDA requires prior review and approval before public release of any information arising from STTR-sponsored research. As such, MDA does not consider STTR-sponsored research as fundamental research.

Protests Procedures
Refer to the DoD Program Announcement for procedures to protest the Announcement.

As further prescribed in Federal Acquisition Regulation (FAR) 33.106(b), and in accordance with FAR clause 52.233-3 Protest after Award, any protests after award should be submitted to Candace Wright via email: sbirsttr@mda.mil.

Proposal Submission Requirements and Proposal Format
Proposals submitted to an MDA SBIR DP2 topic must provide documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the proposal must have been substantially performed by the offeror and/or the Principal Investigator (PI).

A complete DP2 proposal consists of the following volumes:
- Volume 1: Proposal Cover Sheet
- Volume 2: Technical Volume **(25 page maximum)**

- Volume 3: Cost Volume
- Volume 4: Company Commercialization Report
- Volume 5: Supporting Documents
  - Quality Management Questionnaire (**required – use "other" upload category**),
  - Letters of Support (**optional – use "Letter of Support" category**),
  - MDA Phase II TABA Form (**optional – use "other" upload category**).
- Volume 6: Fraud, Waste, and Abuse Certification
- Volume 7: Disclosures of Foreign Affiliations or Relationships to Foreign Countries

Volume 1 – Proposal Coversheet (Required)

- A coversheet will be automatically generated by DSIP and placed at the beginning of your PDF proposal package document.

Volume 2 – Technical Volume (Required – 25 page maximum)

- Use of the MDA provided DP2 template is recommended. The template can be obtained at the following URL: https://www.mda.mil/global/documents/pdf/MDA%20SBIR%20phase%20II.pdf. The technical volume should include the following 11 sections:

  (1) **Executive Summary.**
  Provide a summary of the key objectives that will be accomplished in the DP2 effort.

  (2) **Phase I Proof of Feasibility.**
  The offeror must describe work performed that substantiates Phase I feasibility as described in the topic.

  Proposers interested in participating in DP2 must include Phase I feasibility documentation that substantiates the scientific and technical merit and ensure that the Phase I feasibility described in the topic has been met and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology as stated in Phase I above in previous work or research completed. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the proposer and/or the PI. Feasibility documentation cannot be based upon or logically extend from any prior or ongoing federally funded SBIR or STTR work.

  (3) **Description of Proposed DP2 Technical Effort and Objectives.**
  Define the specific technical problem or opportunity addressed and its importance.

  (4) **Phase II Technical Objective and Statement of Work**.
  Enumerate the specific objectives of the Phase II work, and describe the technical approach and methods to be used in meeting these objectives. The statement of work should provide an explicit, detailed description of the Phase II approach, indicate what is planned, how and where the work will be carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the total proposal.

(5) **Related Work.**
Describe significant activities directly related or similar to the proposed effort, including any conducted by the PI, the proposing firm, consultants, or stakeholders. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal must accentuate its state-of-the-art technology and how it relates to the topic to capture the Government's interest for further development. In addition, please indicate whether your firm has performed on a classified government contract in the past as either a prime or subcontractor.

(6) **Relationship with Future Research or Research and Development.**
State the anticipated results if the project is successful. Discuss the significance of the Phase II effort in providing a foundation for Phase III research and development or commercialization.

(7) **Key Personnel.**
Identify at least two key personnel who will be involved in the Phase II effort including information on directly related education and experience. A concise resume of the PI that includes a list of relevant publications (if any) authored by the PI, must be submitted. All resumes count toward the page limitation in the technical volume.

a) **Foreign Persons**: ALL offerors proposing to use foreign persons, green-card holders, or dual citizens, MUST disclose this information regardless of whether the topic is subject to export control restrictions. Identify any foreign nationals or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. You may be asked to provide additional information during negotiations in order to verify the foreign citizen's eligibility to participate on an SBIR/STTR contract. Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)).

(8) **Facilities/Equipment**
Describe the equipment and physical facilities necessary to carry out the Phase II effort. Items of equipment to be purchased (as detailed in the cost proposal) shall be justified under this section. Also, certify that the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name), and local governments (name) for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

(9) **Subcontractors/Consultants**.
Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be described in detail and identified in the Cost Volume. A minimum of one-half of the research and/or analytical work in Phase II, as measured by direct and indirect costs, must be carried out by the offeror, unless otherwise approved in writing by the Contracting Officer.

(10) **Prior, Current or Pending Support of Similar Proposals or Awards.**

While it is permissible to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations or Broad Agency Announcements (BAA), it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning prior, current, or pending support of similar proposals or awards, it must be disclosed to the soliciting agency or agencies as early as possible.

(11) **Commercialization Strategy**

The Commercialization Strategy must address the following questions:

a) What is the first product that this technology will go into (identify the components of the MDS and areas within the commercial marketplace where you can transition this technology)?
b) Who will be your customers, and what is your estimate of the market size?
c) How much funding will you need to bring the technology to market, how will you acquire the necessary funds, and how do you expect to integrate this technology into the MDS?
d) Does your company have marketing expertise? If yes, please elaborate. If not, how do you intend to bring that expertise into the company?
e) Who are your competitors, and what makes you more competitive with your technology?

The commercialization strategy must also include a schedule showing the quantitative commercialization results from the Phase II project at one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.). After Phase II award, the company is required to report actual sales and investment data in its Company Commercialization Report at least annually.

Volume 3 – Cost Volume (Required)

Complete the on-line cost proposal in DSIP. Your cost volume may not exceed $2,000,000 (or $2,020,000 if TABA is included – use of the MDA Phase II TABA form is required if applying for TABA). Proposals whose cost volumes exceed $2,000,000 (or $2,020,000 if TABA is included) will not be evaluated or considered for award. The Phase II Period of Performance is generally 24 months. MDA will not accept any deviation to the percentage of work requirements.

Volume 4 – Company Commercialization Report (CCR) (Required)

The CCR allows companies to report funding outcomes resulting from prior SBIR and STTR awards. The CCR is required for DP2 proposals. The information contained in the CCR will not be considered by MDA during proposal evaluations.

Small businesses must complete the CCR by logging into their account at https://www.sbir.gov. Please refer to the "Instructions" and "Guide" documents contained in the DSIP Dashboard for more detail on completing and updating the CCR.

Once the CCR is certified and submitted on SBIR.gov, it must be uploaded to Volume 4: Company Commercialization Report in the Firm Information section of DSIP by the Firm Admin.

Volume 5 – Supporting Documents

MDA will accept the following documents under Volume 5:

1. Quality Management Questionnaire (**Required** – use "other" upload category)

2. TABA Request (Optional – use "other" upload category)
3. Letter of Support (Optional – use "Letter of Support" upload category)

   If including a request for TABA, the MDA Phase II TABA Form MUST be completed and uploaded using the "Other" category within Volume 5 of DSIP.

   If including letters of support, they MUST be uploaded using the "Letter of Support" category within Volume 5 of DSIP. A qualified letter of support is from a relevant commercial or Government Agency procuring organization(s) working with MDA, articulating their pull for the technology (i.e., what MDS need(s) the technology supports and why it is important to fund it), and possible commitment to provide additional funding and/or insert the technology in their acquisition/sustainment program. Letters of support shall not be contingent upon award of a subcontract.

   Note that letters of support from any MDA officials or references to such letters in a proposal WILL NOT be accepted and may result in the rejection of the proposal.

Any additional documentation included as part of Volume 5 WILL NOT be considered.

Volume 6 – Fraud, Waste, and Abuse Certification (Required)
All offerors must complete the fraud, waste, and abuse training that is located on DSIP.

Volume 7 – Disclosures of Foreign Affiliations or Relationships to Foreign Countries
Small business concerns must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission. Please be aware that the Disclosures of Foreign Affiliations or Relationships to Foreign Countries WILL NOT be accepted as a PDF Supporting Document in Volume 5 of the DSIP proposal submission. Do not upload any previous versions of this form to Volume 5. For additional details, please refer to the DoD SBIR Program BAA.

References to Hardware, Computer Software, or Technical Data
In accordance with the SBIR/STTR Policy Directive, SBIR contracts are to conduct feasibility-related experimental or theoretical Research/Research & Development (R/R&D). Phase II is not for formal end-item contract delivery or ownership by the Government of the contractor's hardware, computer software, or technical data.

The SBIR/STTR Policy Directive states that Agencies may issue Phase II awards for testing and evaluation of products, services, or technologies for use in technical or weapons systems.

As a result, the technical proposal should not use the term "Deliverables" when referring to your hardware, computer software, or technical data. Instead use the term: "Products for Testing, Evaluation, and/or Demonstration (possibly destruction)."

The standard formal deliverables for a Phase II are the:
(a) Report of Invention and Disclosure
(b) Contract Summary Report: Final Report
(c) Certificate of Compliance: SBIR_STTR Life-Cycle Certification
(d) Status Report: Quarterly Status Reports
(e) Computer Software Product: Product Description (if applicable, for Government Testing, Evaluation, and/or Demonstration ONLY)
(f) Technical Report - Study Services: Prototype Design and Operation Document

(g) Contract Summary Report: Phase III Plan
(h) Final Summary Chart: SBIR/STTR Transition Summary Chart
(i) Government Property Inventory Report: Government Furnished Property (GFP) and Contractor Acquired Property (CAP) Listing

FAR 52.203-5 Covenant Against Contingent Fees
As prescribed in FAR 3.404, the following FAR 52.203-5 clause shall be included in all contracts awarded under this BAA:

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) Bona fide agency, as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

MDA Proposal Evaluations and Selection
MDA will evaluate DP2 proposals using scientific review criteria based upon technical merit and other criteria as discussed in this document. MDA reserves the right to award none, one, or more than one contract under any topic. MDA is not responsible for any money expended by the offeror before award of any contract.

DP2 proposals will be evaluated based on the criteria outlined below, including potential benefit to the MDS. Selections will be based on best value to the Government considering the following factors:

a) The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
b) The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.
c) The potential for commercial (Government or private sector) application and the benefits expected to accrue from its commercialization.

Please note that potential benefit to the MDS will be considered throughout all the evaluation criteria and in the best value trade-off analysis. When combined, the stated evaluation criteria are significantly more important than cost or price.

It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments. Technical reviewers will base their conclusions on information contained in the proposal. Relevant supporting data such as journal articles, literature, including Government publications, etc., should be contained in Volume 2 and will count toward the applicable page limit. Qualified letters of support and/or requests for TABA, if included, MUST be uploaded as part of Volume 5 and will not count towards the Volume 2-page limit. Letters of support shall not be contingent upon award of a subcontract.

All Phase II awardees must have a Defense Contract Audit Agency (DCAA) approved accounting system. It is strongly urged that an approved accounting system be in place prior to the MDA Phase II award timeframe. If you do not have a DCAA approved accounting system, this will delay/prevent Phase II contract award. Please reference https://www.dcaa.mil/Portals/88/AccountingSystemRequirementsPreAwards_1.pdf for more information on obtaining a DCAA approved accounting system.

Attachment – Standard MDA Mandatory Flowdown Local Clauses

H-08 PUBLIC RELEASE OF INFORMATION (MAR 2020)

a. In addition to the requirements of National Industrial Security Program Operations Manual (DoD 5220.22-M), all foreign and domestic contractor(s) and its subcontractors are required to comply with the following:

1) Any official MDA information/materials that a contractor/subcontractor intends to release to the public that pertains to any work under performance of this contract, the Missile Defense Agency (MDA) will perform a pre-publication review prior to authorizing any release of information/materials.

2) At a minimum, these information/materials may be technical papers, presentations, articles for publication, key messages, talking points, speeches, and social media or digital media, such as press releases, photographs, fact sheets, advertising, posters, videos, etc.

b. Subcontractor public information/materials must be submitted for approval through the prime contractor to MDA.

c. Upon request to the MDA Procuring Contracting Officer (PCO), contractors shall be provided the "Request for Industry Media Engagement" form (or any superseding MDA form).

d. At least 45 calendar days prior to the desired release date, the contractor must submit the required form and information/materials to be reviewed for public release to MDAPressOperations@mda.mil, and simultaneously provide courtesy copy to the appropriate PCO. (Additional distribution emails can be added by the Program Office to ensure proper internal coordination and tracking of PR requests.)

e. All information/materials submitted for MDA review must be an exact copy of the intended item(s) to be released, must be of high quality and are free of tracked changes and/or comments. Photographs must have captions, and videos must have the intended narration included. All items must be marked with the applicable month, day, and year.

f. No documents or media shall be publically released by the Contractor without MDA Public Release approval.

g. Once information has been cleared for public release, it resides in the public domain and must always be used in its originally cleared context and format. Information previously cleared for public release but containing new, modified or further developed information must be re-submitted.

H-09 ORGANIZATIONAL CONFLICT OF INTEREST (Apr 2020)

a. Purpose: The purpose of this clause is to ensure that:

(1) the Contractor is rendering impartial assistance and advice to the Government at all times under this contract and related Government contracts;

(2) the Contractor's objectivity in performing work under this contract or related Government contracts is not impaired; and

(3) the Contractor does not obtain an unfair competitive advantage by virtue of its access to non-public Government information, or by virtue of its access to proprietary information belonging to others.

b. Scope: The Organizational Conflict of Interest (OCI) rules, procedures and responsibilities described in FAR 9.5 "Organizational and Consultant Conflicts of Interest", FAR 3.101-1 "Standards of Conduct – General, DFARS 209.5 "Organizational and Consultant Conflicts of Interest," and in this clause are applicable to the prime Contractor (including any affiliates and successors-in-interest), as well as any co-sponsor, joint-venture partner, consultant, subcontractor or other entity participating in the performance of this contract. The Contractor shall flow this clause down to all subcontracts, consulting agreements, teaming agreements, or other such arrangements which have OCI concerns, while modifying the terms "contract", "Contractor", and "Contracting Officer" as appropriate to preserve the Government's rights.

c. Access to and Use of Nonpublic Information: If in performance of this contract the contractor obtains access to nonpublic information such as plans, policies, reports, studies, financial plans, or data which has not been released or otherwise made available to the public, the Contractor agrees it shall not use such information for any private purpose or release such information without prior written approval from the Contracting Officer.

d. Access to and Protection of Proprietary Information: The Contractor agrees to exercise due diligence to protect proprietary information from misuse or unauthorized disclosure in accordance with FAR 9.505-

(4) the Contractor may be requested to enter into a written non-disclosure agreement with a third party asserting proprietary restrictions, if required in the performance of the contract.

e. In accordance with FAR 3.101-1, the Contractor shall also take all appropriate measures to prevent the existence of conflicting roles that might bias the Contractor's judgement, give the Contractor an unfair competitive advantage, and deprive MDA of objective advice or assistance that can result from hiring former Government employees. (See Health Net Fed. Svcs, B-401652.3).

f. Restrictions on Participating in Other Government Contract Efforts.

g. OCI Disclosures: The Contractor shall disclose to the Contracting Officer all facts relevant to the existence of an actual or potential OCI, using an OCI Analysis/Disclosure Form which the Contracting Officer will provide upon request. This disclosure shall include a description of the action the Contractor has taken or plans to take to avoid, neutralize or mitigate the OCI.

h. Remedies and Waiver:

(1) If the contractor fails to comply with any requirements of FAR 9.5, FAR 3.101-1, DFARS 209.5, or this clause, the Government may terminate this contract for default, disqualify the Contractor from subsequent related contractual efforts if necessary to neutralize a resulting organizational conflict of interest, and/or pursue other remedies permitted by law or this contract. If the Contractor discovers and promptly reports an actual or potential OCI subsequent to contract award, the Contracting Officer may terminate this contract for convenience if such termination is deemed to be in the best interest of the Government, or take other appropriate actions.

(2) The parties recognize that the requirements of this clause may continue to impact the contractor after contract performance is completed, and that it is impossible to foresee all future impacts. Accordingly, the Contractor may at any time seek an OCI waiver from the Director, MDA by submitting a written waiver request to the Contracting Officer. Any such request shall include a full description of the OCI and detailed rationale for the OCI waiver.

H-27 FOREIGN PERSONS (Jun 2010)

1. "Foreign National" (also known as Foreign Persons) as used in this clause 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(a)(3).

"Lawful permanent resident" is a person having the status of having been lawfully accorded the privilege of residing permanently in the United States as an immigrant in accordance with the immigration laws and such status not having changed.

"Protected individual" is an alien who is lawfully admitted for permanent residence, is granted the status of an alien lawfully admitted for temporary residence under 8 U.S.C.1160(a) or 8 U.S.C.1255a(a)(1), is admitted as a refugee under 8 U.S.C.1157, or is granted asylum under section 8 U.S.C.1158; but does not include (i) an alien who fails to apply for naturalization within six months of the date the alien first becomes eligible (by virtue of period of lawful permanent residence) to apply for naturalization or, if later, within six months after November 6, 1986, and (ii) an alien who has applied on a timely basis, but has not been naturalized as a citizen within 2 years after the date of the application, unless the alien can establish that the alien is actively pursuing naturalization, except that time consumed in the Service's processing the application shall not be counted toward the 2-year period."

2. Prior to contract award, the contractor shall identify any lawful U.S. permanent residents and foreign nationals expected to be involved on this project as a direct employee, subcontractor or consultant. For these individuals, in addition to resumes, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. You may be asked to provide additional information during negotiations in order to verify the foreign citizen's eligibility to participate on a contract. Supplemental information provided in response to this clause will be protected in accordance with Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)). After award of the contract, the Contractor shall promptly notify the Contracting Officer and Contracting Officer's Representative with the information above prior to making any personnel changes involving foreign persons. No changes involving foreign persons will be allowed without prior approval from the Contracting Officer. This clause does not remove any liability from the contractor to comply with applicable ITAR and EAR export control obligations and restrictions. This clause shall be included in any subcontract."

H-28 DISTRIBUTION CONTROL OF TECHNICAL INFORMATION (AUG 2014)

a. The following terms applicable to this clause are defined as follows:

1. DoD Official. Serves in DoD in one of the following positions: Program Director, Deputy Program Director, Program Manager, Deputy Program Manager, Procuring Contracting Officer, Administrative Contracting Officer, or Contracting Officer's Representative.

2. Technical Document. Any recorded information (including software) that conveys scientific and technical information or technical data.

3. Scientific and Technical Information. Communicable knowledge or information resulting from or pertaining to the conduct or management of effort under this contract. (Includes programmatic information).

4. Technical Data. As defined in DFARS 252.227-7013.

b. Except as otherwise set forth in the Contract Data Requirements List (CDRL), DD Form 1423 the distribution of any technical documents prepared under this contract, in any stage of development or completion, is prohibited outside of the contractor and applicable subcontractors under this contract unless authorized by the Contracting Officer in writing. However, distribution of technical data is permissible to DOD officials having a "need to know" in connection with this contract or any other MDA contract provided that the technical data is properly marked according to the terms and conditions of this contract. When there is any doubt as to "need to know" for purposes of this paragraph, the Contracting Officer or the Contracting Officer's Representative will provide direction. Authorization to distribute technical data by the Contracting Officer or the Contracting Officer's Representative does not constitute a warranty of the technical data as it pertains to its accuracy, completeness, or adequacy. The contactor shall distribute this technical data relying on its own corporate best practices and the terms and conditions of this contract. Consequently, the Government assumes no responsibility for the distribution of such technical data nor will the Government have any liability, including third party liability, for such technical data should it be inaccurate, incomplete, improperly marked or otherwise defective. Therefore, such a distribution shall not violate 18 United States Code § 1905.

c. All technical documents prepared under this contract shall be marked with the following distribution statement, warning, and destruction notice identified in sub-paragraphs 1, 2 and 3 below. When it is technically not feasible to use the entire WARNING statement, an abbreviated marking may be used, and a copy of the full statement added to the "Notice To Accompany Release of Export Controlled Data" required by DoD Directive 5230.25.

1. DISTRIBUTION - [PCO, Insert the appropriate distribution statement and complete the statement, if necessary, to include the applicable controlling office.]

2. WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C., App. 2401 et seq), as amended. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25

3. DESTRUCTION NOTICE - For classified documents follow the procedures in DOD 5220.22-M, National Industrial Security Program Operating Manual, February 2006, Incorporating Change 1, March 28, 2013, Chapter 5, Section 7, or DoDM 5200.01-Volume 3, DoD Information Security Program:

Protection of Classified Information, Enclosure 3, Section 17. For controlled unclassified information follow the procedures in DoDM 5200.01-Volume 4, Information Security Program: Controlled Unclassified Information.

d. The Contractor shall insert the substance of this clause, including this paragraph, in all subcontracts.

MDA SBIR 25.4 Release 8
Topic Index

MDA254-D002 TITLE: SBIR/STTR Command Center: A Unified Platform for Innovation

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

OBJECTIVE: Design, develop, and implement an innovative, centralized, user-friendly, AI-powered platform intended to streamline and enhance every stage of the program lifecycle. The SBIR/STTR Command Center will address the following key objectives:

1. Streamline the application and review process: Simplify application materials, establish a centralized online portal, and significantly reduce review turnaround times.
2. Enhance transparency and consistency: Develop standardized review criteria, ensure technical expertise within review panels, and provide real-time visibility into the process for all stakeholders.
3. Improve post-award management: Streamline reporting requirements, promote flexibility in funding use, and facilitate valuable connections between awardees and potential partners.
4. Leverage technology: Harness the power of AI, data analytics, and intelligent automation to improve program efficiency, effectiveness, and data-driven decision-making. This may include exploring the integration of Retrieval Augmented Generation (RAG) technology to further enhance the platform's capabilities.

DESCRIPTION: The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are critical drivers of technological innovation and economic growth, empowering U.S. small businesses to develop groundbreaking technologies. The SBIR/STTR process plays a vital role in supporting innovation, and there are opportunities to enhance its efficiency to better align with the rapid evolution of technology. Improving review times, simplifying application procedures, and increasing standardization could further strengthen the programs' impact on economic growth and national competitiveness. The SBIR/STTR Command Center will empower all program stakeholders – agencies, small businesses, and reviewers – with a unified platform that fosters a more efficient, transparent, and impactful innovation ecosystem. This centralized approach will:

1. Reduce administrative burden and accelerate funding timelines, allowing small businesses to focus on research and development.
2. Improve the quality and consistency of proposal evaluations, leading to more informed funding decisions.
3. Enhance communication and collaboration among agencies, reviewers, and awardees.
4. Provide valuable data and insights to inform program improvement and strategic decision-making.

Proposals must demonstrate a comprehensive understanding of and commitment to addressing the following legal and ethical considerations:

1. Data Security and Privacy: Compliance with all relevant federal and state laws and specific regulations governing SBIR/STTR data.
2. Intellectual Property Rights: Clear definition and protection of intellectual property rights for both applicants and the government.
3. Accessibility and Non-Discrimination: Compliance with accessibility standards and adherence to non-discrimination principles.
4. Algorithmic Transparency and Fairness: Mitigation of potential bias in AI/ML algorithms and promotion of transparency in automated decision-making.

Summarizing, the successful proposal will address the following technical challenges (but not limited to):

1. Conducting a comprehensive needs assessment: Analyze current SBIR/STTR processes to identify areas for improvement and gather feedback from stakeholders (agencies, small businesses, reviewers).

2. Developing a strategic plan: Outline specific recommendations, a detailed implementation roadmap, and necessary steps to integrate efficiencies into the SBIR/STTR process, addressing the objectives outlined above.
3. Designing and developing the platform: Create a secure, scalable, and user-friendly platform that incorporates the key features and modules outlined in the proposal requirements, including the potential integration of RAG.
4. Implementing pilot programs: Conduct thorough testing and evaluation of the platform in a controlled environment, incorporating feedback from stakeholders, before wider deployment.
5. Providing ongoing support and evaluation: Monitor the impact of implemented changes, provide ongoing support to stakeholders, and recommend adjustments to optimize functionality and impact, as well as ensuring continuous compliance with legal and ethical standards.

PHASE I: This topic is accepting Direct to Phase II proposals ONLY. Phase I-like proposals will not be evaluated and will be rejected as nonresponsive. For this topic, the Government expects the small business would have accomplished the following in a Phase I-like effort via some other means, e.g., independent research and development (IRAD) or other source, a concept for a workable prototype or design to address, at a minimum, the basic capabilities of the stated objective above. Proposal must show, as appropriate, a demonstrated technical feasibility or nascent capability. The documentation provided must substantiate the proposer's development of a preliminary understanding of the technology to be applied in their Phase II proposal in meeting topic objectives. Documentation should comprise all relevant information including, but not limited to, technical reports, test data, prototype designs/models, and performance goals/results.

Feasibility = maturity and what have you already done/validated.

Proposers interested in participating in Direct to Phase II must include in their responses to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and Phase I feasibility described in Phase I above has been met.

(i.e., the small business must have performed a proof of concept like "Phase I" component and/or other validation in a relevant environment, and/or at a much higher TRL level (5 or higher) and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology in previous work or research completed.)

IRAD work: Documentation should include the most relevant information including, but not limited to: technical reports, test data, prototype designs/models, and/or performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the proposer and/or the principal investigator (PI).

PHASE II: Proposals will be evaluated to the degree that they deliver an integrated solution that demonstrates performance, efficiency, and functionality in support of the SBIR/STTR lifecycle management process from topic development to award. Metrics for success are: delivery of an advanced, user-centric SBIR/STTR evaluation portal with a suite of reporting capabilities to effectively manage the SBIR/STTR programs and report progress, ability to create specific and open topic evaluation workflows that can adhere to solicitation requirements managed by the SBIR/STTR Program Office, operational automation to integrate with the Defense SBIR/STTR Innovation Portal (DSIP), system ability to provide ad hoc and enhanced reporting using historical data to generate reports and trend analysis, dashboard generation that provides status of multiple overlapping solicitations in varying steps of the program, and provide 24x 7 support. The technology solution should be designed with the flexibility to accommodate program-specific modifications as needed by the SBIR/STTR Program Office.

PHASE III DUAL USE APPLICATIONS: Scale up the capability into a mature, full-scale, stand-alone capability and integrate across the government workforce. The solution will provide completed modifications to meet specific program goals as determined during the initial development.

REFERENCES:

1. https://www.gao.gov/products/gao-14-748t
2. https://www.gao.gov/products/gao-22-104677
3. https://www.turbosbir.com/education/blog/inside-the-mind-of-an-sbir-sttr-reviewer-what-to-expect-during-the-review-process/
4. https://legacy.www.sbir.gov/tutorials/preparing-proposal/tutorial-1

KEYWORDS: Workflow; Autonomy; Scalable; Integration; AI/ML

Appendix A
TECHNICAL PROPOSAL TEMPLATE (VOLUME 2)

INSTRUCTIONS

These instructions and template apply to DoD SBIR/STTR Phase I topics and provide general guidelines for completing the Phase I Technical Volume. Information provided in the Service/Component-specific instructions for the topic of interest take precedence over any instructions listed below.

The template (beginning on the following page) is the format model that may be used to prepare the Phase I Technical Volume. Do not include the instructions provided on this page or any bracketed [ ] guidance in the template.

Disclosure
Offerors that include in their proposals data which they do not want disclosed to the public for any purpose, or used by the U.S. Government except for evaluation purposes, must:

(1) Mark the first page of each Volume of the Submission with the following legend:
"This proposal includes data that must not be disclosed outside the Government and must not be duplicated, used, or disclosed-in whole or in part-for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of-or in connection with-the submission of this data, the Government has the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in pages [insert numbers or other identification of sheets]";

(2) Mark each sheet of data it wishes to restrict with the following legend:
"Use or disclosure of data contained on this page is subject to the restriction on the first page of this volume."

Format
The Technical Volume shall meet the following requirements:

- Please refer to Service/Component-specific topic instructions for the page limit and how a technical volume is handled if the stated page count is exceeded. It is the proposing firm's responsibility to verify that the Technical Volume does not exceed the page limit after upload to DSIP. Unless otherwise noted, all content in the Technical Volume will count toward the limit.
- Single column format, single-spaced typed lines.
- Standard 8 ½" x 11" paper format.
- Page margins one inch on all sides. A header and footer may be included in the one-inch margin.
- **The header on each page of the Technical Volume should contain your company name, topic number, and DSIP-assigned proposal number.**
- No font smaller than 10-point. For headers, footers, imbedded tables, figures, images, or graphics that include text, a font size of smaller than 10-point is allowable, though proposers are cautioned that the text may be unreadable by evaluators.

Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document.

Delete this instruction page and begin the Technical Volume starting with the following page.

[Title]

Volume 2: Technical Volume

[Note: Remove the disclosure statement below if not applicable to your proposal. Refer to Instructions.]

> This proposal includes data that must not be disclosed outside the Government and must not be duplicated, used, or disclosed – in whole or in part – for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of – or in connection with – the submission of this data, the Government has the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in pages <insert numbers or other identification of sheets>.

1. <u>Identification and Significance of the Problem or Opportunity</u>.

[Define the specific technical problem or opportunity addressed and its importance.]

2. <u>Phase I Technical Objectives</u>.

[Enumerate the specific objectives of the Phase I work, including the questions the research and development effort will try to answer to determine the feasibility of the proposed approach.]

3. <u>Phase I Statement of Work (include Subcontractors and/or Research Institutions)</u>.

(a) [Provide an explicit, detailed description of the Phase I approach. If a Phase I option is required or allowed by the Component (refer to Component-specific instructions for topic of interest), describe appropriate research activities which would commence at the end of Phase I base period should the Component elect to exercise the option. The Statement of Work should indicate what tasks are planned, how and where the work will be conducted, a schedule of major events, and the final product(s) to be delivered. The Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the Technical Volume.

(b) The BAA may contain topics that have been identified by the Program Manager as research or activities involving Human/Animal Subjects and/or Recombinant DNA. If Phase I performance includes performance of these kinds of research or activities, please identify the applicable protocols and how those protocols will be followed during Phase I. Please note that funds cannot be released or used on any portion of the project involving human/animal subjects or recombinant DNA research or activities until all of the proper approvals have been obtained. **SBCs proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal in order to avoid potential delay of contract award.**]

4. <u>Related Work</u>.

[Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The Technical Volume must persuade evaluators of the proposer's awareness of the state of the art in the topic. Describe any previous work not directly related but similar to the proposed effort. Provide the following: (1) a short description, (2) the client for which work was performed (including the Government Point of Contact to be contacted including e-mail address and phone number), and (3) date of performance including project completion.]

5. **<u>Relationship with Future Research or Research and Development</u>.**

(a) [State the anticipated results of the proposed approach if the project is successful.

(b) Discuss the significance of the Phase I effort in providing a foundation for a Phase II research or research and development effort.

(c) Identify the applicable clearances, certifications and approvals required to conduct Phase II testing. Outline the plan for ensuring timely completion of stated authorizations in support of a Phase II research or research and development effort.]

6. **<u>Commercialization Strategy.</u>**

[Describe in approximately one page the SBC's strategy for commercializing this technology in DoD, other Federal Agencies, and/or private sector markets. Provide specific information on the market need the technology will address and the size of the market. Also include a schedule showing the quantitative commercialization results from the project that your company expects to achieve.]

7. **<u>Key Personnel</u>.**

[Identify key personnel who will be involved in the Phase I effort including information on directly related education and experience. A concise technical resume of the principal investigator, including a list of relevant publications (if any), must be included (Please do not include Privacy Act Information). All resumes will count toward the page limit for Volume 2, as specified in the Component-specific instructions.]

[Principal Investigator Name]
[School, Degree, Year]

Relevant Experience
[A concise description of the principal investigator's relevant technical experience and its application to this topic.]

Relevant Awards or Patents
[List any awards received or patents granted or applications submitted for work related to this topic.]

Relevant Publications
[List any publications relevant to this topic.]

[Repeat this format as necessary to address the qualifications of all key personnel.]

8. **<u>Foreign Citizens</u>.**

[Identify any foreign citizens or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. The proposal may be deemed nonresponsive if the requested information is not provided. You may be asked to provide additional information during negotiations in order to verify the foreign citizen's eligibility to participate on a SBIR/STTR contract. Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)). Note: If no foreign nationals will be involved in proposed work, the word "None" can be substituted for the table.]

Name [include direct employees, subcontractors, and consultants]	Foreign National (Yes/No)	Country of Origin	Type of Visa or Work Permit	Level of Involvement (Role)

9. Facilities/Equipment.

[Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Justify equipment purchases in this section and include detailed pricing information in the Cost Volume. State whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name), and local Governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.]

10. Subcontractors/Consultants.

[Propose efforts as applicable to either SBIR or STTR as follows:

SBIR. Involvement of a university or other subcontractors or consultants in the project may be appropriate. A minimum of two-thirds of the research and/or analytical work in Phase I, as measured by direct and indirect costs, must be carried out by the proposing small business firm, unless otherwise approved in writing by the Contracting Officer. SBIR efforts may include subcontracts with Federal Laboratories and Federally Funded Research and Development Centers (FFRDCs). A waiver is not required for the use of Federal Laboratories and FFRDCs; however, proposers must certify their use of such facilities on the proposal cover sheet. Subcontracts with other Federal organizations are not permitted. Note that universities cannot publicly release information related to Export Controlled/ITAR restricted topics. (Refer to the DoD SBIR/STTR Broad Agency Announcement for detailed eligibility requirements as it pertains to the use of subcontractors/consultants.)

STTR. Involvement of a Research Institution in the project is required. A minimum of 40 percent of the research and/or analytical work in Phase I, as measured by direct and indirect costs, must be conducted by the proposing small business firm, and a minimum of 30 percent of the research and/or tasks in Phase I, as measured by direct and indirect costs, must be conducted by a single Research Institution. STTR efforts may include subcontracts with Federally Funded Research and Development Centers (FFRDCs). A waiver is not required for the use of Federal Laboratories, but they do not qualify as a Research Partner; proposers may only subcontract to Federal Laboratories within the remaining 30 percent and must certify their use of such facilities on the proposal cover sheet. Subcontracts with other Federal organizations are not permitted. Note that universities cannot publicly release information related to Export Controlled/ITAR restricted topics. (Refer to the DoD SBIR/STTR Broad Agency Announcement for detailed eligibility requirements as it pertains to the use of subcontractors/consultants.]

11. Prior, Current or Pending Support of Similar Proposals or Awards.

[If a proposal submitted in response to this BAA is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, another or the same DoD Service/Component, you must disclose this on the proposal cover sheet and provide the following information:

a) Name and address of the Federal Agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.

b) Date of proposal submission or date of award.

c) Title of proposal.

d) Name and title of principal investigator for each proposal submitted or award received.

e) Title, number, and date of BAA(s) or solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.

f) If award was received, provide contract number.

g) Specify the applicable topics for each proposal submitted or award received.

Note: If this does not apply, state in the proposal "No prior, current, or pending support has been provided for proposed work."]

12. Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software.

The Offeror asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

Technical Data or Computer Software to be Furnished with Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person or Organization Asserting Restrictions
[(LIST)]	[(LIST)]	[(LIST)]	[(LIST)]

[Completion of this table and submission of the proposal constitutes signature for the information listed in the table above.]

[**ADDITIONAL INFORMATION/INSTRUCTION:** Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this BAA generally remain with the contractor, except that the Government obtains a royalty-free license to use such technical data only for Government purposes during the period commencing with contract award and ending twenty years after completion of the project under which the data were generated. This data must be marked with the restrictive legend specified in DFARS 252.227-7018 Class Deviation 2020-O0007. Upon expiration of the twenty-year restrictive license, the Government has unlimited rights in the SBIR data. During the license period, the Government may not release or disclose SBIR data to any person other than its support services contractors except: (1) For evaluation purposes; (2) As expressly permitted by the contractor; or (3) A use, release, or disclosure that is necessary for emergency repair or overhaul of items operated by the Government. See DFARS clause 252.227-7018 Class Deviation 2020-O0007 "Rights in Noncommercial Technical Data and Computer Software – Small Business Innovation Research (SBIR) Program."

If a proposer plans to submit assertions in accordance with DFARS 252.227-7017 Class Deviation 2020-O0007, those assertions must be identified and assertion of use, release, or disclosure restriction MUST be included with your proposal submission. The contract cannot be awarded until assertions have been approved. Please note that only the table is included in the page limitation; any supporting data concerning the contract/grant number and awarding agency, as well as planned use or need of the data asserted, can be provided in Volume 5, Supporting Documents.

The following instructions apply to the fields in the table above (Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software).

1) For technical data (other than computer software documentation) pertaining to items, components, or processes developed at private expense, identify both the deliverable technical data and each such item, component, or process. For computer software or computer software documentation identify the software or documentation.
2) Generally, development at private expense, either exclusively or partially, is the only basis for asserting restrictions. For technical data, other than computer software documentation, development refers to development of the item, component, or process to which the data pertain. The Government's rights in computer software documentation generally may not be restricted. For computer software, development refers to the software. Indicate whether development was accomplished exclusively or partially at private expense. If development was not accomplished at private expense, or for computer software documentation, enter the specific basis for asserting restrictions.
3) Enter asserted rights category (e.g., Government purpose license rights from a prior contract, rights in SBIR/STTR data generated under another contract, limited, restricted, or government purpose rights under this or a prior contract, or specially negotiated licenses).
4) Corporation, individual, or other person, as appropriate.

Enter “none” when all data or software will be submitted without restrictions.]

Appendix B
DEFINITIONS

The following definitions from the SBA SBIR/STTR Policy Directive, the Federal Acquisition Regulation (FAR) and other cited regulations apply to this BAA.

Commercialization

The process of developing products, processes, technologies, or services, and the production and delivery (whether by the originating party or others) of the products, processes, technologies, or services for Federal Government or commercial markets purchase or use.

Cooperative Research and Development

An SBC and a research institution jointly conduct R&D. For purposes of the STTR Program, the SBC performs 40 percent of the work, and the single research institution performs not less than 30 percent of the work. For purposes of the SBIR Program, this refers to work a research institution conducts as the SBC's subcontractor. The proposing SBC must conduct at least two-thirds of the research and/or analytical work in Phase I.

Covered Individual

An individual who contributes in a substantive, meaningful way to the scientific development or execution of a R&D project proposed to be carried out with a DoD-funded award. DoD has further designated covered individuals as including all proposed key personnel.

Essentially Equivalent Work

Work that is substantially the same research, which is proposed for funding in more than one contract proposal or grant application submitted to the same federal agency or submitted to two or more different federal agencies for review and funding consideration; or work where a specific research objective and the research design for accomplishing the objective are the same or closely related to another proposal or award, regardless of the funding source.

Export Control

The International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, apply to all projects with military or dual-use applications that develop beyond fundamental research, which is basic and applied research ordinarily published and shared broadly within the scientific community. Details are available here.

NOTE: Export control compliance statements found in the individual Service/Component-specific proposal instructions are not meant to be all inclusive. They do not remove any liability from the submitter to comply with applicable ITAR or EAR export control restrictions or from informing the U.S. Government of any potential export restriction as fundamental R&D efforts proceed.

Federal Laboratory

In 15 U.S.C. §3703, it means any laboratory, any federally funded R&D center (FFRDC), or any center established under 15 U.S.C. §§ 3705 & 3707 that a federal agency owns, leases, or otherwise uses and the Federal Government funds, whether the U.S. Government or the contractor operates.

Federally Funded Award

A Phase I, Phase II (including Direct to Phase II, sequential Phase II/subsequent Phase II and cross-agency Phase II), or Phase III SBIR or STTR award made using a funding agreement.

Foreign Affiliation

Under 15 U.S.C. § 638(e)(16), foreign affiliation means a funded or unfunded academic, professional, or institutional appointment or position with a foreign government or government-owned entity, whether full-time, part-time, or voluntary (including adjunct, visiting, or honorary). This includes appointments or positions deemed adjunct, visiting, or honorary with research institutions located in a foreign country of concern.

Foreign Country of Concern

In 15 U.S.C. § 638(e)(17), foreign country of concern means the People's Republic of China, the Democratic People's Republic of Korea, the Russian Federation, the Islamic Republic of Iran, or any other country the Secretary of State determines as a country of concern.

Foreign Entity

Foreign entity means any branch, partnership, group or sub-group, association, estate, trust, corporation or division of a corporation, non-profit, academic institution, research center, or organization that foreign owners, foreign investors, foreign management, or a foreign government establish, direct, or control.

Foreign Government

Foreign government means any government or governmental body, organization, or instrumentality, including government owned-corporations, other than the U.S. Government or U.S. state, territorial, tribal, or jurisdictional governments or governmental bodies. The term includes, but is not limited to, non-U.S. national and subnational governments, including their respective departments, agencies, and instrumentalities.

Foreign National

Foreign National (also known as Foreign Person) under 22 CFR 120.16 mean any natural person who is not a lawful permanent resident as defined by 8 U.S.C. § 1101(a)(20) or who is not a protected individual as defined by 8 U.S.C. § 1324b(a)(3). It also means any foreign corporation, business association, partnership, trust, society, or any other entity or group that is not incorporated or organized to do business in the United States, as well as international organizations, foreign governments and any agency or subdivision of foreign governments (e.g., diplomatic missions).

"Lawfully admitted for permanent residence" means the status of having been lawfully accorded the privilege of residing permanently in the United States as an immigrant in accordance with the immigration laws, such status not having changed.

"Protected individual'' means an individual who (A) is a citizen or national of the United States, or (B) is an alien who is lawfully admitted for permanent residence, is granted the status of an alien lawfully admitted for temporary residence under 8 U.S.C. § 1160(a) or 8 U.S.C. § 1255a(a)(1), is admitted as a refugee under 8 U.S.C. § 1157, or is granted asylum under Section 8 U.S.C. § 1158; but does not include (i) an alien who fails to apply for naturalization within six months of the date the alien first becomes eligible (by virtue of period of lawful permanent residence) to apply for naturalization or, if later, within six months after November 6, 1986, and (ii) an alien who has applied on a timely basis, but has not been naturalized as a citizen within two years after the date of the application, unless the alien can establish that the alien is actively pursuing naturalization, except that time consumed in the Service's processing the application shall not be counted toward the two-year period.

Fraud, Waste and Abuse

a. Fraud includes any false
b. about a material fact or any intentional deception designed to deprive the United States unlawfully of something of value or to secure from the United States a benefit, privilege, allowance, or consideration to which an individual or business is not entitled.
c. Waste includes extravagant, careless or needless expenditure of government funds, or the consumption of government property, that results from deficient practices, systems, controls, or decisions.
d. Abuse includes any intentional or improper use of government resources, such as misuse of rank, position, or authority or resources.
e. The SBIR/STTR Program training related to Fraud, Waste and Abuse is available here. See Section 1.13 for reporting fraud, waste, and abuse.

Funding Agreement

Any contract, grant, or cooperative agreement entered between any Federal Agency and any SBC for the performance of experimental, developmental, or research work, including products or services, Federal Government-funded in whole or in part. DoD Services/Components will only use contracts and other transaction authority (OTA) agreements for all SBIR awards.

Historically Black Colleges and Universities, and Minority-Serving Institutions

Department of Education list for historically Black colleges and universities and minority-serving institutions.

HUBZone Certified Small Business Concern

An SBC with SBA certification under the Historically Underutilized Business Zones (HUBZone) Program (13 C.F.R. § 126) as a HUBZone firm listed in the dynamic small business search (DSBS).

Malign Foreign Talent Recruitment Program

As defined in 42 U.S.C § 19237, the term "malign foreign talent recruitment program" means-

(A) any program, position, or activity that includes compensation in the form of cash, in-kind compensation, including research funding, promised future compensation, complimentary foreign travel, things of non de minimis value, honorific titles, career advancement opportunities, or other types of remuneration or consideration directly provided by a foreign country at any level (national, provincial, or local) or their designee, or an entity based in, funded by, or affiliated with a foreign country, whether or not directly sponsored by the foreign country, to the targeted individual, whether directly or indirectly stated in the arrangement, contract, or other documentation at issue, in exchange for the individual-

(i) engaging in the unauthorized transfer of intellectual property, materials, data products, or other nonpublic information owned by a United States entity or developed with a Federal R&D award to the government of a foreign country or an entity based in, funded by, or affiliated with a foreign country regardless of whether that government or entity provided support for the development of the IP, materials, or data products;

(ii) being required to recruit trainees or researchers to enroll in such program, position, or activity;

(iii) establishing a laboratory or company, accepting a faculty position, or undertaking any other employment or appointment in a foreign country or with an entity based in, funded by, or affiliated with a foreign country if such activities are in violation of the standard terms and conditions of a Federal R&D award;

(iv) being unable to terminate the foreign talent recruitment program contract or agreement except in extraordinary circumstances;

(v) through funding or effort related to the foreign talent recruitment program, being limited in the capacity to carry out a R&D award or required to engage in work that would result in substantial overlap or duplication with a Federal R&D award;

(vi) being required to apply for and successfully receive funding from the sponsoring foreign government's funding agencies with the sponsoring foreign organization as the recipient;

(vii) being required to omit acknowledgment of the recipient institution with which the individual is affiliated, or the Federal research agency sponsoring the R&D award, contrary to the institutional policies or standard terms and conditions of the Federal R&D award;

(viii) being required to not disclose to the Federal research agency or employing institution the participation of such individual in such program, position, or activity; or

(ix) having a conflict of interest or conflict of commitment contrary to the standard terms and conditions of the Federal R&D award; and

(B) a program that is sponsored by-

(i) a foreign country of concern or an entity based in a foreign country of concern, whether or not directly sponsored by the foreign country of concern;

(ii) an academic institution on the list developed under section 1286(c)(8) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note; 1 Public Law 115–232) ; or

(iii) a foreign talent recruitment program on the list developed under section 1286(c)(9) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note; 1 Public Law 115–232).

Performance Benchmark Requirements

SBCs with multiple SBIR/STTR awards must meet minimum performance requirements to be eligible to apply for a new Phase I or Direct-to-Phase II award. The purpose of these requirements is to ensure that Phase I SBCs with multiple prior SBIR/STTR awards are making progress towards commercializing the work done under those awards. The Phase I to Phase II transition rate addresses the extent to which an awardee progresses a project from Phase I to Phase II. The commercialization benchmark addresses the extent to which an awardee has moved past Phase II work towards commercialization.

The SBIR and STTR Extension Act of 2022 (Pub. L. 117-183) amended the benchmarks' applications for more experienced firms. Detailed information on benchmark calculations and increased performance standards for more experienced firms can be found here.

Personal Conflict of Interest

A situation in which an individual has a financial interest, personal activity, or relationship that could impair the employee's ability to act impartially and in the best interest of the government when performing under the contract. (A de minimis interest that would not "impair the employee's ability to act impartially and in the best interest of the government" is not covered under this definition.)

Among the sources of personal conflicts of interest are:

a. The covered employee's, their close family members' or other members of their household's financial interests;
b. Other employment or financial relationships (including seeking or negotiating for prospective employment or business); and
c. Gifts, including travel.

Financial interests referred to in this definition's first paragraph may arise from:

a. Compensation, including wages, salaries, commissions, professional fees, or fees for business referrals;
b. Consulting relationships (including commercial and professional consulting and service arrangements, scientific and technical advisory board memberships, or serving as an expert witness in litigation);
c. Services provided in exchange for honorariums or travel expense reimbursements;
d. Research funding or other forms of research support;
e. Investment in the form of stock or bond ownership or partnership interest (excluding diversified mutual fund investments);
f. Real estate investments;
g. Patents, copyrights, and other IP interests; or
h. Business ownership and investment interests.

Principal Investigator/Program Manager

The principal investigator/project manager is the proposing SBC-designated individual who provides the scientific and technical direction to a funding agreement-supported project.

Proprietary Information

Proprietary information is any information that a SBC considers to be non-public information the SBC owns and is marked accordingly.

Research Institution

Any organization located in the United States that is:

a. A university.
b. A nonprofit institution as defined in Section 4(5) of the Stevenson-Wydler Technology Innovation Act of 1980.
c. A contractor-operated federally funded R&D center, as identified by the National Science Foundation in accordance with the government-wide FAR issued in accordance with the Office of Federal Procurement Policy Act Section 35(c)(1). A list of eligible FFRDCs is here.

Research or Research and Development

Any activity that is:

a. A systematic, intensive study directed toward greater knowledge or understanding of the subject studied.
b. A systematic study directed specifically toward applying new knowledge to meet a recognized need; or
c. A systematic knowledge application toward the production of useful materials, devices, systems, or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Research Involving Animal Subjects

All activities involving animal subjects shall be conducted in accordance with DoDI 3216.01 "Use of Animals in DoD Programs," 9 C.F.R. parts 1-4 "Animal Welfare Regulations," National Academy of Sciences Publication "Guide for the Care & Use of Laboratory Animals," as amended, and the Department of Agriculture rules implementing the Animal Welfare Act (7 U.S.C. §§ 2131-2159), as well as other applicable federal and state law and regulation and DoD instructions.

"Animal use" protocols apply to all activities that meet any of the following criteria:

a. Any research, development, test, evaluation or training, (including experimentation) involving an animal or animals.
b. An animal is defined as any living or dead, vertebrate organism (non-human) that is being used or is intended for use in research, development, test, evaluation or training.
c. A vertebrate is a member of the subphylum Vertebrata (within the phylum Chordata), including birds and cold-blooded animals.

See DoDI 3216.01 for definitions of these terms and more information about the applicability of DoDI 3216.01 to work involving animals.

Research Involving Human Subjects

All research involving human subjects shall be conducted in accordance with 32 C.F.R. § 219 "The Common Rule," 10 U.S.C. § 980 "Limitation on Use of Humans as Experimental Subjects," and DoDI 3216.02 "Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research," as well as other applicable federal and state law and regulations, and DoD Services/Component guidance. Proposing SBCs must be cognizant of and abide by the additional restrictions and limitations imposed on the DoD regarding research involving human subjects, specifically as they regard vulnerable populations (DoDI 3216.02), recruitment of military research subjects (DoDI 3216.02), and informed consent and surrogate consent (10 U.S.C. § 980) and chemical and biological agent research (DoDI 3216.02). Food and Drug Administration regulation and policies may also apply.

"Human use" protocols apply to all research that meets any of the following criteria:

a. Any research involving an intervention or an interaction with a living person that would not be occurring or would be occurring in some other fashion but for this research.
b. Any research involving identifiable private information. This may include data/information/specimens collected originally from living individuals (broadcast video, web-use logs, tissue, blood, medical or personnel records, health data repositories, etc.) in which the identity of the subject is known, or the identity may be readily ascertained by the investigator or associated with the data/information/specimens.

See DoDI 3216.02 for definitions of these terms and more information about the applicability of DoDI 3216.02 to research involving human subjects.

Research Involving Recombinant DNA Molecules

Any recipient performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the National Institutes of Health Guidelines for Research Involving Recombinant DNA Molecules, dated January 2011, as amended. The guidelines can be found at: https://osp.od.nih.gov/wp-content/uploads/2016/05/NIH_Guidelines.pdf. Recombinant DNA is defined as (i) molecules that are constructed outside living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in living cells or (ii) molecules that result from the replication of those described in (i) above.

Service-Disabled Veteran-Owned Small Business (SDVOSB)

A service-disabled veteran or service-disabled veterans-owned and controlled SBC defined in Small Business Act 15 USC § 632(q)(2) and SBA's implementing SDVOSB regulations (13 CFR 125).

Small Business Concern (SBC)

A concern that meets the requirements set forth in 13 C.F.R. § 121.702 (available here).

An SBC must satisfy the following conditions on the date of award:

a. Is organized for profit, with a place of business located in the United States, which operates primarily within the United States, or which makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor;
b. Is in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that if the concern is a joint venture, each entity to the venture must meet the requirements set forth in paragraph (c) below;
c. Is more than 50 percent directly owned and controlled by one or more individuals (who are citizens or permanent resident aliens of the United States), other SBCs (each of which is more than 50 percent directly owned and controlled by individuals who are citizens or permanent resident aliens of the United States), or any combination of these; and
d. Has, including its affiliates, not more than 500 employees. (See here for definition of an affiliate.)

Subcontract

A subcontract is any agreement, other than one involving an employer-employee relationship, including consultants, the funding agreement awardee enters calling for supplies or services for the performance of the original funding agreement.

Subcontractor

Subcontractor means any supplier, distributor, vendor, firm, academic institution, research center, or other person or entity that furnishes supplies or services pursuant to a subcontract, at any tier.

United States

United States means the fifty states, the territories and possessions of the Federal Government, the Commonwealth of Puerto Rico, the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the District of Columbia.

Women-Owned Small Business Concern

An SBC where one or more women own at least 51 percent, or in the case of any publicly owned business, women own at least 51 percent of the stock, and women control the management and daily business operations.

Appendix C
POTENTIAL APPLICABLE FEDERAL ACQUISITION REGULATION, DEFENSE FEDERAL ACQUISITION REGULATION SUPPLEMENT CLAUSES

Note: Green cells are potential required Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS) clauses. Blue cells are potential required FAR and DFARS clauses, when applicable.

Clause Number	Title	Date	When Applicable
52.203-17	Contractor Employee Whistleblower Rights	Nov-23	
52.203-19	Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements	Jan-17	
52.204-10	Reporting Executive Compensation and First-Tier Subcontract Awards	Jun-20	
52.204-13	System for Award Management Maintenance	Oct-18	
52.204-18	Commercial and Government Entity Code Maintenance	Aug-20	
52.204-19	Incorporation by Reference of Representations and Certifications	Dec-14	
52.204-21	Basic Safeguarding of Covered Contractor Information Systems	Nov-21	
52.204-23	Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities	Dec-23	
52.204-25	Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment	Nov-21	
52.204-27	Prohibition on a ByteDance Covered Application	Jun-23	
52.204-30	Federal Acquisition Supply Chain Security Act Orders—Prohibition	Dec-23	
52.209-06	Protecting the Government's Interest When Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment	Nov-21	
52.209-10	Prohibition on Contracting with Inverted Domestic Corporations	Nov-15	
52.219-06	Notice of Total Small Business Set-Aside	Nov-20	
52.219-08	Utilization of Small Business Concerns	Feb-24	
52.219-28	Post-Award Small Business Program Representation	Feb-24	
52.222-03	Convict Labor	Jun-03	
52.222-19	Child Labor-Cooperation with Authorities and Remedies	Feb-24	
52.222-21	Prohibition of Segregated Facilities	Apr-15	
52.222-25	Affirmative Action Compliance	Apr-84	
52.222-26	Equal Opportunity	Sep-16	
52.222-36	Equal Opportunity for Workers with Disabilities	Jun-20	
52.222-50	Combating Trafficking in Persons	Nov-21	

Clause Number	Title	Date	When Applicable
52.225-01	Buy American-Supplies	Oct-22	
52.225-13	Restrictions on Certain Foreign Purchases	Feb-21	
52.226-07	Drug-Free Workplace	May-24	
52.226-08	Encouraging Contractor Policies to Ban Text Messaging While Driving	May-24	
52.227-01 Alt I	Authorization and Consent - Alternate I (Apr-84)	Jun-20	
52.227-02	Notice and Assistance Regarding Patent and Copyright Infringement	Jun-20	
52.227-11	Patent Rights-Ownership by the Contractor	May-14	
52.227-20	Rights in Data-SBIR Program	May-14	
52.232-11	Extras	Apr-84	
52.232-23	Assignment of Claims	May-14	
52.232-25	Prompt Payment	Jan-17	
52.232-33	Payment by Electronic Funds Transfer - System for Award Management	Oct-18	
52.232-39	Unenforceability of Unauthorized Obligations	Jun-13	
52.232-40	Providing Accelerated Payments to Small Business Subcontractors	Mar-23	
52.232-01	Disputes	May-14	
52.233-04	Applicable Law for Breach of Contract Claim	Oct-04	
52.242-15	Stop-Work Order	Aug-89	
52.243-01 Alt V	Changes-Fixed-Price Alternate V (Apr-84)	Aug-87	
52.244-06	Subcontracts for Commercial Products and Commercial Services	Feb-24	
52.246-09	Inspection of Research and Development (Short Form)	Apr-84	
52.252-02	Clauses Incorporated by Reference	Feb-98	
52.252-06	Authorized Deviations in Clauses	Nov-20	
52.253-01	Computer Generated Forms	Jan-91	
252.203-7000	Requirements Relating to Compensation of Former DoD Officials	Sep-11	
252.203-7002	Requirement to Inform Employees of Whistleblower Rights	Dec-22	
252.204-7000	Disclosure of Information	Oct-16	
252.204-7003	Control of Government Personnel Work Product	Apr-92	
252.204-7008	Compliance with Safeguarding Covered Defense Information Controls	Oct-24	
252.204-7009	Limitations on the Use or Disclosure of Third-Party Contractor Reported Cyber Incident Information	Jan-23	
252.204-7012	Safeguarding Covered Defense Information and Cyber Incident Reporting (DEVIATION 2024-O0013)	May-24	
252.204-7016	Covered Defense Telecommunications Equipment or Services—Representation	Dec-19	

Clause Number	Title	Date	When Applicable
252.204-7017	Prohibition on the Acquisition of Covered Defense Telecommunications Equipment or Services—Representation	May-21	
252.204-7018	Prohibition on the Acquisition of Covered Defense Telecommunications Equipment or Services	Jan-23	
252.204-7019	Notice of NISTSP 800-171 DoD Assessment Requirements	Nov-23	
252.204-7020	NIST SP 800-171 DoD Assessment Requirements	Nov-23	
252.204-7022	Expediting Contract Closeout	May-21	
252.204-7024	Notice on the use of the Supplier Performance Risk System	Mar-23	
252.227-7016	Rights in Bid or Proposal Information	Jan-23	
252.227-7018	Rights in Noncommercial Technical Data and Computer Software--Small Business Innovation Research (SBIR) Program (DEVIATION 2020-O0007) (Jul 23)	Nov-23	
252.227-7019	Validation of Asserted Restrictions--Computer Software	Jan-23	
252.227-7025	Limitations on the Use or Disclosure of Government-Furnished Information Marked with Restrictive Legends	Jan-23	
252.227-7030	Technical Data--Withholding of Payment	Mar-00	
252.227-7037	Validation of Restrictive Markings on Technical Data	Jan-23	
252.227-7039	Patents--Reporting of Subject Inventions	Apr-90	
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	Dec-18	
252.232-7006	Wide Area WorkFlow Payment Instructions	Jan-23	
252.232-7010	Levies on Contract Payments	Dec-06	
252.235-7010	Acknowledgment of Support and Disclaimer	May-95	
252.235-7011	Final Scientific or Technical Report	Dec-19	
252.243-7001	Pricing of Contract Modifications	Dec-91	
252.244-7000	Subcontracts for Commercial Items	Nov-23	
52.203-03	Gratuities	Apr-84	Exceeding the simplified acquisition threshold.
52.203-05	Covenant Against Contingent Fees	May-14	Exceeding the simplified acquisition threshold.
52.203-06 or Alt I	Restrictions on Subcontractor Sales to the Government or ALT I	Nov-21	Exceeding the simplified acquisition threshold, Alt I commercial products or commercial services.
52.203-07	Anti-Kickback Procedures	Jun-20	Contracts exceeding $150,000.
52.203-08	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	May-14	Exceeding the simplified acquisition threshold.
52.203-10	Price or Fee Adjustment for Illegal or Improper Activity	May-14	Exceeding the simplified acquisition threshold.
52.203-12	Limitation on Payments to Influence Certain Federal Transactions	Jun-20	Contracts exceeding $150,000.
52.204-02	Security Requirements	Mar-21	May require access to classified information; cost contract (see 16.302) for research and development with an educational institution is contemplated.

Clause Number	Title	Date	When Applicable
52.212-04	Contract Terms and Conditions—Commercial Products and Commercial Services	Nov-23	Commercial products or commercial services.
52.212-05	Contract Terms and Conditions Required to Implement Statutes or Executive Orders-Commercial Items	May-24	Commercial products or commercial services.
52.219-14	Limitations on Subcontracting	Oct-22	Set aside for small business and the contract amount is expected to exceed the simplified acquisition threshold.
52.222-35	Equal Opportunity for Veterans	Jun-20	Contracts exceed $150,000.
52.222-37	Employment Reports on Veterans	Jun-20	If contract contains 52.222-35.
52.222-40	Notification of Employee Rights Under the National Labor Relations Act	Dec-10	Exceeding the simplified acquisition threshold.
52.222-54	Employment Eligibility Verification	May-22	Contracts exceed $150,000.
52.223-03	Hazardous Material Identification and Material Safety Data	Feb-21	Requires the delivery of hazardous materials.
52.229-03	Federal, State, and Local Taxes	Feb-13	A fixed-price contract is contemplated; and the contract is expected to exceed the simplified acquisition threshold.
52.232-02	Payment under Fixed-Price Research and Development Contracts	Apr-84	Fixed Price R&D.
52.233-03	Protest After Award	Aug-96	Exceed the simplified acquisition threshold.
52.242-13	Bankruptcy	Jul-95	Exceed the simplified acquisition threshold.
52.242-17	Government Delay of Work	Apr-84	Supplies other than commercial or modified-commercial products.
52.245-01	Government Property	Sep-21	When property is expected to be furnished.
52.245-09	Use and Charges	Apr-12	When the clause at 52.245-1 is included.
52.246-04	Inspection of Services-Fixed Price	Aug-96	Services, or supplies that involve the furnishing of services, when a fixed-price contract is contemplated, and the contract amount is expected to exceed the simplified acquisition threshold.
52.246-16	Responsibility for Supplies	Apr-84	Supplies, services involving the furnishing of supplies, or research and development, when a fixed-price contract is contemplated, and the contract amount is expected to exceed the simplified acquisition threshold.
52.246-23	Limitation of Liability	Feb-97	Exceed the simplified acquisition threshold.
52.247-34	F.o.b. Destination	Nov-91	When the delivery term is f.o.b. destination.
252.204-7015	Notice of Authorized Disclosure of Information for Litigation Support	Jan-23	Commercial products and commercial services.
252.209-7004	Subcontracting with Firms that are Owned or Controlled by the Government of a Country that is a State Sponsor of Terrorism	May-19	Contracts value of $150,000 or more.
252.211-7003	Item Identification and Valuation	Jan-23	For supplies, and for services involving the furnishing of supplies.
252.223-7001	Hazard Warning Labels	Dec-91	Requires submission of hazardous material data sheets.
252.223-7008	Prohibition of Hexavalent Chromium	Jan-23	For supplies, maintenance and repair services, or construction.
252.225-7001	Buy American and Balance of Payments Program	Feb-24	Acquisition of commercial products and commercial services.

Clause Number	Title	Date	When Applicable
252.225-7002	Qualifying Country Sources as Subcontractors	Mar-22	(i) 252.225-7001, Buy American and Balance of Payments Program. Use if one or more is included: (ii) 252.225-7021, Trade Agreements. (iii) 252.225-7036, Buy American - Free Trade Agreements - Balance of Payments Program.
252.225-7012	Preference for Certain Domestic Commodities	Apr-22	Commercial products and commercial services.
252.225-7052	Restriction on Acquisition of Certain Magnets, Tantalum, and Tungsten	May-24	Products and commercial services, that exceed the simplified acquisition threshold.
252.225-7056	Prohibition Regarding Business Operations with the Maduro Regime	Jan-23	Commercial products and commercial services.
252.225-7060	Prohibition on Certain Procurements from the Xinjiang Uyghur Autonomous Region	Jun-23	Products utilizing funds appropriated or otherwise made available for any fiscal year.
252.225-7972	Prohibition on the Procurement of Foreign-Made Unmanned Aircraft Systems (DEVIATION 2020-O0015)	May-20	
252.225-7967	Prohibition Regarding Russian Fossil Fuel Business Operations (DEVIATION 2024-O0006, Revision 1)	Feb-24	Exceeding the simplified acquisition threshold.
252.228-7001	Ground and Flight Risk	Mar-23	Acquisition, development, production, modification, maintenance, repair, flight, or overhaul of aircraft owned by or to be delivered to the Government.
252.228-7005	Mishap Reporting and Investigation Involving Aircraft, Missiles, and Space Launch Vehicles	Nov-19	Acquisition, development, production, modification, maintenance, repair, flight, or overhaul of aircraft owned by or to be delivered to the Government.
252.235-7002	Animal Welfare	Dec-14	Uses live vertebrate animals.
252.235-7004	Protection of Human Subjects	Jul-09	Involving human subjects.
252.243-7002	Requests for Equitable Adjustment	Dec-22	Exceeding the simplified acquisition threshold.
252.245-7003	Contractor Property Management System Administration	Apr-12	Containing the clause at FAR 52.245-1, Government Property.
252.245-7005	Management and Reporting of Government Property	Jan-24	Containing the clause at FAR 52.245-1, Government Property.
252.247-7023	Transportation of Supplies by Sea	Jan-23	Except - those with an anticipated value at or below the simplified acquisition threshold.