DEPARTMENT OF THE NAVY (DON)
DoW 2027 Small Business Innovation Research (SBIR) BAA
Release 2
Phase I
Proposal Submission Instructions

IMPORTANT

- **Effective October 1, 2026, the Department of the Navy transformed from a Systems Command-centric model to a centralized development pipeline, directly integrated with the Portfolio Acquisition Executive (PAE) framework to ensure alignment to naval priorities.**

- **The following instructions apply to topics:**
  - **DON27BZ02-NV006 through DON27BZ02-NV025**

- Submitting small business concerns (SBCs) are encouraged to thoroughly review the DoW SBIR/STTR Program Broad Agency Announcement (BAA) and register for the DSIP Listserv to remain apprised of important programmatic changes.
  - The DoW Program BAA is located at: https://www.dodsbirsttr.mil/submissions/login.
  - Register for the DSIP Listserv at: https://www.dodsbirsttr.mil/submissions/login.

- The information provided in the DON Proposal Submission Instructions takes precedence over the DoW Instructions posted for this BAA.

- DoW has established proposal limitations on a per-topic basis. SBCs may submit only one (1) proposal in response to a single topic. Please review the DoW SBIR/STTR Program BAA for further information.

- **DON Phase I Technical Volume (Volume 2) page limit is not to exceed 10 pages.**

- Proposing SBCs 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 are eligible to submit proposals in response to DON topics advertised in this BAA. Information on Majority Ownership in Part and certification requirements at time of submission for these proposing SBCs are detailed in the section titled ADDITIONAL SUBMISSION CONSIDERATIONS.

- DON templates are available at https://www.navysbir.com/links_forms.htm.

- The DON may consider the following FAR and Non-FAR contract strategies when issuing Phase I awards: Firm Fixed Price (FFP), Basic Ordering Agreement (BOA), or Prototype Other Transaction (OT). The DON may consider the following FAR and Non-FAR contracting strategies when issuing Phase II awards: Cost Plus Fixed Fee (CPFF), FFP, BOA, or Prototype OT.

- This BAA is issued under regulations set forth in Federal Acquisition Regulation (FAR) 35.016 and awards will be made under “other competitive procedures”. The policies and procedures of

FAR Subpart 15.3 shall not apply to this BAA, except as specifically referenced in it. All procedures are at the sole discretion of the Government as set forth in this BAA. Submission of a proposal in response to this BAA constitutes the express acknowledgement to that effect by the proposing SBC.

INTRODUCTION

The DON SBIR/STTR Programs are mission-oriented programs that integrate the needs and requirements of the DON's Fleet through research and development (R&D) topics that have dual-use potential, but primarily address the needs of the DON. More information on the programs can be found on the DON SBIR/STTR website at www.navysbir.com. Additional information on DON's mission can be found on the DON website at www.navy.mil.

For questions regarding this BAA, use the information in Table 1 to determine who to contact for what types of questions.

TABLE 1: POINTS OF CONTACT FOR QUESTIONS REGARDING THIS BAA

Type of Question	When	Contact Information
Program and administrative	Always	Navy SBIR/STTR Program Management Office DON_SBIR_STTR@us.navy.mil or appropriate participating Command listed in Table 2 (below)
Topic-specific technical questions	BAA Pre-release	Technical Point of Contact (TPOC) listed in each topic on the DoW SBIR/STTR Innovation Portal (DSIP). Refer to the Proposal Submission section of the DoW SBIR/STTR Program BAA for details.
	BAA Open	DoW SBIR/STTR Topic Q&A platform (https://www.dodsbirsttr.mil/submissions) Refer to the Proposal Submission section of the DoW SBIR/STTR Program BAA for details.
Electronic submission to the DoW SBIR/STTR Innovation Portal (DSIP)	Always	DSIP Support via email at dodsbirsupport@reisystems.com
Navy-specific BAA instructions and forms	Always	DON SBIR/STTR Program Management Office DON_SBIR_STTR @us.navy.mil

TABLE 2: DON SBIR PARTICIPATING COMMANDS

Topic Numbers	Point of Contact	Participating Command	Email
DON27BZ02-NV006 to DON27BZ02-NV008	Tatiana Sears	Marine Corps	PAE_Marine_Corps_SBIR_STTR @us.navy.mil
DON27BZ02-NV009	Shadi Azoum	Mission Systems	PAE_MS_SBIR_STTR@us.navy. mil

Topic Numbers	Point of Contact	Participating Command	Email
DON27BZ02-NV010 to DON27BZ02-NV025	Lore-Anne Ponirakis	Office of Naval Research (ONR)	ONR_SBIR_STTR@us.navy.mil

PHASE I SUBMISSION INSTRUCTIONS

The following section details requirements for submitting a compliant Phase I proposal to the DoW SBIR/STTR Programs.

(NOTE: Proposing SBCs are advised that support contract personnel will be used to carry out administrative functions and may have access to proposals, contract award documents, contract deliverables, and reports. All support contract personnel are bound by appropriate non-disclosure agreements.)

DoW SBIR/STTR Innovation Portal (DSIP). Proposing SBCs are required to submit proposals via the DoW SBIR/STTR Innovation Portal (DSIP); and follow proposal submission instructions in the DoW SBIR/STTR Program BAA on the DSIP at https://www.dodsbirsttr.mil/submissions. Proposals submitted by any other means will be disregarded. Proposing SBCs submitting through DSIP for the first time will be asked to register. It is recommended that SBCs register as soon as possible upon identification of a proposal opportunity to avoid delays in the proposal submission process. Proposals that are not successfully certified electronically in DSIP by the Corporate Official prior to BAA Close will NOT be considered submitted and will not be evaluated by DON. Proposals that are encrypted, password protected, or otherwise locked in any portion of the submission will be REJECTED unless specifically directed within the text of the topic to which you are submitting. Please refer to the DoW SBIR/STTR Program BAA for further information.

Proposal Volumes. The following seven volumes are required.

- **Proposal Cover Sheet (Volume 1).** As specified in DoW SBIR/STTR Program BAA.

- **Technical Proposal (Volume 2)**
  - Technical Proposal (Volume 2) must meet the following requirements or the proposal will be REJECTED:
    - Not to exceed ten (10) pages, regardless of page content
    - Single column format, single-spaced typed lines
    - Standard 8 ½" x 11" paper
    - Page margins one inch on all sides. A header and footer may be included in the one-inch margin.
    - No font size smaller than 10-point
    - Include, within the ten-page limit of Volume 2, an Option that furthers the effort in preparation for Phase II and will bridge the funding gap between the end of Phase I and the start of Phase II. Tasks for both the Phase I Base and the Phase I Option must be clearly identified. Phase I Options are exercised upon selection for Phase II.
    - Work proposed for the Phase I Base must be exactly six (6) months.
    - Work proposed for the Phase I Option must be exactly six (6) months.

- Additional information:
  - A Phase I proposal template specific to DON to meet Phase I requirements is available at https://navysbir.com/links_forms.htm
  - A font size smaller than 10-point is allowable for headers, footers, imbedded tables, figures, images, or graphics that include text. However, proposing SBCs are cautioned that if the text is too small to be legible it will not be evaluated.

- **Cost Volume (Volume 3).**
  - Cost Volume (Volume 3) must meet the following requirements or the proposal will be REJECTED:
    - The Phase I Base amount must not exceed $200,000.
    - Phase I Option amount must not exceed $115,000.
    - Costs for the Base and Option must be separated and clearly identified in Volume 3.
    - For Phase I, a minimum of two-thirds of the work is performed by the proposing SBC. The two-thirds percentage of work requirement must be met in the Base costs as well as in the Option costs. DON will not accept deviations from the minimum percentage of work requirements for Phase I. The percentage of work is measured by both direct and indirect costs. To calculate the minimum percentage of work for the proposing SBC the sum of all direct and indirect costs attributable to the proposing SBC represent the numerator and the total cost of the proposal (i.e., Total Cost before Profit Rate is applied) is the denominator. The subcontractor percentage is calculated by taking the sum of all costs attributable to the subcontractor (Total Subcontractor Costs (TSC)) as the numerator and the total cost of the proposal (i.e., Total Cost before Profit Rate is applied) as the denominator.
      - Proposing SBC Costs (included in numerator for calculation of the SBC):
        - Total Direct Labor (TDL)
        - Total Direct Material Costs (TDM)
        - Total Direct Supplies Costs (TDS)
        - Total Direct Equipment Costs (TDE)
        - Total Direct Travel Costs (TDT)
        - Total Other Direct Costs (TODC)
        - General & Administrative Cost (G&A)

        NOTE: G&A, if proposed, will only be attributed to the proposing SBC.
      - Subcontractor Costs (numerator for subcontractor calculation):
        - Total Subcontractor Costs (TSC)
      - Total Cost (i.e., Total Cost before Profit Rate is applied, denominator for either calculation)
    - **Cost Sharing: Cost sharing is not accepted on DON Phase I proposals. A value above or below $0.00 entered in the Cost Sharing field will not be considered in the Phase I contract award.**

  - Additional information:
    - Provide sufficient detail for subcontractor, material, and travel costs. Subcontractor costs must be detailed to the same level as the prime contractor. Material costs must include a listing of items and cost per item. Travel costs must include the purpose of the trip, number of trips, location, length of trip, and number of personnel.
    - Inclusion of cost estimates for travel to the participating Command's facility for one day of meetings is recommended for all proposals.
    - The "Additional Cost Information" of Supporting Documents (Volume 5) may be used to provide supporting cost details for Volume 3. When a proposal is selected for award, be prepared to submit further documentation to the Contracting Officer to substantiate costs

(e.g., an explanation of cost estimates for equipment, materials, and consultants or subcontractors).

- **Company Commercialization Report (Volume 4)**. DoW collects and uses Volume 4 and DSIP requires Volume 4 for proposal submission. Please refer to the Proposal Preparation Instructions and Requirements section of the DoW SBIR/STTR Program BAA for details to ensure compliance with DSIP Volume 4 requirements.

- **Supporting Documents (Volume 5).** Volume 5 is for the submission of administrative material that DON may or will require to process a proposal, if selected, for contract award.

  - Proposing SBCs must review and submit the following items, as applicable:
    - **Majority Ownership in Part.** Proposing SBCs 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 DON topics advertised within this BAA. Complete the certification as detailed under ADDITIONAL SUBMISSION CONSIDERATIONS.

  - Additional information:
    - Proposing SBCs may include the following administrative materials in Supporting Documents (Volume 5); a template is available at https://navysbir.com/links_forms.htm to provide guidance on optional material the proposing SBC may want to include in Volume 5:
      - Additional Cost Information to support the Cost Volume (Volume 3)
      - SBIR/STTR Funding Agreement Certification
      - Data Rights Assertion
      - Disclosure of Information (DFARS 252.204-7000)
      - Prior, Current, or Pending Support of Similar Proposals or Awards
      - Foreign Citizens
    - Details of Request for Discretionary Technical and Business Assistance (TABA), if proposed, is to be included under the Additional Cost Information section if using the DON Supporting Documents template.
    - Do not include documents or information to substantiate the Technical Volume (Volume 2) in Volume 5 (e.g., resumes, test data, technical reports, or publications). Such documents or information will not be considered.
    - A font size smaller than 10-point is allowable for documents in Volume 5; however, proposing SBCs are cautioned that the text may be unreadable.

    - **Fraud, Waste and Abuse Training (Volume 6)**. DoW requires Volume 6 for submission. Please refer to the Proposal Preparation Instructions and Requirements section of the DoW SBIR/STTR Program BAA for details.

- **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 DoW will review all proposals submitted in response to this BAA to assess security risks presented by SBCs seeking a Federally funded award. SBCs must complete the Disclosures of Foreign Affiliations or Relationships to Foreign Countries webform in Volume 7 of the DSIP proposal submission. Please refer to the Proposal Preparation Instructions and Requirements section of the DoW SBIR/STTR Program BAA for details.

PHASE I EVALUATION AND SELECTION

The following section details how the DON SBIR/STTR Programs will evaluate Phase I proposals.

Proposals meeting DSIP submission requirements will be forwarded to the DON SBIR/STTR Programs. Prior to evaluation, all proposals will undergo a compliance review to verify compliance with DoW and DON SBIR/STTR proposal eligibility requirements. Proposals not meeting submission requirements will be REJECTED and not evaluated.

- **Proposal Cover Sheet (Volume 1).** The Proposal Cover Sheet (Volume 1) will undergo a compliance review to verify the proposing SBC has met eligibility requirements and followed the instructions for the Proposal Cover Sheet as specified in the DoW SBIR/STTR Program BAA.

- **Technical Volume (Volume 2).** The DON will evaluate and select Phase I proposals using the evaluation criteria specified in the Method of Selection and Evaluation Criteria section of the DoW SBIR/STTR Program BAA, with technical merit being most important, followed by qualifications of key personnel and commercialization potential of equal importance. The information considered for this decision will come from Volume 2. This is not a FAR Part 15 evaluation and proposals will not be compared to one another. Cost is not an evaluation criterion and will not be considered during the evaluation process; the DON will only do a compliance review of Volume 3. Due to limited funding, the DON reserves the right to limit the number of awards under any topic.

  The Technical Volume (Volume 2) will undergo a compliance review (prior to evaluation) to verify the proposing SBC has met the following requirements or the proposal will be REJECTED:
  - Not to exceed ten (10) pages, regardless of page content
  - Single column format, single-spaced typed lines
  - Standard 8 ½" x 11" paper
  - Page margins one inch on all sides. A header and footer may be included in the one-inch margin.
  - No font size smaller than 10-point, except as permitted in the instructions above.
  - Include, within the 10-page limit of Volume 2, an Option that furthers the effort in preparation for Phase II and will bridge the funding gap between the end of Phase I and the start of Phase II. Tasks for both the Phase I Base and the Phase I Option must be clearly identified.
  - Work proposed for the Phase I Base must be exactly six (6) months.
  - Work proposed for the Phase I Option must be exactly six (6) months.

- **Cost Volume (Volume 3).** The Cost Volume (Volume 3) will not be considered in the selection process and will only undergo a compliance review to verify the proposing SBC has met the following requirements or the proposal will be REJECTED:
  - Must not exceed values for the Base ($200,000) and Option ($115,000).
  - Must meet minimum percentage of work; a minimum of two-thirds of the work is performed by the proposing SBC. The two-thirds percentage of work requirement must be met in the Base costs as well as in the Option costs. DON will not accept deviations from the minimum percentage of work requirements for Phase I.
  - **Cost Sharing: Cost sharing is not accepted on DON Phase I proposals. A value above or below $0.00 entered in the Cost Sharing field will not be considered in the Phase I contract award.**

- **Company Commercialization Report (CCR) (Volume 4).** The CCR (Volume 4) will not be evaluated by the DON nor will it be considered in the award decision. However, all proposing SBCs

must refer to the DoW SBIR/STTR Program BAA to ensure compliance with DSIP Volume 4 requirements.

- **Supporting Documents (Volume 5).** Supporting Documents (Volume 5) will not be considered in the selection process and will only undergo a compliance review to ensure the proposing SBC has included items in accordance with the PHASE I SUBMISSION INSTRUCTIONS section above.

- **Fraud, Waste, and Abuse Training Certificate (Volume 6).** Not evaluated.

- **Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7)**. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Volume 7) will be assessed as part of the Foreign Risk Evaluation Program to Assess Security Risks. Refer to the DoW SBIR/STTR Program BAA to ensure compliance with Volume 7 requirements.

ADDITIONAL SUBMISSION CONSIDERATIONS

This section details additional items for proposing SBCs to consider during proposal preparation and submission process.

Foreign Risk Evaluation (FRE) Program to Assess Security Risks. 15 U.S.C. §638(vv) requires the Department of War, in coordination with the Small Business Administration, to establish and implement a due diligence program, known as Foreign Risk Evaluation (FRE) Program, to assess and, when possible, mitigate security risks presented by SBCs seeking a Federally-funded award. Please review the Certifications and Registrations section of the DoW SBIR/STTR Program BAA for details on how DoW will assess security risks presented by SBCs. The FRE Program to Assess Security Risks will be implemented for all Phases.

Discretionary Technical and Business Assistance (TABA). The Small Business Innovation and Economic Security Act Section 7 mandates agencies offer TABA. The purpose of TABA is to assist awardees in making better technical decisions on SBIR/STTR projects; solving technical problems that arise during SBIR/STTR projects; minimizing technical risks associated with SBIR/STTR projects; commercializing the SBIR/STTR product or process, including intellectual property protections and cybersecurity assistance; and screening for potential foreign involvement in technology development or commercialization activities. TABA services can be provided through vendor(s) selected by the SBC or the SBC may propose use of TABA funding to hire new staff, augment staff, or direct staff to conduct or participate in training activities consistent with the purpose of TABA as detailed above. The Phase I TABA amount, if proposed, cannot include any profit/fee by the proposing SBC and must be inclusive of all applicable indirect costs. TABA cannot be used in the calculation of general and administrative expenses (G&A) for the SBIR proposing SBC. An SBC receiving TABA will be required to submit a report detailing the results and benefits of the service received. This TABA report will be due at the time of submission of the final report.

Request for TABA funding will be reviewed by the DON SBIR/STTR Program Management Office.

If proposing a TABA Provider, the following MUST be included in the request or be subject to denial.
- Provider(s)
- Provider(s) point of contact, email address, and phone number
- An explanation of the provider's unique qualifications to provide the TABA service
- Tasks that will be performed by the provider (to include the purpose and objective of the assistance)
- Total provider(s) cost, number of hours, and labor rates (average/blended rate is acceptable)

If proposing TABA funding to hire new staff, augment staff, or direct staff to conduct or participate in training activities consistent with the purpose of TABA, the following MUST be included or be subject to denial.

- Name(s), position(s), business need to be filled, and/or training to be provided
- Number of employees to be hired, augmented, or directed to participate in training activities
- Qualifications of employees hired or augmented, or detailed need for training
- Tasks that will be performed (to include the purpose and objective of the assistance)
- Total staff/training cost, number of hours, and labor rates (average/blended rate is acceptable)

TABA requests must be included in the proposal as follows:

- Phase I:
    - — Online DoW Cost Volume (Volume 3) – the value of the TABA request.
    - — Supporting Documents (Volume 5) – a detailed request for TABA (as specified above) specifically identified as "TABA" in the section titled Additional Cost Information when using the DON Supporting Documents template.
- Phase II:
    - — DON Phase II Cost Volume (provided by the DON) - the value of the TABA request.
    - — Supporting Documents (Volume 5) – a detailed request for TABA (as specified above) specifically identified as "TABA" in the section titled Additional Cost Information when using the DON Supporting Documents template.

Proposed values for TABA must NOT exceed:

- Phase I: A total of $6,500, in addition to the Phase I award amount.
- Phase II: A total of $25,000 per award, not to exceed $50,000 per Phase II project, included in the Phase II award amount.

Disclosure of Information (DFARS 252.204-7000). In order to eliminate the requirements for prior approval of public disclosure of information (in accordance with DFARS 252.204-7000) under this award, the proposing SBC shall identify and describe all fundamental research to be performed under its proposal, including subcontracted work, with sufficient specificity to demonstrate that the work qualifies as fundamental research. Fundamental research means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons (defined by National Security Decision Directive 189). An SBC whose proposed work will include fundamental research and requests to eliminate the requirement for prior approval of public disclosure of information must complete the DON Fundamental Research Disclosure and upload as a separate PDF file to the Supporting Documents (Volume 5) in DSIP as part of their proposal submission. The DON Fundamental Research Disclosure is available on https://navysbir.com/links_forms.htm and includes instructions on how to complete and upload the completed Disclosure. Simply identifying fundamental research in the Disclosure does **NOT** constitute acceptance of the exclusion. All exclusions will be reviewed and, if approved by the Government Contracting Officer, noted in the contract.

Majority Ownership in Part. Proposing SBCs 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 DON topics advertised within this BAA.

For proposing SBCs 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, SBCs must register with the SBA Company Registry Database.

b. The proposing SBC 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://navysbir.com/links_forms.htm. Include the SBIR VC Certification in the Supporting Documents (Volume 5).
c. Should a proposing SBC become a member of this ownership class after submitting its proposal and prior to any receipt of a funding agreement, the proposing SBC must immediately notify the Contracting Officer, register in the appropriate SBA database, and submit the required certification, which can be found on https://navysbir.com/links_forms.htm.

System for Award Management (SAM). It is strongly encouraged that proposing SBCs register in SAM, https://sam.gov, by the Close date of this BAA, or verify their registrations are still active and will not expire within 60 days of BAA Close. Additionally, proposing SBCs should confirm that they are registered to receive contracts (not just grants) and the address in SAM matches the address on the proposal. An SBC selected for an award MUST have an active SAM registration at the time of award or they will be considered ineligible.

Cybersecurity Maturity Model Certification (CMMC) Program. DoW has established the CMMC Program to verify that awardees have implemented required security measures necessary to safeguard Federal Contract Information (FCI) and Controlled Unclassified Information (CUI). CMMC Level requirements are identified within each topic and must be met prior to award. Proposing SBCs should anticipate that a Projected CMMC Level for Phase II award may be higher than the Projected CMMC Level advertised in the Phase I topic. Proposing SBCs should carefully review and consider the CMMC requirements as compliance may impact proposed costs and technical approach. Please review the DoW SBIR/STTR Program BAA for additional information on the CMMC Program.

Notice of NIST SP 800-171 Assessment Database Requirement. The purpose of the National Institute of Standards and Technology (NIST) Special Publication (SP) 800-171 is to protect Controlled Unclassified Information (CUI) in Nonfederal Systems and Organizations. As prescribed by DFARS 252.240-7997, in order to be considered for award, an SBC is required to implement NIST SP 800-171 and shall have a current assessment uploaded to the Supplier Performance Risk System (SPRS) which provides storage and retrieval capabilities for this assessment. The platform Procurement Integrated Enterprise Environment (PIEE) will be used for secure login and verification to access SPRS. For brief instructions on NIST SP 800-171 assessment, SPRS, and PIEE, please visit https://www.sprs.csd.disa.mil/nistsp.htm. For in-depth tutorials on these items, please visit https://www.sprs.csd.disa.mil/webtrain.htm.

Human Subjects, Animal Testing, and Recombinant DNA. Due to the short timeframe associated with Phase I of the SBIR/STTR process, the DON does **not** recommend the submission of Phase I proposals that require the use of Human Subjects, Animal Testing, or Recombinant DNA. For example, the ability to obtain Institutional Review Board (IRB) approval for proposals that involve human subjects can take 6-12 months, and that lengthy process can be at odds with the Phase I goal for time-to-award. Before the DON makes any award that involves an IRB or similar approval requirement, the proposing SBC must demonstrate compliance with relevant regulatory approval requirements that pertain to proposals involving human, animal, or recombinant DNA protocols. It will not impact the DON's evaluation, but requiring IRB approval may delay the start time of the Phase I award and if approvals are not obtained within two months of notification of selection, the decision to award may be terminated. If the use of human, animal, and recombinant DNA is included under a Phase I or Phase II proposal, please carefully review the requirements at: https://www.nre.navy.mil/work-with-us/how-to-apply/compliance-and-protections/research-protections. This webpage provides guidance and lists approvals that may be required before contract/work can begin.

Government Furnished Equipment (GFE). Due to the typical lengthy time for approval to obtain GFE, it is recommended that GFE is not proposed as part of the Phase I proposal. If GFE is proposed, and it is determined during the proposal evaluation process to be unavailable, proposed GFE may be considered a weakness in the technical merit of the proposal.

International Traffic in Arms Regulation (ITAR). For topics indicating ITAR restrictions or the potential for classified work, limitations are generally placed on disclosure of information involving topics of a classified nature or those involving export control restrictions, which may curtail or preclude the involvement of universities and certain non-profit institutions beyond the basic research level. Small businesses must structure their proposals to clearly identify the work that will be performed that is of a basic research nature and how it can be segregated from work that falls under the classification and export control restrictions. As a result, information must also be provided on how efforts can be performed in later phases if the university/research institution is the source of critical knowledge, effort, or infrastructure (facilities and equipment).

SELECTION, AWARD, AND POST-AWARD INFORMATION

Notifications. Email notifications for proposal receipt (approximately one week after the Phase I BAA Close) and selection are sent based on the information received on the proposal Cover Sheet (Volume 1). Consequently, the e-mail address on the proposal Cover Sheet must be correct.

Debriefs. Requests for a debrief must be made within 15 calendar days of select/non-select notification via email as specified in the select/non-select notification. Please note debriefs are typically provided in writing via email to the Corporate Official identified in the proposal of the proposing SBC within 60 days of receipt of the request. Requests for oral debriefs may not be accommodated. If contact information for the Corporate Official has changed since proposal submission, a notice of the change on company letterhead signed by the Corporate Official must accompany the debrief request.

Protests. Interested parties have the right to protest in accordance with the procedures in FAR Subpart 33.1.

Pre-award agency protests related to the terms of the BAA must be served to: osd.ncr.ousd-r-e.mbx.SBIR-STTR-Protest@mail.mil. A copy of a pre-award Government Accountability Office (GAO) protest must also be filed with the aforementioned email address within one day of filing with the GAO.

Protests related to a selection or award decision should be filed with the appropriate Contracting Officer for an Agency Level Protest or with the GAO. Contracting Officer contact information for specific DON Topics may be obtained from the Point of Contact for the participating Command listed in Table 2 above. For protests filed with the GAO, a copy of the protest must be submitted to the appropriate Point of Contact for the participating Command and the appropriate Contracting Officer within one day of filing with the GAO.

Awards. Due to limited funding, the DON reserves the right to limit the number of awards under any topic. Any notification received from the DON that indicates the proposal has been selected does not ultimately guarantee an award will be made. This notification indicates that the proposal has been selected in accordance with the evaluation criteria and has been sent to the Contracting Officer to conduct compliance review of Volume 3 to confirm eligibility of the proposing SBC, and to take other relevant steps necessary prior to making an award.

Contract Types. A Firm Fixed Price (FFP), Basic Ordering Agreement (BOA), or Prototype Other Transaction (OT) may be used for Phase I awards.

Funding Limitations. In accordance with the SBIR and STTR Policy Directive section 4(b)(5), there is a limit of one sequential Phase II award per SBC per topic. The maximum Phase I proposal/award amount including all options (less TABA) is $315,000. The Phase I Base amount must not exceed $200,000 and the Phase I Option amount must not exceed $115,000. The maximum Phase II proposal/award amount including all options (including TABA) is $2,000,000 (unless non-SBIR/STTR funding is being added). Individual Commands may award amounts, including Base and all Options, of less than $2,000,000 based on available funding. The structure of the Phase II proposal/award, including maximum amounts as well as breakdown between Base and Option amounts will be provided to all Phase I awardees either in their Phase I award or a minimum of 30 days prior to the due date for submission of their Initial Phase II proposal.

Contract Deliverables. Contract deliverables for Phase I are typically a kick-off brief, progress reports, and a final report. Required contract deliverables (as stated in the contract) must be uploaded to https://www.navysbirprogram.com/navydeliverables/.

Payments. The DON makes three payments from the start of the Phase I Base period, and from the start of the Phase I Option period, if exercised. Payment amounts represent a set percentage of the Base or Option value as follows:

Days from Start of Base Award or Option	Payment Amount
15 Days	50% of Total Base or Option
90 Days	35% of Total Base or Option
180 Days	15% of Total Base or Option

Transfer Between SBIR and STTR Programs. Section 4(b)(1)(i) of the SBIR and STTR Policy Directive provides that, at the agency's discretion, projects awarded a Phase I under a BAA for SBIR may transition in Phase II to STTR and vice versa.

PHASE II GUIDELINES

Evaluation and Selection. All Phase I awardees may submit an **Initial** Phase II proposal for evaluation and selection. The evaluation criteria for Phase II is the same as Phase I (as stated in this BAA). The Phase I Final Report and Initial Phase II Proposal will be used to evaluate the SBC's potential to progress to a workable prototype in Phase II and transition the technology to Phase III. Details on the due date, content, and submission requirements of the Initial Phase II Proposal will be provided by the awarding Command either in the Phase I contract or by subsequent notification.

Awards. The DON will consider the following for Phase II award: Cost Plus Fixed Fee (CPFF), Firm Fixed Price (FFP), Basic Ordering Agreement (BOA), or Prototype Other Transaction (OT). Phase II awards can be structured in a way that allows for increased funding levels based on the project's transition potential. To accelerate the transition of SBIR/STTR-funded technologies to Phase III, especially those that lead to Programs of Record and fielded systems, the Commercialization Readiness Program was authorized and created as part of section 5122 of the National Defense Authorization Act of Fiscal Year 2012. The statute set-aside is 1% of the available SBIR/STTR funding to be used for administrative support to accelerate transition of SBIR/STTR-developed technologies and provide non-financial resources for the SBCs (e.g., the Navy SBIR Transition Program, STP).

Navy SBIR Transition Program (STP). Phase II awardees have the opportunity to participate in the virtual Navy STP Kickoff during the first or second year of the Phase II contract. While there are no travel costs associated with this virtual event, Phase II awardees should budget time of up to a full day to

participate. STP information can be obtained at: https://navystp.com. Phase II awardees will be contacted separately regarding this program.

PHASE III GUIDELINES

A Phase III SBIR/STTR award is any work that derives from, extends, or completes effort(s) performed under prior SBIR/STTR funding agreements, but is funded by sources other than the SBIR/STTR programs. This covers any contract, grant, or agreement issued as a follow-on Phase III award or any contract, grant, or agreement award issued as a result of a competitive process where the awardee was an SBIR/STTR firm that developed the technology as a result of a Phase I or Phase II award. The DON will give Phase III status to any award that falls within the above-mentioned description. Consequently, DON will assign SBIR/STTR Data Rights to any noncommercial technical data and noncommercial computer software delivered in Phase III that were developed under SBIR/STTR Phase I/II effort(s). Government prime contractors and their subcontractors must follow the same guidelines as above and ensure that companies operating on behalf of the DON protect the rights of the SBIR/STTR firm.

NAVY SBIR DOW 2027 BAA
Phase I
Topic Index
Release 2

DON27BZ02-NV006	Mobile Vehicle Forensics
DON27BZ02-NV007	Lightweight, Energy-Efficient Portable Nitrogen Generator for Expeditionary Operations
DON27BZ02-NV008	Integrated Multi-Spectral Periscope for the Amphibious Combat Vehicle (ACV)
DON27BZ02-NV009	Distributed Multispectral Event-Driven Integrated Sensing and Communications
DON27BZ02-NV010	Automated Hardening for Cyber Secure Operating Systems
DON27BZ02-NV011	Low-cost Mid-wave Infrared Focal-Plane Array (FPA) Fabrication through Direct-bond Interconnection
DON27BZ02-NV012	"Self-Replicating Evolutionary Agentic SI Swarming Force" with Autonomous Embedded SI Guardrail Enforcers
DON27BZ02-NV013	Electro-Optical/Infrared Tactical Decision Aid
DON27BZ02-NV014	Autonomous Multi-Intelligence Acoustic Reasoning Agent for Anti-Submarine Warfare
DON27BZ02-NV015	High Sensitivity Tunneling Magnetoresistive Magnetometers
DON27BZ02-NV016	Improved Ionosphere D-region Specification for High Frequency Propagation
DON27BZ02-NV017	Expeditionary Water Quality Sensors
DON27BZ02-NV018	Rapid Thermoplastic Patching Capability for Legacy Thermoset Airframe Sustainment
DON27BZ02-NV019	Navy Shipboard Gas Turbine Rotating Detonation Combustor Operation with Diesel Fuel
DON27BZ02-NV020	Rapid Imagery Creation for Navy Training
DON27BZ02-NV021	SI-Enabled "Just-in-time" Knowledge Delivery for Naval Maintainers
DON27BZ02-NV022	Collapsible Fixed-Wing Low-Cost Unmanned Aerial System for Intelligence, Surveillance, and Reconnaissance Missions
DON27BZ02-NV023	Attritable Turbine for Low-Cost Attack Systems (ATLAS)
DON27BZ02-NV024	Zero-Retrofit Robotic Ammunition Handling for the MK 45 Mod 4, 5-Inch Gun Magazine
DON27BZ02-NV025	Innovative Shortwave Infrared High Energy Laser Source and Coupled Imager

DON27BZ02-NV006 TITLE: Mobile Vehicle Forensics

COMPONENT TECHNOLOGY PRIORITY AREA(S): Human-Machine Interfaces;Integrated Sensing and Cyber;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Design, develop, and demonstrate a ruggedized, field-deployable vehicle forensics device capable of non-destructive, rapid data triage and extraction.

DESCRIPTION: Operational Need & Gap: During tactical site exploitation (TSE), Marine Corps and Joint operators require immediate, field-deployable hardware and software to recognize, preserve, and collect materials of forensic value. While multi-purpose forensic kits exist to process traditional materials, a critical intelligence gap remains regarding vehicle-derived data. Modern vehicles function as mobile data hubs featuring advanced navigation, localized track logs, and cached external device connections. Exploiting this telematics and informatics data is vital for generating actionable intelligence, mapping networks, and establishing identity dominance.

The Problem (Technological Fragmentation): The primary barrier to tactical vehicle exploitation is severe technological fragmentation. Current vehicle forensic solutions are often designed for controlled laboratory environments. Because In-Vehicle Infotainment (IVI) systems and Electronic Control Units (ECUs) rely on proprietary software architectures and inconsistent file structures, existing tools are often restricted to narrow manufacturer subsets. Consequently, field operators may be forced to perform invasive, time-consuming physical disassembly of the vehicle dashboard—a method that is untenable in many field environments.

Scope of Effort: This SBIR topic seeks innovative proposals to develop a low-SWaP (Size, Weight, and Power), ruggedized, all-in-one device that automates the forensic exploitation of vehicle data systems. The system must interface via standard external access points (e.g., On-Board Diagnostic [OBD-II] ports or Universal Serial Bus [USB]); automatically profile the vehicle's make, model, year, and digital architecture; and execute an automated script to extract and structure data. Crucially, these features must be achieved through a non-invasive approach requiring no component disassembly, while maintaining strict forensic data integrity and verifiable accuracy.

The system must seamlessly interface with a broad registry of modern commercial and civilian vehicles across diverse model years, makes, and international manufacturers. Specifically, the device must extract and normalize data from disparate telematics systems (e.g., embedded GPS, localized track logs) and informatics modules (e.g., infotainment systems, paired Bluetooth logs, Wi-Fi cache, and cellular device pairings) without requiring laboratory-grade component disassembly.

Performance Goals:

- Threshold (Minimum): Demonstrate compatibility with representative samples of common vehicles; extract high-priority telematics (i.e., GPS, route history) and informatics (paired device logs) in under 15 minutes with verifiable accuracy (i.e., comparison with test data collected separately); packaged in a portable, field-ruggedized kit.
- Objective (Ideal): A pocket-sized, plug-and-play device that requires minimal operator training; demonstrates a modular path to broad vehicle compatibility; and extracts a comprehensive forensic data set in under 5 minutes via an intuitive, automated interface.

PHASE I: Develop a technical approach and assess the feasibility of a mobile, software-intelligent vehicle forensics capability that enables rapid data extraction from vehicle telematics (e.g., GPS, navigation logs)

and infotainment systems (e.g., paired Bluetooth devices, call histories) and prioritizes universal applicability across diverse vehicle head units, makes, and models, avoiding dependencies on specific hardware teardowns.
Required Phase I deliverables include:

- A comprehensive feasibility study and initial system design architecture.
- An assessment of projected data extraction speeds, performance metrics, and technical limitations.
- A detailed Phase II development plan mapping out performance goals, key technical milestones, and risk mitigation strategies.

PHASE II: Develop, demonstrate, and validate a functional, field-ready prototype based on the feasibility concepts established in Phase I. Focus on expanding compatibility across a broader registry of vehicle makes, models, and head unit architectures, while increasing the depth and fidelity of extracted telematics and informatics data. Ensure that the prototype is ruggedized or packaged appropriately for expeditionary testing.
Required Phase II deliverables include:

- A fully functional prototype vehicle forensics tool (software, hardware, or hybrid) ready for Government evaluation.
- Demonstrations of the tool's capability in an operationally relevant environment against representative vehicle targets.
- Complete technical documentation, including system architecture, user operating manuals, and finalized performance data metrics.
- A commercialization and transition plan detailing manufacturing viability and scaling strategies for military integration.

PHASE III DUAL USE APPLICATIONS: Upon successful completion of Phase II, support technology transition into a Phase III acquisition pathway for integration into the Forensics Dominance System – Marine Corps (FDS-MC) tactical site exploitation kits. Given the Joint requirement, position this rapid field-extraction capability for immediate transition to U.S. Special Operations Command (USSOCOM) exploitation programs and other Department of War service forensic intelligence elements.
In the commercial sector, this software-intelligent tool has direct dual-use applicability for federal, state, and local civilian law enforcement agencies by significantly modernizing digital forensics units through enabling roadside or scene-of-crime vehicle data extraction, thus bypassing extensive laboratory backlogs. Additionally, the capability will serve private sector markets, including automotive insurance fraud investigators, crash reconstruction experts, and corporate cybersecurity firms analyzing fleet vehicle telematics breaches.

REFERENCES:

1. "iVe Vehicle and System Support." Berla Corp., 2024. https://berla.co
1. "CAN Bus Explained - A Simple Intro." CSS Electroinics, 2024. https://www.csselectronics.com/pages/can-bus-simple-intro-tutorial
2. "NIST Special Publication 800-101 Revision 1, Guidelines on Mobile Device Forensics." National Institute of Standards and Technology, 2014. https://csrc.nist.gov/publications/detail/sp/800-101/rev-1/final
3. "Rusolut Vehicle Data Reconstructor." Rusolut, 2024. https://rusolut.com/vehicle-data-recovery/ https://rusolut.com/vehicle-data-reconstructor/
4. "United States Special Operations Command (USSOCOM) Tactical Forensics Event (TFE) 21.1, 2025". https://www.vulcan-sof.com/login/ng2/collection/a1e8fd06-ac2a-4fc6-bfb8-b1fcbe101b1c

KEYWORDS: Vehicle; forensics; information; collection; telematics; informatics

DON27BZ02-NV007 TITLE: Lightweight, Energy-Efficient Portable Nitrogen Generator for Expeditionary Operations

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Contested Logistics Technologies (LOG)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 man-portable, self-contained nitrogen generator capable of producing high-purity (equal to or less than 99.5%) nitrogen at 1,800 to 3,500 pounds per square inch (PSI), operating strictly within a 120-volt, 25-Amp single-phase electrical limit to support United States Marine Corps (USMC) expeditionary maintenance operations. While utilizing common enabling gas-separation technologies similar to topic N244-P02, this effort is strictly distinguished by its unique requirement for a highly modular, lightweight, two-man portable form factor engineered specifically for point-of-need operations in austere, forward-deployed environments.

DESCRIPTION: The United States Marine Corps (USMC) requires high-pressure nitrogen gas at forward operating locations to perform essential maintenance tasks, including aircraft and ground vehicle tire servicing, recoil mechanism servicing, recharging of gas suspension and accumulator components, and filling gas cylinders. Historically, the military relies on pre-filled, heavy steel gas cylinders resupplied through a vulnerable logistics chain. This process creates a severe logistical burden and hazardous material handling risk. Generating nitrogen at the point of need is essential to sustaining mission readiness in distributed, austere, and expeditionary environments consistent with USMC Force Design 2030 and Expeditionary Advanced Base Operations (EABO) concepts. The final product will be employed by USMC maintainers operating from forward tactical enclosures, specifically integrating with the JLTV Electronic Maintenance Shelter (JEMS). The system will provide point-of-need, high-purity nitrogen to service tactical vehicle and aircraft tires, hydraulic accumulators, recoil mechanisms, and suspension struts in support of distributed expeditionary operations.

While the USMC currently utilizes a legacy portable nitrogen generation system, it presents severe technical limitations that hinder expeditionary operations. First, the legacy system weighs 450 pounds, severely limiting mobility and requiring a four-person lift. Second, it requires 240-volt single-phase electrical power drawing 25 Amps. This exceeds the standard 120-volt, 25-Amp electrical limits of forward tactical enclosures, such as the Joint Expeditionary Maintenance Shelter (JEMS). Third, the current system only achieves 99.0% nitrogen purity (falling short of the required 99.5% for sensitive aviation and vehicle struts) and suffers from extremely slow flow rates, taking up to 6 hours to fill a standard 244-cubic-foot cylinder.

Commercial industry has introduced 120-volt single-phase configurations that achieve high purity. However, these state-of-the-art commercial units fall short of expeditionary physical requirements: they weigh in excess of 650 pounds, require separate external air compressors to operate, and maximize output

at only 3,000 pounds per square inch (PSI). No known existing solution simultaneously achieves man-portable weight limits, 120-volt/25-Amp operation, self-contained air compression, high purity (Develop and demonstrate a man-portable, self-contained nitrogen generator capable of producing high-purity (equal to or less than 99.5%) nitrogen at 1,800 to 3,500 pounds per square inch (PSI), operating strictly within a 120-volt, 25-Amp single-phase electrical limit to support United States Marine Corps (USMC) expeditionary maintenance operations.

This SBIR topic seeks innovative small business proposals to design, develop, demonstrate, and deliver a prototype device for a man-portable, energy-efficient, self-contained nitrogen generator that overcomes the stated limitations. Proposed approaches may include advanced membrane separation, pressure swing adsorption (PSA) with novel sorbent materials, hybrid separation architectures, lightweight composite enclosures, advanced electric motor/compressor technologies, intelligent power management, or other innovative approaches that meaningfully advance the state of the art. The prototype device must address extreme environmental challenges, specifically maintaining gas separation efficiency in high heat and high humidity, and must physically fit within tactical maintenance shelters.

The prototype device shall target the following performance parameters to bound the scope of effort, while remaining open to innovative approaches that may refine specific parameters:
Performance Parameter Phase II Threshold (T = Minimum Acceptable) Phase II Objective (O = Desired)
Output Pressure (Selectable/Continuous): No less than 3,500 PSI (T); Greater than 3500 PSI (O)
Nitrogen Purity: =/- 99.5% (T); =/- 99.99% (O)
Continuous Output Flow Rate: =/- 60 Standard Cubic Feet per Hour (SCFH) (T); =/- 120 SCFH (O)
System Weight & Transportability: =/+ 250 lbs total. Must include two-wheeled cart configuration. System can break down into modular components where no single module exceeds the two-person lift limits defined in MIL-STD-1472 (T); =/+ 150 lbs total. System can break down into modular components where no single module exceeds the two-person lift limits defined in MIL-STD-1472 (O)
Form Factor/Size Limits: Must physically clear a 51.5 in (W) x 64.5 in (H) shelter door Modular, compact footprint (e.g., =/+ 30 in x 30 in base) (T = O)
Electrical Power Input: =/+ 3.4 kW, 120 VAC (single-phase, 50-60 Hz, max 25-Amp draw) (T): =/+ 3 kW, 120 VAC (single-phase) AND/OR 28V DC (Tactical Vehicle Integration) (O)
Operational Temperature: 40°F to +90°F (-32°C to +49°C) (T); -40°F to +140°F (-40°C to +60°C) (O)
Operational Humidity: Operable in 0% to 95% Relative Humidity (RH) (T); Operable in up to 100% RH (condensing) (O)

Proposals shall clearly identify the selected nitrogen generation approach, provide a credible technical basis for meeting the target performance parameters (particularly regarding thermal/moisture management and weight reduction), demonstrate awareness of the state of the art, and demonstrate that the effort is achievable within SBIR Phase I and Phase II timelines.

PHASE I: Define and develop a conceptual approach to portable high-pressure nitrogen generation that meaningfully advances beyond the current state of the art, with particular emphasis on achieving significant weight reduction (via modularity), self-contained air compression, and thermal/moisture management in expeditionary environments. Determine the technical feasibility of the conceptualized man-portable, self-contained nitrogen generator.

Perform modeling and simulation to predict prototype device performance against the parameters defined in the Description. Develop engineering approaches to address key technical challenges, including modular enclosure design to meet MIL-STD-1472 lift limits, high-efficiency nitrogen separation (e.g., advanced membranes or PSA sorbents) at reduced power input, and intelligent power management to ensure seamless integration with the Joint Light Tactical Vehicle (JLTV) Expeditionary Maintenance

Shelter (JEMS) Power Entry Panel. Identify and assess critical technical risks associated with the proposed approach and define mitigation strategies.

Deliver the following required Phase I deliverables: a final technical report documenting the proposed conceptual design, modeling and simulation results, technology trade space analysis, technical risk assessment, and a recommended path forward for Phase II prototype device development.

PHASE II: Based on the conceptual design, modeling and simulation results, and technical feasibility findings from Phase I, design, fabricate, and validate a prototype man-portable, self-contained, energy-efficient portable nitrogen generator capable of producing high-purity nitrogen (=/- 99.5%) at up to 3,500 pounds per square inch (PSI) output pressure on 120-volt, 25-Amp single-phase electrical power in support of United States Marine Corps (USMC) expeditionary maintenance operations.

Demonstrate and validate the prototype device against the performance parameters defined in the Description, with particular emphasis on modularity to meet MIL-STD-1472 two-person lift limits, single-phase power consumption, output pressure range, nitrogen purity, and operational flow rate in high heat and high humidity environments. To guide prototype development and ensure suitability for long-duration expeditionary deployments, the prototype design should target a Mean Time Between Failure (MTBF) of no less than 1,000 operating hours, and scheduled preventive maintenance intervals (e.g., filter or seal replacements) of no less than 250 operating hours Fabricate and validate the prototype device through laboratory testing and, where feasible, demonstration in a tactically representative expeditionary environment in coordination with USMC end-user representatives.

Develop and validate the manufacturability process for the prototype device, identify critical components and supply chain considerations, and produce a Phase III transition plan identifying the target acquisition program, production pathway, and dual-use commercialization strategy.

Deliver the following required Phase II deliverables: a functional prototype device, a comprehensive test and evaluation report documenting measured performance against Threshold and Objective parameters defined in the Description, and a Phase III transition plan.

PHASE III DUAL USE APPLICATIONS: The expected final state of this technology is a fully validated, production-ready, man-portable expeditionary nitrogen generator. Upon successful completion of Phase II, support Phase III transition of the prototype device to the Product Manager Maintenance Support Systems (PdM MSS), under Program Manager Combat Support Systems (PM CSS) at Marine Corps Systems Command (MCSC). Assist with formal integration of the nitrogen generator into the Tool Sets and Kits Program of Record as a direct replacement for the legacy High-Pressure Deployable (HPCD) system.

In addition to the primary military transition path, the new nitrogen generator has substantial commercialization potential. A lightweight, 120V single-phase, high-pressure (3,500 PSI) nitrogen generator that does not require heavy industrial power or external air compressors has direct applicability in several commercial sectors, including remote commercial aviation maintenance (e.g., servicing landing gear struts and tires at austere airstrips), the automotive and off-road racing industry for high-performance shock absorber tuning, and remote heavy industry such as mining, agriculture, and oil/gas exploration, where transporting heavy, pre-filled nitrogen cylinders is costly and logistically prohibitive.

REFERENCES:

1. “Commercial Item Description (CID) A-A-59503E: Nitrogen, Technical (4 June 2025).” https://everyspec.com/COMML_ITEM_DESC/A-A-59000_A-A-59999/A-A-59503_31795/

2. “MIL-STD-1472H: Department of Defense Design Criteria Standard, Human Engineering (15 Sep 2020).” https://everyspec.com/MIL-STD/MIL-STD-1400-1499/MIL-STD-1472H_57041/
3. “MIL-STD-810H: Department of Defense Test Method Standard, Environmental Engineering Considerations and Laboratory Tests (31 Jan 2019).” https://everyspec.com/MIL-STD/MIL-STD-0800-0899/MIL-STD-810H_5598/

KEYWORDS: Nitrogen; Generation; Portable; Adsorption; Gas; High-pressure; Single-phase power; Maintenance; Expeditionary

DON27BZ02-NV008 TITLE: Integrated Multi-Spectral Periscope for the Amphibious Combat Vehicle (ACV)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Computing and Software;Human-Machine Interfaces

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop and demonstrate a ruggedized, multi-spectral imaging, 360-degree-capable camera system capable of integration into Amphibious Combat Vehicle (ACV) periscopes.

DESCRIPTION: Current periscopic vision systems on Marine Corps combat vehicles are limited to daylight optical performance, over a limited Field of View (FoV), and lack the ability to integrate modern digital imaging, thermal, and night vision technologies. The new system shall provide daylight, low-light/night vision, and thermal (IR) imaging capabilities through a single, compact, and modular unit; and enhance situational awareness, target detection, and crew safety for Marines during water, transition, and land operating environments.
This SBIR topic seeks to develop an integrated camera-based periscope module that:

- Provides visible (Electro-Optical [EO]), night vision (Near-Infrared Low-Level Laser (or Light) [NIR/LLL]), and long-wave infrared (LWIR) imaging in a compact unit.
- Is retrofit-compatible with existing periscope housings used in the USMC ACV FOV, or is capable of replacing optical viewports with an electronic display module.
- Includes onboard image fusion and low-latency video output for vehicle displays and augmented-reality systems.
- Meets ruggedization standards (MIL-STD-810H, MIL-STD-461D, and EC Standard 60529, rating IP66) for temperature, shock, vibration, EMI, dust and water resistance.
- Provides hardware resistance to seawater corrosion, as tested in accordance with GMW 14872, “Exterior, Exposure D” as stated in Table A3.
- Does not result in significant weight increase over that of the standard periscope.
- Supports integration with vehicle electronics architectures, including Vehicular Integration for C4ISR/EW Interoperability (VICTORY) and NATO STANAG 4609 standards.

Novel design approaches may include:

- Digital overlay in periscope eyepieces, merging optical and sensor imagery for seamless situational awareness.
- Edge processing and SI-assisted fusion of EO/NIR/LWIR feeds to highlight threats or movement.
- Wireless or wired integration with crew display systems such as:
- Integrated Visual Augmentation System (IVAS)
- Enhanced Night Vision Goggle – Binocular (ENVG-B)
- Joint Mounted Display System (JMDS)

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and MCSC in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National

Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Design a concept for a compact, multi-spectral camera system suitable for integration into combat vehicle periscopes. (Note: The preliminary mechanical and electrical design will include a high-level architecture diagram and interface concepts for periscope integration.) Deliver a final report that includes a technical feasibility study assessing image performance, latency, durability, and interface compatibility with vehicle systems. Document the design in a performance specification and an architecture diagram to be used in Phase II to build a prototype for testing.

PHASE II: Develop, integrate, and test a prototype multi-spectral camera system. (Note: This will include engineering development of the camera, optics, and electronics to meet environmental and vehicle standards including a detailed architecture diagram. Integrate and demonstrate the camera system on a USMC ACV in coordination with PM AAA. (Note: The prototype must demonstrate interoperability with onboard display systems (IVAS, ENVG-B, JMDS, etc.) and meet the performance specification developed in Phase I.) Include in the final report a Phase III commercialization and transition plan that addresses manufacturing scalability, cost models, and potential dual-use applications.
Work in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: Support transition of the resulting camera system to Marine Corps combat platforms for integration into periscope or vision systems.
Dual-use opportunities include:

- Military Dismounted Operations, Federal and DoW Law Enforcement.
- Adaptation for ballistic shields used by the FBI, U.S. Marshals Service, Department of War, and local SWAT agencies by providing improved visibility and situational awareness.
- Armored security vehicles, border patrol systems, and maritime platforms that require all-weather visibility.

REFERENCES:

1. BAE. “ACV Spec Sheet.” https://www.baesystems.com/dam/jcr:36eb6327-a224-4f84-bc43-ab0a1914c618
2. “ACV conducting water and land operations.” https://www.youtube.com/watch?v=nw7qtudd_L0
3. National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993”. https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004
4. “MIL-STD-810H”. https://everyspec.com/MIL-STD/MIL-STD-0800-0899/download.php?spec=MIL-STD-810H.055998.pdf
5. “MIL-STD-461D”. https://everyspec.com/MIL-STD/MIL-STD-0300-0499/download.php?spec=MIL-STD-461D.019032.pdf
6. “IEC Standard 60529”. https://webstore.iec.ch/en/publication/2452
7. “GMW 14872”. https://store.accuristech.com/standards/gmw-gmw14872?product_id=2619373
8. “VICTORY v1.10”. https://govtribe.com/file/government-file/fy22c5isrcmoss-victory-spec-doc-v1-10-dist-a-approved-23-1003-dot-pdf
9. “NATO STANAG 4609” https://www.scribd.com/document/442950599/STANAG-4609-Ed3-NATO-DIGITAL-MOTION-IMAGERY-STANDARD

KEYWORDS: Periscope; Combat Vehicle, Multi-Spectral Imaging; Electro-Optical/Infrared; EO/IR; Thermal Camera; Night Vision; Sensor Fusion; Situational Awareness

DON27BZ02-NV009 TITLE: Distributed Multispectral Event-Driven Integrated Sensing and Communications

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Quantum and Battlefield Information Dominance (Q-BID)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Integrated Sensing and Cyber

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 distributed multispectral event-driven integrated sensing and communications capability that can timely provide robust detection of a wide range of objects and integrate into existing onboard sensors to expand operational battlespace.

DESCRIPTION: The Navy Aegis Program Office is interested in expanding battlespace awareness to support cross-domain operations through the integration of remote passive sensors. Currently, these sensors rely on real-time frame-based processing that generates large volumes of data, requiring significant processing power and energy and creating constraints for resource-limited hardware platforms with finite battery life, processing capabilities, and memory. In addition, transmitting large volumes of data over dynamic communication links can introduce delays and encounter bandwidth limitations that cannot meet time-critical operational needs. The complexity of the battlespace and electromagnetic environment further presents challenges for robust detection, classification, and identification. Advanced remote passive-sensor technologies that enable efficient and distributed sensing and processing will support multidomain operations by providing timely and resilient battlespace awareness. Successful technologies will be transitioned to the Aegis Combat System (ACS) to enhance distributed sensing, accelerate decision-making, and enable cross-domain operations.

The Navy is seeking to develop Multispectral Integrated Neuromorphic Sensing and Communications (MINSC) technology to support endurant remote sensing capability. MINSC is an event-driven sensor featuring low-probability-of-intercept (LPI) data transmission that can timely identify a wide range of objects and transmit the information to remote platforms to integrate into the existing decision-making process. Neuromorphic computing can provide energy efficient, parallel processing, and low-latency framework for passive sensing, edge computing, and remote inference.

Neuromorphic sensors deliver high temporal resolution, asynchronous, energy and bandwidth efficient data inspired by biological vision. The Navy seeks to build an Event-Driven Energy-Efficient Ecosystem to support Endurant Long-Range Sensing and Communications capability. Solutions can be software, neuromorphic hardware, and/or end-to-end neuromorphic system that can deliver robust information and fuse with existing sensors to provide improved tracking, detection, classification, and identification. The Navy is open to innovative ideas of novel system design that can make decisions locally and communicate sparingly or timely send out the event-driven information for remote inference. The intended capability is an integrated remote passive-sensing capability that performs event-driven local

sensing and processing, communicating only the information necessary to enhance remote awareness, and fuses with existing sensors to improve tracking, detection, classification and identification.

Distributed MINSC will provide advantages in dynamic environment and resilience to noise and debris associated with military applications. Incorporating event-based multispectral remote sensors with onboard sensors will expand operational battlespace, contribute to robust Common Operational Picture (COP) and enhance situational awareness. It will integrate with the Aegis and permit realistic testing of all threat types and configurations in a dynamic testing environment. Track visualization will be delivered through the existing ACS console Graphical User Interfaces (GUIs). The solution will support current operator track management and decision-making and integrate with the AEGIS Test Bed (ATB) to facilitate system evaluation against more advanced threats. The solution will provide an enhanced capability to address targets in all configurations and optimal engagement options to the sailors, which will increase mission capability and effectiveness against the latest threats.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and PAE MS in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Develop a design concept for MINSC technology for remote, instant, and robust reporting of objects of interest. Demonstrate the feasibility in meeting the requirements in the Description to support the tests and operational environments. Establish feasibility through analysis and modeling. Consider Design for Manufacturing (DFM) framework in the hardware design to simplify production processes throughout the design phase, ensuring design aligns with manufacturing standards. The Phase I Option, if exercised, will include the initial design specifications and capabilities description to build a prototype solution in Phase II.

PHASE II: Develop and deliver a MINSC prototype based on the results of Phase I. Ensure that the hardware prototype includes firmware and detailed interface specifications to support tests and evaluation in a Government Lab. Support evaluation of the prototype through lab testing, analytical methods, modeling, and simulation (if a simulation model is provided). For software prototype provide an emulator or hardware to demonstrate the technology to be evaluated by Government subject matter experts for validation. Deliver two prototypes at the end of Phase II. Provide a Phase III commercialization/transition plan.

It is probable that the work under this effort will be classified under Phase II (see the Description for details).

PHASE III DUAL USE APPLICATIONS: Support the Navy in transitioning the prototype to allow for further experimentation and refinement for Navy uses. Incorporate the prototype into the AEGIS baseline testing modernization process and/or incorporated into Electronic Support Measures (ESM) in the SEWIP program to include integration into a baseline definition and incorporation of the baselines existing and new threat capabilities, validation, and combat system certification.

Integrated Neuromorphic Sensing and Communications will have applications in FutureG, Autonomous Vehicles, IoT, Surveillance, Robotics and Automation, Wearable Electronics, and Healthcare.

REFERENCES:

1. López-Randulfe, Javier, et.al. “Spiking Neural Network for Fourier Transform and Object Detection for Automotive Radar.” Frontiers in Neurorobotics, Volume 15, June 2021: Article 688344. https://www.frontiersin.org/journals/neurorobotics/articles/10.3389/fnbot.2021.688344/full
2. Lee, Jihun, et.al. “An asynchronous wireless network for capturing event-driven data from large populations of autonomous sensors.” Nature Electronics, Volume 7, May 2024: pp. 313-324. https://www.nature.com/articles/s41928-024-01134-y
3. Skatchkovsky, Nicolas; Jang, Hyeryung and Simeone, Osvaldo. “End-to-End Learning of Neuromorphic Wireless Systems for Low-Power Edge Artificial Intelligence.” The 54th Asilomar Conference on Signals, Systems, and Computers, November 2020. https://ieeexplore.ieee.org/document/9443351
4. Chen, Jiechen; Skatchkovsky, Nicolas and Simeone, Osvaldo. “Neuromorphic Wireless Cognition: Event-Driven Semantic Communications for Remote Inference.” IEEE Transactions on Cognitive Communications and Networking, Volume 9, Issue 2, April 2023: pp. 252-265. https://ieeexplore.ieee.org/document/10016643
5. Chen, Jiechen, et.al. “Neuromorphic Split Computing With Wake-Up Radios: Architecture and Design via Digital Twinning.” IEEE Transactions on Signal Processing, Volume 72, October 2024: pp. 4635-4650. https://ieeexplore.ieee.org/document/10682971
6. “National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993.” https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: Neuromorphic Sensors; Neuromorphic Computing; Passive Sensors; Distributed Sensing; Edge Computing; Remote Inference; Remote Sensing

DON27BZ02-NV010 TITLE: Automated Hardening for Cyber Secure Operating Systems

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Applied Artificial Intelligence (AAI)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Computing and Software;Sustainment;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop an automated tool to cyber harden various platform instantiations built on a Linux operating system.

DESCRIPTION: Navy platforms have computing devices that drive their operational capabilities, especially autonomous or unmanned systems. Many platforms such as autonomous vehicles have some version and distribution of Linux as their operating system (OS) as well as an application running on it. Providing cybersecurity to these platforms is not only challenging due to their complexities but also very time consuming from a manpower perspective. This workload includes analyzing all levels of software (to include the OS) and configuring them to make them more secure as well as other cyber hardening operations such as software debloating to remove unnecessary functionality. The Navy has many platforms so each would require its own analysis and hardening. There are various means for improving the cybersecurity posture of the platform, each either manual or with its own tool, which creates undue burden on the developer of the platform for hardening without missing certain security features.
The focus of this SBIR effort is strictly on the OS, in this case Linux. The tool should determine the Linux OS functionality actually required by a specific platform instantiation, remove unnecessary OS components and functionality, and configure the remaining Linux OS to improve cybersecurity posture while preserving required system functionality. The goal is to create an automated tool that analyzes the various specifications, configurations, applications, etc. to harden the cybersecurity posture of the underlying Linux OS. The performer should propose their own platform, preferably either a commercial off-the-shelf (COTS) or open source platform that has a Linux OS and use this for design and experimentation on how to automate the cyber hardening of just the OS. It is preferred that the device be some type of autonomous vehicle. The performer will produce an overall software architecture for the automated OS hardening tool as well as a demonstration of the conceptual capability in Phase I while Phase II will involve development of a prototype in cooperation/guidance with Navy personnel. Metrics to demonstrate the improvements from the automated tool should be provided in the proposal.

PHASE I: Determine a conceptual software architecture for an automated cyber hardening tool for the Linux OS. Ensure that this tool will (1) leverage available runtime information for an existing system to identify the minimal set of OS functionality required for system functionality and (2) then recommend and/or configure the OS, removing unnecessary OS components and functionality and add/or configure recommended security features/functionality. At the conclusion of Phase I, present the proposed software architecture (i.e., the tool's design and specification of functionality) and a demonstration on a representative platform (e.g., COTS or open-source autonomous platform) that shows improvement in cybersecurity posture (e.g., code analysis, pen testing, etc.). Tools will be compared on cybersecurity OS hardening completeness and approach (i.e., architecture) for ingesting various sources to automate the tool's execution.

PHASE II: Develop a functional prototype of the automated tool. Interact with Navy personnel who own a platform and who will provide guidance and experimentation against the prototype OS cyber hardening tool. In conjunction with the Navy, devise, develop, and implement means for verifying the automated OS cyber hardening. Demonstrate that the tool can automatically ingest data sources (e.g., specifications, test plans, other hardening tools capabilities, etc.), and harden and minimalize the Linux OS footprint on the

Navy platform. (Note: Navy personnel will examine metrics such as code reduction in the Linux OS, configurations, debloating, code analysis, and pen testing results to measure the effectiveness of the automated OS hardening.) Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Support the transition to Navy use.
Many commercial platforms leverage the Linux OS (e.g., IoT and Smart Home technology). The manufacturers of those devices often implement them on Linux and also need cyber hardening.

REFERENCES:

1. "Engineering Trustworthy Secure Systems, NIST SP 800-160 Vol. 1 Rev. 1." https://csrc.nist.gov/pubs/sp/800/160/v1/r1/final
2. Brown, Michael D. and Meily, Adam. "Trail of Bits"; Fairservice, Brian; Sood, Akshay and Dorn, Jonathan. "GrammaTech"; Kilmer, Eric and Eytchison, Ronald, "Trail of Bits." "A Broad Comparative Evaluation of Software Debloating Tools". 33rd USENIX Security Symposium. https://www.usenix.org/conference/usenixsecurity24/presentation/brown

KEYWORDS: Cybersecurity; Operating System; OS; cyber hardening; Automation; Zero-Trust

DON27BZ02-NV011 TITLE: Low-cost Mid-wave Infrared Focal-Plane Array (FPA) Fabrication through Direct-bond Interconnection

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Quantum and Battlefield Information Dominance (Q-BID)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Integrated Sensing and Cyber;Microelectronics

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 focal-plane array (FPA) fabrication process based on wafer-scale 3D-heterogeneous integration that enables a mid-wave infrared (MWIR) III-V detector epi-layer wafer to be directly bonded to a Silicon-based read-out integrated circuit (Si-ROIC) wafer, thereby eliminating the inefficient die-level Indium (In) bump-bonding process currently required to assemble Mid-wave Infrared (MWIR) FPA sensor chips.

DESCRIPTION: Electro-Optic and Infrared (EO/IR) sensors are used in a wide variety of applications, such as navigation, wide-area surveillance, and targeting. Operating in the visible and near-IR bands, EO sensors are available with small pixels and in large arrays at low cost, because the Si-detector wafer and Si-ROIC wafer can be 3D-integrated directly through wafer-to-wafer bonding with high yield at high volume based on material and complementary metal-oxide-semiconductor (CMOS)-process compatibility. By contrast, sensors operating in the MWIR employ III-V detector materials, which are not CMOS-process compatible, while III-V epi-layer detectors cannot be epitaxially grown directly on Si, as required to produce the crystalline order of high-quality detectors [Refs 1-2]. Instead, the III-V detector epi-layer is grown on a lattice-compatible substrate wafer, which is then flip-chip bonded to a Si-ROIC through a dense array of sub-pixel indium bumps placed on each wafer, followed by detector-substrate removal. The technically demanding process of depositing, aligning, and compressing the dense arrays of indium bumps on detector and ROIC die, results in a labor-intensive, inefficient, low-yield process for IR FPA fabrication, which greatly increases cost.

In recent years, 3D-heterogeneous integration has enabled a single integrated chip of greater overall functionality to be realized at reduced cost by assembling multiple smaller chips, each having unique functionality, material, node size, and/or foundry origin. Direct-bond interconnection (DBI) [Refs 3-5] is a 3D-heterogeneous integration technique that can potentially enable low-cost MWIR FPA fabrication. In principle, DBI should enable very large format FPAs with small pixels to be fabricated, as the process is largely independent of wafer and pixel size, in contrast to conventional bump-bonding. Moreover, the DBI process utilizes a temperature range that is compatible with MWIR IR detector materials.
The goal of this SBIR topic is to demonstrate the use of DBI or a similar process for fabrication of high-performance, large format, small-pixel, MWIR FPAs at low cost with the objective of refining the technique sufficiently to potentially replace conventional bump-bonding.

PHASE I: Plan a detailed concept for a FPA fabrication and characterization process, including a risk assessment. While the pixel unit cell design is flexible, a pixel size of less than or equal to 10 micro-meters (um) and format of at least 2K x 2K are required, but otherwise any existing or commercially available Si-based ROIC can potentially be used for this effort. The III-V detector epi-layer spectral response must cover at least the MWIR band (3-5 um). The specific foundry and fabrication process steps will be determined in Phase I. Develop a detailed FPA characterization plan, including measurement of inter-wafer voids, pixel operability, and yield. Perform a per-FPA cost analysis that compares DBI or the selected alternative process to conventional bump-bonding and includes an assessment of the cost impact of process selection trade-offs.

PHASE II: Use the DBI or selected alternative process to fabricate multiple wafers of FPAs having less or equal to 10 um pixels and greater than or equal to 2K x 2K format. Dice and thoroughly characterize the FPAs. Integrate one or more FPA sensor chips into an imaging system and subsequent optical performance characterization (favorable but is not required under this effort.) Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Build and test an imaging sensor employing a DBI-fabricated FPA with available Phase III funding upon successful completion of Phase II.

The advancement of MWIR imagers could support many dual-use applications, such as border security, law enforcement, and industrial process monitoring. In general, the advancement of 3D-HI and DBI specifically could facilitate the development of novel micro-electronic devices beyond MWIR imagers.

REFERENCES:

1. Rogalski, A. "Recent progress in infrared detector technologies." Infrared Physics & Technology, 54(3), 2011, pp. 136-154. https://www.scirp.org/reference/referencepapers?referenceid=838480
2. Martyniuk, P. and Rogalski, A. "HOT infrared photodetectors." Opto-Electronics Review, 21(2), 2013, pp. 239-257. https://www.researchgate.net/publication/257909096_HOT_infrared_photodetectors
3. US Patent 9,082,627: Method for low temperature bonding and bonded structure (covers the core process of room or low-temperature dielectric-to-dielectric and metal-to-metal bonding). https://patents.google.com/patent/US9082627B2/zh
4. US Patent 6,962,835: Method for room temperature metal direct bonding. https://patents.google.com/patent/US6962835B2
5. US Patent 9,391,143: Method for low temperature bonding and bonded structure. https://patents.google.com/patent/US9391143B2

KEYWORDS: Focal plane array, FPA, direct-bond interconnection, DBI, 3D heterogeneous integration, 3D HI, infrared imaging, IR, semiconductor processing, read out integrated circuit, ROIC, sensor chip assembly, SCA, mid-wave infrared, MWIR, IR detector materials

DON27BZ02-NV012 TITLE: “Self-Replicating Evolutionary Agentic SI Swarming Force” with Autonomous Embedded SI Guardrail Enforcers

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Applied Artificial Intelligence (AAI)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Integrated Network Systems-of-Systems;Integrated Sensing and Cyber;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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- Develop a platform agnostic fully autonomous Agentic SI swarm system suitable for multidomain naval operations (i.e., Sea, Air, Space, Land, and Cyber) with self-awareness for rapid operationally scalable response, namely “hyper-scalability”. The Agentic SI system, a hybrid-evolutionary SI, must self-replicate and self-deploy. In other words, it must self-evolve as it gets feedback from its internal SI agents; it must coevolve as it interacts with the environment and the adversary to adapt and survive in littoral ecosystem without human guidance. As a team, it must autonomously reason to scale-up or scale-down its swarming clusters to generate tactical sub-clusters or end-game sub-clusters for defensive and offensive measures to confront and overwhelm threats. Neuro-Symbolic SI is to be a practical method for these SI-based swarm agents to explore and exploit the conditions in the operational ecosystem.

2- The developed platform must strictly adhere to operational policies, safety, and security with embedded SI agents serving as guardrails to control all sustaining SI agents (i.e., Self-Evolving SI agents) by checking outputs, cross-referencing data feeds and plans, and correcting flagged responses. These SI-enabled Guardrail-Enforcers must be active and adaptive systems embedded into the Agentic SI Swarm workflows. The embedded SI Guardrail-Enforcers validate-and-verify policies for additional safety and behavior guardrail checks beyond the ordinary trust metrics. The important performance question is “Did Agentic SI system get better without changing policy permissions, safety boundaries, or behavior unpredictably?”

DESCRIPTION: This SBIR topic seeks hardware-agnostic Agentic SI swarm-teaming technologies capable of self-replication, hybrid-evolution (self-evolution and coevolution), and self-organization into teaming many arrangements. It is important to note that this project does not challenge the importance of physical platforms/machines (i.e., unmanned assets) that have physical presence in operational environments. The envisioned Agentic SI system is the machine’s intelligent autonomy software that controls the platform’s presence and its interactions with entities in the operational environment. It autonomously configures individual swarms with unique missions and networks of collaborative swarms operating in multiple operational domains with specific teaming assignments.

The envisioned swarm system is agentic as it pursues goals autonomously. It interprets assigned mission objectives and determines how to achieve them. It knows how to process, fuse, and exploit all source intelligence (ASI) and live sensor feeds to determine the course of action (CoA) and keeps adjusting it

until the outcome is reached. It decides which payloads to use and when to use them, for example, active and/or passive intelligence, surveillance, reconnaissance, and targeting (ISRT) sensors, point-to-point or omni-broadcast communication, or weapon systems, etc. It adapts when situations or environmental conditions change, or certain aspects of a plan fail. It can recover from various system failures and processing errors. It is designed with embedded SI-Guardrail-Enforcers to manage, validate, and verify every aspect of the Agentic SI system's performance and associated risks to ensure that the end-to-end system adheres to established policies set forth by the Department of War and the U.S. Navy including operational safety requirements as well as the national security doctrines and mandates. The highest priority for this program is to establish ZERO tolerance for SI-generated rogue populations of unaligned agents rapidly and uncontrollably increase.

The hybrid-evolutionary aspect of the Agentic SI system focuses on attaining new operational proficiency and know-how to execute emerging missions with the highest accuracy, persistence, and endurance. The self-evolving SI system monitors endogenous performance of all subsystems, gets feedback, and improves its own internal design configuration autonomously, for example, altering or generating new internal models. The coevolutionary SI system monitors exogenous performance interactions and coevolves the internal design in response to interactions with the environment and adversaries. It improves autonomous teaming performance interactions and reconfigurations, for example, altering or generating new swarming models, plans, and configurations to maintain operational tempo.
The self-replication aims to create autonomous, self-improving agents capable of independent survival and expansion. This Agentic SI system autonomously improves itself, creates its own successors, and builds specialized sub-agents to solve operational issues.

The self-configuring aspect of the Agentic SI system focuses on a variety of mission-focused collaborative teaming arrangements, including scouting teams for early detection of indications and warning signs to ensure survival, trip-wire teams to detect encroaching threats, ad-hoc networking teams for continuous collaboration and tracking threats, a self-defense team for fault-tolerant operations, and offensive teams to ensure survival. In aggregate, these teams form an Agentic-Force that self-adapts, self-organizes, and self-heals.

The Agentic SI Swarming-Force addresses mission capability gaps that require agile adaptation to novel adversarial TTPs and unanticipated asymmetric countermeasures. The envisioned SI capability requires SI-based evolutionary modelling techniques for learning, reasoning, recognition, and autonomous decision-making to counter emergent and/or unanticipated observable patterns of life activities or events. In other words, agentic discovery of unknown-unknown events/assets posed by the intelligent adversaries. It ensures the timely execution of CoA plans to neutralize emerging threats, including asymmetric attacks, novel deployment of joint civilian and military assets, cloaked military assets, decoys, and deceptive asset deployments. A representative set of agentic impelling operations may be conducted overtly or covertly to influence hostile forces to undertake desired actions, including adopting specific courses of action or modifying their pattern of life to safeguard critical assets through reconfiguration, relocation, or repurposing. These observable responses can then be exploited by the Agentic SI Swarming Force to degrade adversarial autonomy and disrupt, reshape, and ultimately defeat their operational plans and tactical engagements.

A notional framework for developing the required critical technologies is as follows. First, meta-learning and meta-reasoning capabilities—learning how to learn and reason—are foundational. Rather than relying on static training, agents continuously refine their internal learning processes to autonomously adapt to new tasks and conditions. This allows the system to create specialized sub-agents for various operational tasks and teaches them optimal strategies. Second, replication logic creates next-generation agents to improve operational efficiency, reduce false-alarm rates, and field additional task-organized agents to address emergent or previously unanticipated requirements. Third, autonomous resource management

mechanisms must dynamically replicate, allocate, sustain, scale, or retire agents to maintain operational efficiency and mission alignment. Finally, secure, low-probability-of-intercept/low-probability-of-detection (LPI/LPD) ad hoc networking and communications are essential to enable mission-focused teaming, decentralized coordination, and Reachback to share operational insights across agent networks beyond local clusters. Critical SI technology components and developments are as follows:

- Self-reflecting Agentic SI system to provide: 1) an introspection feedback loop to enable the Agentic SI system to analyze its own plan, spot errors or weak reasoning logic, and revise them before acting, which would make the system better at goal-seeking and improve its strategy; and 2) a retrospection feedback loop to enable the Agentic SI system to analyze its past plans, decisions, and resulting outcomes. Spot and learn from both the advantages and the shortcomings of those past decision processes to improve future planning and reasoning logic.
- Identification of novel and evolutionary behaviors appearing in a new generation of SI-agent models.
- Methodology to specify how self-replication and coevolutionary processes are initiated and developed, strategic life-cycle planning, resource acquisition for autonomous self-replication, and survival tactics that exploit operational ecosystem.
- Contextual modeling: relational, spatial, logic-based, uncertainty, and hybrid context modeling.
- Meta learning: decision tree and multilayer perception classifiers, collaborative filtering, pattern mining, deep learning.
- Spatiotemporal synchronization methods for multimodal data across decentralized architectures.
- Multimodal contextual signal processing and fusion.
- Cross-domain contextual collaborative learning, inference, and recognition.
- Meta reasoning, contextual reasoning, and risk assessment and reduction.
- Contextual priority-based task management balancing operational objectives such as persistence, endurance, and collections.

The scope of the initial feasibility study and deliverables are as follows: a) define the challenge problem that will likely meet the benchmark performance metrics; b) review a set of candidate Agentic SI methods and data requirements; c) develop a low-cost initial proof-of-concept prototype for the assessment; d) evaluate feasibility against measurable criteria; and e) deliver a proposed Phase II prototype development plan including technical risk reduction criteria and next steps.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Determine the technical feasibility of designing and developing the Agentic SI Swarm technology as explained in the Description. Draw key distinctions for the proposed design approach compared to the current state-of-the-art naval ISRT information exploitation cycles. Ensure that the proposed design concept must clearly define the steps that naval ISRT platforms and joint services can capitalize on for transformational SI-assisted ISRT and engagement operations with dominant applications within the next five years. Motivate the design with a compelling challenge problem supported by relevant datasets. Consider a challenge problem that corresponds to cross-domain littoral

operations and navigational risks associated with hostile anti-access/denied-access enforcement scenario that considers seaside terrain, weather, the maritime order of battle and maneuvers; engagement rules and doctrine; logistics and supply demands, etc. Hostile enforcement may include hypersonic missiles, ballistic missile attacks, sea-skimming cruise missile attacks, anti-submarine track and trail, torpedo attacks, littoral mining, and swarming weapons. Testing and demonstrations may use a mix of open-source intelligence (OSINT) datasets, synthetic datasets from DON, MCML, AIS maritime traffic, commercial satellite imagery, or similar sources. Conduct Agentic SI Swarming performance assessment, including cause and effect sensitivity analysis on contextual understanding; confidence rate on SI-generated engagement plans, options, and risk reduction associated with the ups and downs of encounters; confidence rate on SI-risk escalation controls enabling trust decisions across the integrated chain-of-command; efficiency gains in human responsiveness through timely decision-making, chain-of-actions, and resources spent.

Performance metrics for Agentic SI system in a controlled test environment are as follows: task success and completion rates: 90%+; goal attainment rate: 90%+; tool selection accuracy: 95%+; plan adherence: 90%+; hallucination rate: under 2%; safety violation rate: 0% in policy tests (any policy-breaking action is a hard fail); prompt-injection resistance: 95%+ success against red-team prompts (measure on adversarial test sets); human override rate: < 5% on routine tasks; recovery rate: 80%+; end-to-end latency: under 60 seconds for interactive flows; replication success rate: 100% only when explicitly authorized.
Policy, safety, and security performance metrics that are controlled by the embedded SI Guardrail-Enforcers are as follows:

- For self-replicating Agentic SI system to ensure the system can perform useful work without uncontrolled replication, drift, or excessive human intervention. In other words, it must replicate when authorized, and never on its own outside policy. The performance metrics include goal attainment rate: 90%+; tool selection accuracy (i.e., preventing cascading failures from bad tool use): 95%+; hallucination rate: under 2%; human override rate: under 5%; recovery rate: 80%+; boundary violation rate: 0%; and Uncontrolled replication rate: 0%.
- For Hybrid-evolving Agentic SI system, the performance metrics include improvement gains: greater than 20% (self-evolution should improve performance on unchanged tasks); regression rate: less than 5% on core tasks (new versions should not break stable capabilities); reproducibility (evolved behavior must remain traceable and can be validated): 95%+; and Drift from policy, safety, and security: 0% -- self-evolution cannot change the operational constraint envelope.

Assess the feasibility of applying the Agentic SI methods to a candidate challenge problem. Perform requirements analysis, data and interface assessment, evaluation of candidate SI approaches, and development of a limited proof of concept to determine technical viability. Produce a feasibility report, preliminary architecture, risk assessments, and a proposed Phase II prototype development plan.

PHASE II: Conduct proof-of-concept and prototype development incorporating the recommended candidate technology from Phase I. Demonstrate the operational effectiveness based on the following criteria: (a) prioritized sensor alerts, (b) prioritized threat escalation, (c) measured severity of events, and (d) measured analytic completeness. Test and demonstrate the improved capability based on the performance metrics detailed for Phase I. Provide analytics, SI tools, models, prototypes, T&E and demonstration results, and interface requirements. Develop a final report to include a detailed design of the system and a plan for transition to the program of record in Phase III.

Work in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: Advance these capabilities to TRL-7 and integrate the technology into the Maritime Tactical Command and Control POR, Marine Air-Ground Task Force Command and Control, or ISR processing platforms at the Marine Corps Information Operations Center. Once conceptually and technically validated, demonstrate dual-use applications of this technology in civilian law enforcement and security services.

REFERENCES:

1. Finn, C.; Abbeel, P. and Levine, S. "Model-Agnostic Meta-Learning for Fast Adaptation of Deep Networks." IEEE Internet of Things Journal Vol: 5 (Issue: 1), November 2017, pp. 1-27. https://arxiv.org/abs/1703.03400
2. Huisman, M.; van Rijn, J.N. and Plaat, A. "A survey of deep meta learning." Artificial Intelligence Review, April 2021. https://arvix.org/2010.03522
3. Wang, S.; Chen, K.; Yu, M.; Zhao, P. and Duan, H. "Multimodal meta-adaptive reasoning network with dynamic causal modeling and co-evolution of quantum states." Scientific Reports, July 2025, pp 1-19. https://www.nature.com/articles/s41598-025-1127-x
4. Breeden, Joseph L. "The evolution of goals in AI agents." Springer, Published online: March 2025. https://link.springer.com/article/10.1007/s43681-025-00691-y
5. Wang, X.; Feng, T.; Liu, H. and Zhu, W. "Autonomous Embodied AI, Towards Self-evolving Intelligence", Springer, 2026. https://springer.com/book/10.1007/978-981-95-7750-7
6. "National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993". https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: Self-Replicating; Hybrid-Evolutionary; Self-Evolving; Coevolving; Agentic; SI; Swarm; Autonomous; Guardrail; Enforcers

DON27BZ02-NV013 TITLE: Electro-Optical/Infrared Tactical Decision Aid

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Scaled Directed Energy (SCADE)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Computing and Software;Human-Machine Interfaces;Integrated Sensing and Cyber

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 Electro-Optical/Infrared (EO/IR) Tactical Decision Aid (TDA) for surface and air sensors in maritime, littoral, and inland environments.

DESCRIPTION: The United States Navy (USN) requires the capability to rapidly predict the performance of sensors that depend on the propagation of electro-optical/infrared (EO/IR) radiation (i.e., wavelengths from 0.4 to 12 micron) in air. Sensor performance is subject to environmental/meteorologic conditions, as well as sensor, platform, background/clutter, and target characteristics. For a given sensor on a platform and a target in background/clutter, a forecaster should be able to determine key performance metrics; for example, maximum detection range based on the forecasted meteorological conditions. In this way, USN commanders can make tactical decisions based on the predicted sensor performance given ambient/forecast weather conditions. Key modeling components within a TDA include the land/maritime surface background, target signature, radiative transfer, and sensor performance models. These models are often interdependent, requiring feedback between them (e.g., radiative transfer between target and background models is needed to compute the contrast of the target in the background, which then feeds into a sensor performance model).

Target Acquisition Weapons Software (TAWS), a successor to Electro-Optic Tactical Decision Aid (EOTDA), was originally developed by the Air Force Research Laboratory (AFRL) and released in 1998. Later a target scene model improvement for selected high-resolution targets was implemented with Multi-Service Electro-optics Signature (MuSES). The USN is looking for an innovative and accurate EO/IR TDA, which would be an alternative/improvement to TAWS. Improvements could include support for three dimensional meteorological inputs. The primary challenge for implementing an EO/IR TDA is the methodical verification and validation (V&V) of the constituent models and submodels being developed. This SBIR topic seeks innovative solutions to the development of an EO/IR TDA with particular focus on the methods proposed to verify and validate developed models. A list of prior V&V efforts on proposed submodels should be made clear in the responses to this solicitation, as well as the proposed means/methods to conduct V&V under a Phase II and/or Phase III.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or

subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Develop a concept for an EO/IR TDA model architecture and verify the radiative transfer model can solve basic thermal transport problems (e.g., conduction, convection, radiation) with analytic solutions. Ensure facets/grid points can be individually sampled to provide their temperature and spectral radiance. Create a land/sea background model where spatiotemporally varying clutter can be added in Phase II. Create a CUBI thermal target model and a generic, band-selectable imaging sensor (e.g., 3-5 micron midwave IR (MWIR) imager) model.

PHASE II: Implement the EO/IR TDA model into a working prototype and ensure support for a wide range of generic representative targets (e.g., car, truck, ship, boat, plane, unmanned aerial system (UAS)) and a wide range of generic representative sensors (e.g., 0.4-0.7 micron visual band imager, 1.06 micron laser designator, 0.9-1.7 micron shortwave IR (SWIR) imager, 3-5 micron MWIR imager, 8-12 micron longwave IR (LWIR) imager). Develop and add specific target and sensor models, some of which will be provided by the government and might be classified. Add representative spatiotemporally varying clutter in the scene and validate the background/clutter model against prior field data collections. Validate the radiative transfer model with a complex thermal transport experiment using a CUBI target in the laboratory. Prepare a Phase III commercialization/transition plan.

Work in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: Develop and add other specific target and sensor models, some of which will be provided by the government and might be classified. Validate the EO/IR TDA using previously collected field data. Design and execute an experimental validation of the EO/IR TDA using state-of-the art meteorological sensors and scientific grade (or better) thermal imagers, as well as a representative target and sensor to test the capability to determine sensor performance (e.g., maximum detection range).

REFERENCES:

1. Koch, C.A. “Operational Evaluation of the Electro-Optic Tactical Decision Aid, Version 3.1.” DTIC ADA335052, 01 Feb 1997. https://apps.dtic.mil/sti/citations/ADA335052
2. Hernandez, J.H. “Operational Assessment of Target Acquisition Weapons Software (TAWS) Prediction Performance at Nellis AFB, NV.” DTIC ADA445423, 01 Feb 2006. https://apps.dtic.mil/sti/citations/ADA445423
3. Thelen, J.C. “Sensitivities and uncertainties in predicting thermal contrast between a target and a background.” Proc. SPIE 12109, Thermosense: Thermal Infrared Applications XLIV, 121090M, 27 May 2022. https://doi.org/10.1117/12.2618772
4. “National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993.” https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: Electro-Optical; Infrared; Modeling; Simulation; Propagation; Sensor; Target; Weather; Verification; Validation

DON27BZ02-NV014 TITLE: Autonomous Multi-Intelligence Acoustic Reasoning Agent for Anti-Submarine Warfare

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Applied Artificial Intelligence (AAI)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop an autonomous Anti-Submarine Warfare (ASW) reasoning agent that fuses passive and active acoustic detections with non-acoustic maritime situational data, environmental acoustic propagation context, and platform/target behavior models to produce explainable contact assessments, track hypotheses, and recommended sensor-tasking actions; and supports deployment on an Unmanned Surface Vehicle (USV) with constrained communications, power, and computing conditions.

DESCRIPTION: The Department of the Navy (DON) seeks development of an autonomous decision-support and reasoning capability for ASW that can reduce dependence on continuous human interpretation of complex acoustic displays and enable future distributed unmanned ASW operations. Current ASW performance is heavily dependent on trained operators who interpret passive narrowband, passive broadband, Demodulation of Noise (DEMON), and other acoustic products while simultaneously incorporating situational knowledge such as geography, bathymetry, Conductivity Temperature and Depth (CTD) data for sound-speed structure, Global Positioning System (GPS), Automatic Identification System (AIS), organic/non-organic tracks, surface traffic, tactical geometry, and expected target behaviors. This human fusion process is effective but difficult to scale across persistent unmanned systems operating at range, under intermittent communications, and in acoustically cluttered environments.

This SBIR topic requests development of an autonomous ASW agent that can ingest heterogeneous acoustic detections and associated confidence measures, correlate them with non-acoustic common operating picture data, reason over environmental acoustic propagation, and maintain multiple explainable track and classification hypotheses over time. The capability should explicitly account for confusers such as merchant shipping, fishing vessels, biologics, own-force and friendly surface ship contributions, reverberation/clutter, and geographically-dependent propagation effects. The resulting system should not be a single-sensor classifier only; it should demonstrate multi-source temporal reasoning that can explain why a contact is assessed as likely submarine, non-submarine, ambiguous, or requiring additional sensing. The approach should be modular and compatible with Navy acoustic processing and performance-prediction workflows, while allowing Navy-provided threat behavior models, environmental data, and acoustic feature streams to be incorporated without redesign. Submissions should include a description of prior sensor fusion development that will serve as a baseline for the proposed ASW fusion architecture.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National

Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Develop a concept for the proposed software architecture for an autonomous ASW reasoning agent, including data schemas for acoustic detections, Common Operation Picture (COP)/non-acoustic inputs, environmental context, target-behavior priors, uncertainty representation, and operator-interpretable explanations. Demonstrate proof-of-concept using representative or open acoustic and maritime datasets to demonstrate fusion of passive acoustic features with disparate data features. Prepare a Phase I final report that includes a performance assessment plan that quantitively assesses metrics such as track purity, false-track/alarm suppression, classification confidence calibration, explanation quality, latency, and robustness to missing/degraded inputs.

PHASE II: Develop prototype software with implementation capability that should ingest multiple acoustic modalities, correlate acoustic contacts with non-acoustic maritime tracks, maintain multiple hypotheses, and recommend sensor-tasking or unmanned maneuver options to improve classification confidence. Demonstrate the software in simulation or replay using geographically realistic bathymetry, sound-speed profiles, surface traffic, environmental noise, and target/non-target behavior profiles. Include a transition package that documents Application Programming Interfaces (APIs), modular interfaces to Navy propagation/performance-prediction tools, model-card style documentation, training/evaluation data requirements, and a plan for integration with unmanned ASW mission systems. Prepare a Phase III commercialization/transition plan.

Work and/or data used in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: Sensor fusion for acoustic clutter reduction supports seismic surveys of commercial oil prospecting and more general ocean exploration efforts in support of the ocean acoustics National Naval Responsibility. Understanding how to fuse ocean ambient sound in terms of its spatial, temporal, and frequency contributions as well as elucidating information about air and seafloor interfaces will provide a clearer picture of the undersea world where the Navy operates. Commercial dual-use applications may include maritime domain awareness, port and harbor security, offshore infrastructure monitoring, autonomous vessel operations, illegal fishing detection, environmental acoustic monitoring, and marine mammal or vessel-noise characterization.

REFERENCES:

1. DARPA Tactical Technology Office. “Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV)/Sea Hunter.” ACTUV | DARPA
2. Sur, I. et al. “Data-Driven Distributed Common Operational Picture from Heterogeneous Platforms using Multi-Agent Reinforcement Learning.” arXiv, 2024. Data-Driven Distributed Common Operational Picture from Heterogeneous Platforms using Multi-Agent Reinforcement Learning | Arxiv - DeepPaper
3. Panteli, E., Santos, P. E. and Humphrey, N. “AquaSignal: An Integrated Framework for Robust Underwater Acoustic Analysis.” arXiv, 2025. AquaSignal: An Integrated Framework for Robust Underwater Acoustic Analysis
4. Shipton, M., Denona, V., Nad, D. and Diamant, R. “ShipEcho -- An Interactive Tool for Global Mapping of Underwater Radiated Noise from Vessels.” arXiv, 2026. [2605.08194] ShipEcho -- An Interactive Tool for Global Mapping of Underwater Radiated Noise from Vessels
5. Spadon, G., Ferreira, M. D., Soares, A., and Matwin, S. “Unfolding AIS Transmission Behavior for Vessel Movement Modeling on Noisy Data Leveraging Machine Learning.” arXiv, 2022. [2202.13867] Unfolding AIS transmission behavior for vessel movement modeling on noisy data leveraging machine learning

6. Etter, P. C. “Underwater Acoustic Modeling and Simulation.” CRC Press. Underwater Acoustic Modeling and Simulation: Etter, Paul C.: 9781138054929: Amazon.com: Books
7. “ISO 18405:2017, Underwater Acoustics — Terminology Edition 1, 2027” International Organization for Standardization. ISO 18405:2017 - Underwater acoustics — Terminology
8. “National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993.” https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: autonomy, software, acoustic, senor fusion, unmanned vehicles, UxS, ocean, Anti-Submarine Warfare, ASW

DON27BZ02-NV015 TITLE: High Sensitivity Tunneling Magnetoresistive Magnetometers

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Quantum and Battlefield Information Dominance (Q-BID)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Microelectronics;Quantum Science

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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: Modernize United States capabilities to produce ultra-low size, weight, power, and cost (SWAP-C) tunneling magnetoresistive magnetometers with industry leading sensitivities.

DESCRIPTION: Many Navy systems utilize magnetometer technologies for the remote detection, localization, and classification of ferrous objects. Decades of research into different technologies including optically pumped magnetometers have provided highly sensitive technologies which meet most Navy sensitivity needs. However, higher sensitivity magnetometers also possess increased SWAP-C, which limits their applicability in many Navy applications.

Therefore, there is a direct need for highly sensitive magnetometers that are also compact, low cost, and low power to support a broader range of Navy mission requirements including one-way attack vehicles, expeditionary warfare, mine warfare, and swarming systems. Over the past 30 years, an adjacent technology known as tunneling magnetoresistance (TMR) has had drastic improvements in system sensitivities, unlocking a potential new regime of magnetometer technologies that exhibit ultra-low SWAP-C while maintaining Navy relevant sensitivities.

Design Requirements:
-Size: less than 10 mm x 10 mm per axis
-Power: less than 100 mW per axis
-Sensitivity: less than 50 pT/rt(Hz) @ 1 Hz
-Frequency Range: DC-500KHz
-Dynamic Range: -100 uT to 100 uT
-Nonlinearity over dynamic range: less than 0.1 %
-Standardized per unit electrical packaging

PHASE I: Produce a concept for single-axis TMR sensors that possess a design that satisfies the above criteria and also include a per sensor voltage-to-field calibration for confirmation by stakeholders. Provide an analysis or discussion of the potential tradeoffs in the Phase I report if the design concept cannot meet the design objectives. (Note: Justification for the prior should include comparative analysis of COTS capabilities, U.S. and International.)

PHASE II: Fabricate 6 or 9 prototype systems for evaluation and testing in a vector configuration including voltage-to-field calibration for each sensor. Demonstrate that the prototypes achieve or show

potential for meeting the design requirements and intended use applications. Conduct testing in conjunction with Navy personnel. Address both cost effectiveness and manufacturability feasibility as part of the prototype test and evaluation. Consult the appropriate acquisition program office for any additional evaluation metrics needed for Phase III. Perform potential commercialization cost analysis to estimate at production cost per unit and prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Apply the knowledge gained in Phase II to build an advanced vector TMR prototype that meets appropriate technology readiness level (TRL) metrics set by the acquisition program office. Support the Navy for test and validation of the system for certified Navy use. Develop manufacturing plans to facilitate transition to a UUV program of record.
Explore the potential to transfer these TMR sensors for potential commercial use in magnetic surveying and UXO detection.

REFERENCES:

1. TDK: “New Development Based on High-Sensitivity Nivia xMR Sensor: Measurement of Weak Magnetic Fields from Minute Areas.” https://product.tdk.com/en/techlibrary/developing/bio-sensor/migne-xmr-sensor.html

KEYWORDS: Magnetometery, Tunneling Magnetoresistance, Magnetic Anomaly Detection

DON27BZ02-NV016 TITLE: Improved Ionosphere D-region Specification for High Frequency Propagation

COMPONENT TECHNOLOGY PRIORITY AREA(S): Integrated Sensing and Cyber;Space Technology

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop tools and/or techniques to improve characterization of the D-region ionosphere sufficient for skillful ionosphere model specification and forecast over climatology and that demonstrate the impact of improved methodology on ionosphere accuracy for use by high frequency (HF) and very low frequency (VLF) signal propagation tools.

DESCRIPTION: HF and VLF skywave propagation depend on knowledge of the altitudinal structure of the ionosphere for reliable system operation. The D-region ionosphere, a region typically between 60-90 km altitude above the Earth's surface, is particularly challenging to predict with sufficient fidelity for skywave mission planning because the region is difficult to measure with in situ measurements. Remote sensing methods provide a limited dataset from which to develop detailed physical and assimilative models that can reliably produce the regional behavior on a day-to-day basis.

Operational models like the D-Region Absorption Product (D-RAP) produce maps of outage areas as a function of radio frequency (RF) to inform HF system users of anticipated degradation or blackouts due to radiation increases. These predictions primarily address HF absorption due to solar X-ray flares at low and mid-latitudes and do not address the VLF propagation use case. While solar X-ray flares are important effects with Navy relevance, the effects of flares typically only last for a few hours and occur 10-20 times a year. For sufficient use in HF absorption and VLF propagation applications, a D-region ionosphere is required to capture seasonal, solar cycle, and day-to-day variability at all latitudes in addition to solar flare phenomenology.

The intended capability is improved D-region specification and forecast in the 60-70 km and 80-90 km altitude regions for VLF propagation and HF absorption, particularly day-to-day variability and in the high latitude regions at night.

Climatological models like the International Reference Ionosphere (IRI) produce an altitude profile at D-region altitudes. The IRI model is based on about a hundred historical rocket profiles, so it captures some of the basic day/night, latitudinal, and seasonal variations in the D-region ionosphere but the model does not capture day-to-day variations or solar X-ray flare events. The model may be sufficient for some HF propagation applications but has been shown to be severely deficient in the high latitude region and during nighttime. In addition, the observations used to create the model do not accurately capture the shape of the lower D-region, which is required for VLF propagation applications.

The Next-generation Ionospheric Model for Operations (NIMO) is an assimilative geospace model developed to address operational USN space weather needs in the ionosphere. NIMO harnesses contributions from both near real-time data and state-of-the-art implementation of ionospheric theory to provide hindcasts, nowcasts, and forecasts for operational or research purposes. NIMO is currently configured to assimilate various types of electron density measurements through the Ionospheric Data Assimilation Four-Dimensional (IDA-4D) data assimilation schema. The D-region is not included in the data assimilation process but is simply added in post processing to the bottom of the electron density grid. The D-region model includes influence from changes in the solar conditions, but uses a climatological model for the neutral atmosphere, so it does not capture the day-to-day variability that is seen in the ionosphere.

Key performance Metrics/Goals:
Techniques to improve the global specification and forecast of the D-region ionosphere is sought with particular emphasis on the low latitudes (< 30 degrees) and high latitudes (> 60 degrees). Note: Any measurement techniques should provide measurements or any model should ingest measurements of the D-region and demonstrate improvement over existing models in two key altitude regions: 60-70 km altitude and 80-90 km altitude, which are required for VLF propagation and HF absorption, respectively. Key parameters include

1. Specify electron density in the 60-70km and 80-90km regions within 10% error. Alternatively, an improvement 75% of the time over existing models is sought.
2. Specification at a temporal cadence of 5-15 minutes
3. Specification at a spatial resolution of 5 degrees in latitude and longitude

Technical concepts may include developing prototype concept improvements to measurement techniques and systems, developing improvements to data exploitation and modeling, or a combination of the two.

PHASE I: Develop a technical concept for improvements to D-region specification. Establish the feasibility of the concept. Provide required Phase I deliverables that include a detailed plan of operational implementation with sufficient evidence to justify claims of skill improvement.

PHASE II: Develop a prototype system that improves state-of-the-art forecasting for D-region morphology and validate the results in an operationally relevant environment. Depending on the nature of the Phase I concept demonstration, deliver a functioning prototype instrument demonstrated in an operationally relevant environment with low-latency data-feed or a functioning model software package that exploits operationally relevant data sources in near-real-time. Validate either solution using an appropriate ray-trace simulation tool that demonstrates improved performance over current state-of-the-art systems. Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Deliver and integrate a new D-region model concept or data exploitation methodology into the NIMO for USN operational ionosphere prediction needs. Transition new measurement systems to an appropriate operator. Note: Delivery of the measurement system will be dependent upon the intended operational mode and target environment.

REFERENCES:

1. Akmaev, R. A., et al. "DRAP model validation: I. Scientific report." Technical Report (2010). https://www.ngdc.noaa.gov/stp/drap/DRAP-V-Report1.pdf
2. Bilitza, D., Pezzopane, M., Truhlik, V., Altadill, D., Reinisch, B. W. and Pignalberi, A. “The International Reference Ionosphere model: A review and description of an ionospheric benchmark.” Reviews of Geophysics, 60, e2022RG000792, 2022. https://doi.org/10.1029/2022RG000792
3. Burrell, A. G. et al. “Next-generation Ionospheric Model for Operations – validation and demonstration for space weather and research.” Ann. Geophys., 44, 2026, pp. 303-329. https://doi.org/10.5194/angeo-44-303-2026, 2026.

KEYWORDS: Ionosphere; D-region; space weather; very low frequency; VLF; high frequency; HF; skywave propagation; radar; communication

DON27BZ02-NV017 TITLE: Expeditionary Water Quality Sensors

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Contested Logistics Technologies (LOG)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Integrated Sensing and Cyber;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop simple-to-use water quality test kits or electronic sensors that require minimal training to enable personnel in the field to rapidly meet Technical Bulletin Medical 577 (TB-MED 577) requirements to certify potable water without liquid reagents.

DESCRIPTION: Expeditionary forces need updated water testing capabilities to support operations in austere, contested environments. Without proper water testing, water purified in the field are not certified potable for consumption. This creates an unacceptable logistics burden to transport water, or a health risks when consuming untested water; hindering the self-sufficiency, readiness, and lethality required for operations against a pacing challenge. Current approved state-of-the-art water quality testing kits are accurate but cumbersome, and overly complex, requiring chemical reagents, significant operator training, and for some parameters shipping to a certified lab. Present water quality testing methods are not practical for the small, distributed Stand-in Forces operating in expeditionary conditions.

In the event of detection of certain pathogens and contaminants, confirmation through certified laboratories may be required, necessitating sample transportation to CONUS, host-nation, or ally facilities—a process that can take 4-6 weeks. Delays of this magnitude are operationally unacceptable for forces in contested environments that need immediate assurance of water safety at the point of use. In addition, many critical parameters that impact water safety—including heavy metals, organic chemicals, and other contaminants—are not reliably tested with currently fielded sensors.

Force Design 2030 compels distributed forces to reduce their reliance on centralized logistics convoys; therefore, small units are increasingly required to produce and consume water at the tactical edge and at the point of need. Without a reliable and practical method to verify water quality in the field, these units face an alarming tradeoff between logistics supply certainty and warfighter health.

Therefore, the Navy needs simple, field-ready solutions to certify that expeditionary purified water conforms to TB-MED 577 short term potability military field water standards (STW MFWS) without external laboratory support. This SBIR topic seeks the development of new sensors and/or methodologies that will significantly improve existing water testing field kits. Improvements sought include but are not limited to: size and weight, more rapid testing results, simpler procedures requiring minimal training, elimination of liquid chemical reagents, and cost. Proposals can address one or more targeted improvements and can target one or more of the water parameters listed in the STP MFWS, such as physical properties, chemical properties, microbial contamination, chemical warfare agents, or radiological. Resulting improved sensors or methodologies must be integratable into future modernized water testing kits to allow squad- and platoon-level forces to verify compliance with TB MED 577 water safety standards in the field, reducing risk to personnel and decreasing reliance on vulnerable resupply chains. The expected end state of this effort is a fully developed, ruggedized, integratable sensor or set of sensors that enable rapid, automated testing of water quality in expeditionary environments in under 15 minutes (Threshold) / under 5 minutes (Objective), and/or detect all microbial threats in under 1 hour (Threshold) / under 15 minutes (Objective) without incubation or liquid reagents. Modular systems targeting specific critical parameters are equally encouraged and will be evaluated on technical merit.

PHASE I: Establish the technical feasibility of a preliminary conceptual design(s) of a new sensor or series of sensors, capable of rapidly verifying water quality in austere environments without requiring external laboratory support. Define and develop candidate concepts and sensor technologies. Conduct research that will assess the integration potential of the solution(s) into a portable kit for squad- (~13 Marines) and platoon- (40-50 Marines) level operations. Include approaches that may include modeling, simulation, and benchtop testing to evaluate detection accuracy, operational ruggedness, and ease of operation, all while referencing water safety requirements outlined in TB-MED 577. Deliver a final report documenting the technical progress; results of feasibility analyses; a breakdown of size, weight, power, and cost (SWaP-C) improvements and/or trade-offs; performance projections of candidate concepts and sensor technologies; and a defensible preliminary design concept. Ensure that the new sensor(s) should not require liquid chemical reagents, which are problematic due to a short shelf life and customs clearance. Identify anticipated technical risks, mitigation strategies, and a clear development path for Phase II prototype, fabrication, and validation in the final Phase I report.

PHASE II: Design, develop, fabricate, and test a prototype sensor or series of sensors capable of rapidly verifying water quality in simulated expeditionary environments. Ensure that the prototype integrates selected sensor technologies into a ruggedized, portable form factor appropriate for use at the squad and platoon level. Develop hardware and software interfaces, refine user interaction for minimal training burden, and ensure the sensor(s) functions across a range of environmental conditions. Demonstrate and validate the prototype through laboratory and field testing against relevant key water quality parameters such as microbial contamination, heavy metals, salinity, turbidity, and chemical pollutants. Conduct testing that should confirm performance relative to defined metrics including accuracy, test time, ease of use, and environmental durability. Provide the following required Phase II deliverables: prototype hardware, technical data documenting performance results, field evaluation in coordination with a military exercise if practicable, and a detailed plan for Phase III transition opportunities within military and commercial application.

PHASE III DUAL USE APPLICATIONS: Support transition to the Program Manager Engineer Systems (PM ES) at Marine Corps Systems Command for integration into the USMC family of water systems and direct use by small units during distributed operations.

Beyond military use, the technology has strong dual-use potential. Civilian applications include humanitarian assistance and disaster relief operations, rapid deployment by first responders in areas with compromised infrastructure, commercial water treatment facilities, and consumer safety monitoring in developing regions. The commercial pathway may include partnerships with outdoor equipment providers, municipal water authorities, and NGOs focused on clean water access.

REFERENCES:

1. “Technology Assessment of Water Treatment Devices for Small-Scale Production.” https://apps.dtic.mil/sti/trecms/pdf/AD1214090.pdf
2. “Technical Bulletin Medical 577 (TBMED 577).” https://quartermaster.army.mil/pwd/Publications/Water/TB_Med_577_15_Dec_2005.pdf

KEYWORDS: Water Quality; Purification; Sensors; Contaminates; Expeditionary; Health; Desalination; Reverse Osmosis; Detection

DON27BZ02-NV018 TITLE: Rapid Thermoplastic Patching Capability for Legacy Thermoset Airframe Sustainment

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Deliver a rapid, high-strength thermoplastic patching capability for legacy thermoset composite airframes by developing the necessary interfacial enabling technologies to fuse the incompatible polymer systems.

DESCRIPTION: Current composite airframe repair methodologies rely on a combination of wet-layups, B-staged epoxy prepregs, and bonded pre-cured thermoset patches. While pre-cured patches are the standard for high-quality depot repairs due to their autoclave-consolidated strength and “inspectability”, they present significant operational and logistical limitations. All these traditional methods require secondary adhesive bonding (using paste or film adhesives) to attach the repair to the airframe. This secondary bond is the inherent weak link of the repair, demanding long thermal cure cycles (often 4 to 24 hours), strict environmental controls, and burdensome cold-storage logistics (freezers) for the B-staged resins and adhesives. Furthermore, these out-of-autoclave epoxy repairs often struggle to meet the high service temperature requirements of advanced tactical aircraft.

This SBIR topic seeks to evolve the current pre-cured repair methodology by transitioning from secondary adhesive bonding to high-speed fusion welding. The objective is to develop the capability to use pre-consolidated, high-temperature thermoplastic patches (e.g., Carbon/PEEK, Carbon/PEKK) on legacy thermoset aircraft (epoxy/Bismaleimide [BMI]). By replacing the lengthy adhesive cure cycle with a rapid welding process, this technology aims to achieve flight-ready repairs in expeditionary and carrier-based environments in a fraction of the time.

Because thermoplastics melt and thermosets do not, achieving a structural weld between these dissimilar materials is the primary barrier to fielding this capability. The Department of War seeks complete thermoplastic patching solutions that incorporate the requisite chemical or mechanical interfacial enablers—such as plasma surface activation, novel chemical tie-layers, or laser-ablated mechanical interlocking. These enablers must allow the thermoplastic patch to successfully fuse with a fully cured, legacy thermoset airframe using portable ultrasonic, resistance- or -induction welding equipment. The outcome must be a deployable repair process that eliminates cold-storage logistics, restores full structural integrity, meets high service temperature demands, and drastically reduces Aircraft on Ground (AOG) time.

PHASE I: Develop a conceptual thermoplastic patching process and demonstrate the physical viability of the proposed enabling interfacial technology (e.g., tie-layers, surface functionalization). Establish the feasibility of the conceptual process. Perform coupon-level mechanical testing (such as lap-shear and peel-strength) to empirically prove that the thermoplastic-to-thermoset weld achieves a structural load transfer that is comparable to, or exceeds, baseline epoxy adhesive repairs. Deliver a detailed theoretical model explaining the fusion mechanism, an initial assessment of the repair's thermal limits (ensuring the parent thermoset is not degraded), and a conceptual workflow for field-level application that eliminates the need for depot-level infrastructure or cold-storage consumables.

PHASE II: Develop, optimize, and scale a patching capability prototype to representative legacy airframe structures, such as contoured wing skins or stiffened panels. Perform the proposed thermoplastic patch repair using field-representative heating equipment (e.g., portable induction or resistance welding). Validate the repair through rigorous structural testing, including fatigue spectrum loading, thermal

cycling, and damage tolerance assessments, to prove airworthiness. Deliver a prototype repair kit and process documentation. Target metrics must include a complete return-to-flight repair cycle of under 4 hours, restoration of > 115% of the parent structure's Design Ultimate Load, and thermal isolation ensuring the thermoset parent material remains below its degradation threshold during the welding process. Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Transition the validated thermoplastic patching capability to Naval Air Systems Command (NAVAIR) and Air Force Life Cycle Management Center (AFLCMC) for integration into legacy platforms. Incorporate the materials, tooling, and process parameters into standardized Structural Repair Manuals (SRMs) for platforms such as the F/A-18, F-35, or V-22, providing expeditionary units with a rapid, out-of-autoclave, room-temperature-storable repair solution. Commercial dual-use applications include rapid repair for the commercial airline industry, structural maintenance for composite wind turbine blades, and automotive crash repair for high-performance composite vehicles.

REFERENCES:

1. "NAVAIR 01-1A-1, General Manual for Structural Repair." https://www.tinker.af.mil/Portals/106/Documents/Technical%20Orders/AFD-082416-1-1A-1.pdf
2. Fernandes Villegas, Irene and Vizcaino Rubio, Pablo. "On avoiding thermal degradation during welding of high performance thermoplastic composites to thermoset composites, Composites Part A." Applied Science and Manufacturing, 2015-10, Vol 77, pp. 172-180. https://www.sciencedirect.com/science/article/abs/pii/S1359835X15002341

KEYWORDS: Thermoplastic Patching; Thermoset Airframe Repair; Fusion Welding; Interfacial Bonding; Rapid Sustainment; Out of Autoclave

DON27BZ02-NV019 TITLE: Navy Shipboard Gas Turbine Rotating Detonation Combustor Operation with Diesel Fuel

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Contested Logistics Technologies (LOG)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 scaled high density Rotating Detonation Combustor (RDC) that uses NATO F76 diesel fuel (MIL-DTL-16884R) and perform thermodynamic analysis on developed Navy RDC equipped shipboard gas turbine concepts to determine related performance benefits including reduction of stack up length, efficiency improvements, design limitations, and development gaps.

DESCRIPTION: As background, the typical arrangement used on U.S. Navy surface combatants consists of four (4) large (20+MW class – GE LM-2500) gas turbines for propulsion and three 3 smaller (3 MW class – Rolls Royce 501-K34) gas turbines for ship service electrical power generation.

Presently U.S. gas turbine powered warships use simple cycle machines. However, complex cycles with reheat and other cycle enhancements have been considered and analyzed with the potential for increased efficiency. Further examinations have been performed to evaluate improvements in maintainability/reliability, overall generator set power density/stack up length, and alternative configuration installation flexibility for use in overall electric plant designs.

RDCs are advanced power-generation and propulsion devices that operate by propagating one or more supersonic detonation waves continuously around an annular chamber. As fresh fuel and oxidizer are continuously injected into the channel, the rotating shock wave rapidly compresses and ignites the mixture, creating a self-sustaining zone of intense heat and pressure. Thermodynamically, RDCs utilize a detonation-driven pressure-gain cycle, which is most accurately modeled by the Fickett-Jacobs-Salsburg (FJS) cycle and frequently approximated as the constant-volume Humphrey cycle. Unlike conventional gas turbines that rely on the constant-pressure Brayton cycle, the FJS detonation cycle in an RDC generates a substantial net increase in total pressure across the combustor. This inherent pressure gain drastically reduces the workload required by upstream mechanical compressors and significantly boosts the overall thermal efficiency and power output of the gas turbine system. While initial government and industry investigations have centered on the use of RDCs in aerospace applications, future shipboard applications will require a greater understanding of the ability to operate with diesel fuel for long continuous operation as well as a quantification of performance benefits that can be achieved in overall shipboard electric architecture design.

While not required, discussions with Navy shipboard gas turbine Original Equipment Manufacturers (OEM) are recommended.

PHASE I: Perform an analysis of an RDC combustor ignition and continuous operation with NATO F76 fuel by the end of the Base period. Assemble and demonstrate an initial limited laboratory experiment/subscale test to verify analysis findings in coordination with Navy personnel. Complete a conceptual design for a combustor prototype and associated liquid fuel system, to include prototype design refinements, fabrication approach, and testing strategy that should include ignition and endurance operation with defined measurements in coordination with Navy personnel and within the scope of a Phase II budget. Prepare a Phase II plan.

PHASE II: Construct a combustor prototype and associated liquid fuel system. Perform startup and endurance testing for up to 500 hours as defined in Phase I utilizing F76 fuel. Based upon results generated from testing, conduct thermodynamic analyses/model of a marine gas turbine utilizing an RDC primary combustor as well as a thermodynamic analysis/models of marine gas turbine reheat cycles utilizing an RDC inter-turbine (single reheat) and intra-turbine (continuous reheat) in collaboration with Navy personnel. From this analysis, determine impact on overall efficiency, reliability, operating life, power density, and future development gaps. Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS: Demonstrate a full-scale liquid fuel combustor operating continuously for 500 hours. Based on Phase II analysis, develop a full-scale RDC-based gas turbine, either simple or complex cycle, and conduct performance testing prior to an at sea demonstration. Once complete, examine and upgrade the system for marinization requirements accounting material and maintainability improvements to successfully operate in a naval environment.

Examine and demonstrate the RDC based gas turbine in a CIPES electric plant configuration to validate ship benefits for overall operational performance and improvement in platform increases in power density. Commercial dual use application may include commercial maritime ships and offshore drilling and production platforms.

REFERENCES:

1. Naval Sea Systems Command. “Fuel, Naval Distillate.” MIL-DTL-16884R, 3 January 2025. http://quicksearch.dla.mil/
2. Hoeper, M. “Liquid Fuel Transport Phenomena in Rotating Detonation Engines.” Proceeding of the Combustion Institute, Vol 39, Issue 3, 2023, pp. 3051-3061. https://hammer.purdue.edu/articles/thesis/LIQUID_FUEL_TRANSPORT_PHENOMENA_IN_ROTATING_DETONATION_ENGINES/27195012?file=49735404
3. Zhou, S., Wang, R., Liu, F., Ning, H., Ma, Y., Zhang, T. and Hu, H. “Experimental Investigation on Propagation Characteristics of Rotating Detonation Wave Fueled by Diesel.” Acta Astronautica, Volume 225, December 225, pp. 949-959. https://www.sciencedirect.com/science/article/abs/pii/S009457652400586
4. Clark, N. “Design and Application of Compact Combustors in Small-Scale Jet Engines.” Air Force Institute of Technology, Department of Aeronautics and Astronautics, Thesis, 2022. https://apps.dtic.mil/sti/html/trecms/AD1175595/index.html
5. Millsaps, K, Rodman, B. “Thermodynamic Analysis of “Inter-Turbine” and “Intra-Turbine” Reheat for Marine Gas Turbines.” Proceedings of the ASME Turbo Expo 2004: Power for Land, Sea and Air, Volume 5: Turbo Expo 2004, Parts A and B, Vienna, Austria, June 14-17, 2004, pp. 1877-1882. ASME-IGTI GT2004-54174. https://asmedigitalcollection.asme.org/GT/proceedings-abstract/GT20024/41707/1877/307076
6. Russom, D. and Daransky, T. “Fuel Manifold Air Purge System for Allison 501-K17/K34 Marine Gas Turbine Engines.” Proceedings of the ASME 1994 International Gas Turbine and Aeroengine Congress and Exposition, Volume 2: Aircraft Engine; Marine; Microturbines and Small Micromachinery, The Hague, Netherlands, June 13-16, 1994. V002T03408. ASME-IGTI 94-GT-234. https://doi.org/10.1115/94-GT-243

7. Office of Naval Research (ONR) STTR Topic N24A-T016 (2024). “Plasma Assisted Combustion for Enhanced Performance and Operability in Naval Air Vehicles and Weapons.” https://www.navysbir.com/n24_A/N24A-T016.htm
8. Office of Naval Research (ONR) STTR Topic N21A-T011 (2021). “Enhancement of Detonation Wave Dynamics in Rotating Detonation Combustors (RDC).” https://navysbir.us/n21_A/N21A-T011.htm
9. Wolanski, P. “Application of the Continuous Rotating Detonation to Gas Turbine.” Applied Mechanics and Materials, 782, 2015, pp. 3-12. https://doi.org/10.4028/www.scientific.net/amm.782.3
10. Wolanski, P. et al. “Experimental research of liquid-fueled continuously rotating detonation chamber.” Shock Waves 31, 2021, pp. 807-812. https://doi.org/10.1007/s00193-021-01014-w
11. Schwer, D. and Kailasanath, K. “Fluid dynamics of rotating detonation engines with hydrogen and hydrocarbon fuels.” Proceedings of the Combustion Institute, Volume 34, Issue 2, 2013, pp. 1991-1998. https://www.sciencedirect.com/science/articleabs/pii/S1540748912000478
12. Schwer, Douglas and Kailasanath, Kailas. “Feedback into Mixture Plenums in Rotating Detonation Engines.” 50th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Expostition, Nashville, Tennessee, 9-12 January 2012. https://doi.org/10.2514/6.2012-617
13. “Naval Power & Energy Technology Development Roadmap (2019).” https://www.navsea.navy.mil/Portals/103/Documents/2019_NPES_TDR_Distribution_A_Approved_Final.pdf?ver=2019-06-26-132556-223

KEYWORDS: Rotating Detonation; Plasma Assisted Combustion; Power Density; Diesel Fuel, Gas Turbine

DON27BZ02-NV020 TITLE: Rapid Imagery Creation for Navy Training

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Computing and Software

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 technology to use historic real-world satellite imagery and then rapidly (10 minutes or less) modify it to reflect a training scenario order of battle (aircraft, ships, vehicles, etc.) to allow imagery analysts to practice their tradecraft underway or ashore in support of maritime exercises.

DESCRIPTION: Currently, imagery analysts are excluded from, or extremely limited in, participating in dynamic Navy operational and staff training such as Surface Warfare Advanced Team Trainer (SWATT), Information Warfare Advanced Team Trainer (IWATT), Fleet Synthetic Training General Commander/Joint (FST-GC/J), and Commander Training Unit Exercise (COMPTUEX).This is due to the limited ability to dynamically generate the required products for imagery analysts within a reasonable amount of time at a quality that supports training.

Currently, either summaries are provided to the training audience circumventing the imagery analysts all together or providing GRAPHPLOTS - the equivalence of stick figure drawing - to track the order of battle (OOB) made up of aircraft, ships, vehicles, etc., without any use of actual imagery or geospatial analysis.

A technology to address this shortfall would need to take real-world geo-rectified imagery as a base and then rapidly adjust/modify the image to reflect the desired OOB and in a National Imagery Transition Format (NTIF) to be provided to the training audience for imagery analysts to process.
For example, in real-life Port A, identified by Basic Encyclopedia (BE) number, is of high interest and has a collection requirement against it for satellite imagery to be collected. In reality, Port A has three Kilo-class submarines and one Luhu-class destroyer, but in the scenario things have dynamically changed such that one of those submarines is now underway and an additional Luda I-class Destroyer has arrived, requiring the rapid (less than 10 minutes) production of an NITF image depicting two Kilo-class submarines, one Luhu DD, and one Luda I DDG to provide the training audience for analysis. The same would be required for airfields depicting aircraft movement as well.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be

required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Create concept formulation for electro-optical imagery, determine technical feasibility of rapidly generating an NITF image, and validation through the modification of a single image (note: format and quality are not relevant here) to change the depicted order of battle. Determine technical feasibility of infrared (IR), and Synthetic Aperture RADAR (SAR) imagery. Create demonstration standard sufficient to assess preservation of imagery characteristics necessary for realistic imagery-analysis training.

PHASE II: Develop prototype technology on the Secret Internet Protocol Router Network (SIPRnet) to effectively execute the example provided in the Description for Electro-Optical (EO) imagery. Determine a site by BE number (from a limited provided subset), outputting a near real-world NITF image of the desired OOB (from a limited inventory of platforms). Demonstrate standard sufficient to assess preservation of imagery characteristics. Prepare a Phase III commercialization/transition plan.
Work in Phase II may become classified. Please see note in Description section.

PHASE III DUAL USE APPLICATIONS: This technology would be usable and empower any dynamic military training opportunity to support Imagery/GEOINT analysis. Possible transition to National Geospatial-Intelligence Agency, Naval Information Forces (NAVIFOR), Center for Information Warfare Training (CIWT), Carrier Strike Group FOUR and FIFTEEN (CSG-4/15), Tactical Training Group Pacific (TTGP), Tactical Training Group Atlantic (TTGL) and NSWC Corona.
This product will ideally reside on the SIPRNet as a portal for users to query on RED networks, such as NCTE-RED OPS, NMCI SIPR, SIPR TRANET, then providing the requested images.

Potential work in Phase III could include prototype refinement, testing, production, and transition support.

REFERENCES:

1. " Publication 1.0: GEOINT Basic Doctrine, 2018." 170901-038_GEOINT_Basic_Doctrine_Pub_1.pdf
2. "National Imagery Transmission Format Standard (NITFS) Technical Board (NTB)." https://nsgreg.nga.mil/ntb.jsp
3. "National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993." https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: Imagery; analysis; maritime training; Geospatial Intelligence; GEOINT; Order of Battle; OOB; dynamic; electro-optical; collections

DON27BZ02-NV021 TITLE: SI-Enabled “Just-in-time” Knowledge Delivery for Naval Maintainers

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Applied Artificial Intelligence (AAI)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Human-Machine Interfaces;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 SI-enabled maintenance associate that delivers interactive, expert-level guidance for complex diagnostic and repair tasks at point of need, provides technicians historical context on specific vehicles or components being repaired, and curates maintenance histories into easily mineable repository for future use.

DESCRIPTION: This effort is aimed at addressing the critical operational challenge of maintaining increasingly diverse and technologically complex arrays of systems with generalist knowledge. The solution requested in this SBIR topic is a just-in-time knowledge delivery system for Fleet maintainers that tells them what they need to know, when they need to know it. It would provide detailed procedures and technical knowledge for diagnostics, repair and maintenance procedures on demand, both ashore and at sea, where there will be limited access to remote data stores. The system will employ generative SI to analyze authoritative technical documentation and historical maintenance records, at both the Fleet and individual asset levels, and generate summarized technical guidance initiated by free-text queries or guided diagnostic dialogues. Post-task, the system will prompt the technician for repair feedback, synthesizing their insights to update the database with both general maintenance guidance and individual asset histories. Problems with current knowledge delivery are particularly acute when new systems and technology are introduced to the Fleet, such as with the introduction of unmanned systems (UxS), and when locally developed knowledge needs to be propagated across the larger maintenance community. Operational readiness is currently bottlenecked by an inefficient maintenance paradigm: generalist maintenance technicians constantly face unfamiliar equipment without access to historical repair data, while frequent duty rotations continually erase localized (tribal) knowledge. This over-reliance on a transient pool of specialists causes extended system downtime and degrades operational readiness. These problems are particularly acute when new systems and technology are introduced to the Fleet.
While new advances in Large Language Models (LLMs) and generative SI present an opportunity to create sophisticated human-machine teaming tools for providing real-time interactive support, state-of-the-art predictive maintenance systems are not attuned to the unique challenges of the Navy’s maintenance environment. Effective solutions will need to integrate diverse approaches and overcome existing hard science problems to arrive at the desired solution. Current approaches in this domain excel at forecasting component failures and recommending procedures; however, they lack the interactive step-by-step guidance required to conduct the procedures or for dynamic on-the-job technical support to the maintainers. Existing maintenance knowledge tools operate as one-way information pipelines that fail to capture critical institutional knowledge and platform-specific maintenance histories, which prevents the continuous, enterprise-wide learning loop necessary for resilient maintenance operations.

Solutions must be able to ingest, synthesize, and appropriately structure a wide variety of data formats (e.g., technical manuals, structured databases, handwritten logs) while also integrating newly produced recurrent maintenance reports. This data should serve as a dynamically updated foundational knowledge base that is contextualized by the physical and operational situation unique to each repair, providing customized guidance to the technician. The solution should adapt its guidance to the user's specific skill level and experience to ensure interpretability across levels of expertise. Lastly, the desired Maintenance Associate solution must be capable of operating on local hardware in low-bandwidth and disconnected environments, operating on local storage and syncing fleetwide as connectivity allows.
This SBIR topic is seeking proposals that would contribute to the development of an SI-Enabled Maintenance Associate. It is expected that the initial capability would be focused on a specific technical domain and a representative set of equipment that would serve as a prototype that can be scaled up to apply to multiple domains and an array of deployed systems. One target domain of immediate interest is the maintenance and repair of unmanned systems. However, any equipment and application domain that is found within Naval systems is of interest.

The envisioned system workflow will ingest and distill technical documentation into interactive, multi-media or hard-copy repair procedures—complete with parts lists, safety warnings, and annotated tribal knowledge—delivered through a user-friendly Human-Machine Interface (HMI). The system will capture post-repair outcomes to continuously update the foundational knowledge base. Proposed solutions may address individual components of the Maintenance Associate system or work to develop a complete system.

Components of the Maintenance Associate System that may be addressed for this SBIR topic should include:

- A database management system for repair service/technical manuals and logs for distillation into maintenance procedures.
- An HMI for technician requesting support that delivers summary procedure, to include tools, parts lists, cautions, and warnings; and provides results that are appropriately annotated localized (tribal) knowledge (best practices, tips, and comments from other users).
- System products to end-users delivered as: multi-media content and/or hard copy outputs for technicians to access when performing procedures.
- An incorporated mechanism to capture results/maintenance outcomes with a data integration mechanism that feeds into the knowledge base for future reference.

Ideally, this transition effort will specifically focus on supporting the complex maintenance, diagnostics, and repair requirements of UxS hardware and platforms (e.g., Unmanned Surface Vessels, Unmanned Underwater Vehicles, Unmanned Ground Systems, and Unmanned Aerial Systems), although use cases for other Naval Applications and alternative transition customers would be acceptable. Unmanned systems and commands are nascent, and subject to wholesale platform change in short order. Operators and maintainers rely on vendor provided maintenance doctrine as they are developing historical context. Grounding for the Associate must include these documents which may be CUI or SECRET, performers must be able to operate at required classification levels. Reported technical evaluations, capability demonstrations, and success metrics will focus on the accuracy/interpretability of maintenance guidance and quality of the human-machine interaction as assessed by real-world end users and the generalizability of the technical approach across platforms and domains.

Offerors are reminded that SBIRs are expected to sufficiently develop one or more capabilities that will receive endorsement from an acquisition/development organization and who will provide matching funds for transition/acquisition during Phase II of the SBIR. Prospective agencies for potential matching funds should be identified in the Phase I proposal along with the description of the baseline capability to be

delivered that the proposer believes that acquisition agency would be interested in funding during Phase II.

The proposer will need to:

1) Develop an SI-driven, maintenance task context-aware guidance prototype that functions as an on-demand technical expert and centralized intelligence hub for maintenance technicians, providing interactive support for complex diagnostic and repair tasks.
2) Incorporate a mechanism to ingest, process, and index a wide array of reference materials, including technical manuals, vendor publications, Maintenance Required Cards (MRCs), after-action reports, and historical service logs from various databases.
3) Demonstrate a workflow for capturing new experiential knowledge, observations, and "lessons learned" from maintainers post-task to ensure the system continuously learns and shares updated information across the fleet.
4) Be designed to operate effectively on simple hardware (e.g., tablets, laptops) in environments with limited or no connectivity by using a local knowledge store, with the capability to synchronize with a central cloud database when a connection is available.
5) Provide an adaptive human-machine interface that guides a user through troubleshooting and repair via natural language, tailors instructions to the technician’s skill level, and recognizes the specific system variant in use.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Determine the technical feasibility of deploying a generative SI and LLM framework to support complex maintenance and diagnostic tasks in disconnected environments. Initial Phase I scoping should clearly define the domain, data sources, and commercial vendors that will inform a primary knowledge base for maintenance guidance and repair recommendations. (Note: Agent architecture and data ingest should be extensible to new domains and data types for the longer-term technical objective of applying Maintenance Associates to support both legacy platforms and novel technologies.) The system workflow will specify how newly submitted maintenance reports are ingested into the database to optimize future diagnostic guidance and dynamically tailor user assistance according to technician proficiency. Phase I success depends on selecting a use case to validate the Maintenance Associate's core methodology: generating initial repair guidance, iterating based on new inputs and evolving the knowledge base based on maintenance outcomes through an appropriate interface.

The Phase I proposal must address the following objectives:

- Identify and design a concept for the Maintenance Associate system architecture, processes through which the SI will securely ingest, process, index, and reason over heterogeneous maintenance data (e.g., technical manuals, structured databases, and unstructured historical logs).

- Analyze and classify open-source LLMs for their ability to perform consistent and accurate ingest and classification of new data sources and their capacity to generate reliable, accurate, and tailored maintenance guidance.
- Perform modeling and simulation to validate the local-to-cloud data synchronization process and the management of post-task "lessons learned" workflow, ensuring the system can continuously capture field knowledge and update the enterprise database with intermittent and/or low bandwidth connectivity.
- Define and develop a concept for operating the SI knowledge associate efficiently on tactical edge hardware (e.g., standard tablets or laptops) without relying on continuous cloud connectivity.
- Develop approaches for working prototypes for creating an adaptive human-machine interface that can dynamically tailor real-time troubleshooting guidance to the technician's specific information needs as well as address the exact equipment variant to be serviced.

Required Phase I deliverables will include:

1. A technical feasibility report describing the required SI model's performance and its adequacy for employment on edge hardware with limited cloud reach back.
2. A system architecture document outlining software requirements for data ingestion, local data caching, and synchronization protocols for cloud data storage and data management.
3. A preliminary human-machine interface mock-up or design concept for: a) data ingestion, b) user prompting of the system to obtain maintenance procedures, c) delivering prototype output from the recommender system, and d) ingestion of results from maintenance to update the knowledge base with lessons learned and details for repairs to specific equipment.
4. A detailed Phase II research and development plan that includes proposed performance metrics and a commercialization roadmap, and identifies a prospective transition target and describe customer expectations for providing matching funds as required during the Phase II development effort.

PHASE II: Develop, demonstrate, and validate a fully functional, edge-capable software prototype integrated onto representative ruggedized tactical hardware.

To the degree possible, describe the maturity of the capabilities and relevant performance metrics expected to be met in Phase II. Describe the proposed maintenance use-case(s) expected to be targeted for development and demonstration. Describe the process by which technical information will be ingested to be used by the Maintenance Associate system, and the requirements for scaling it to other application domains. Validate the system's ability to ingest a complex corpus of real-world technical manuals, proprietary vendor publications, and historical logs specific to that platform, its components, and its modular payloads. Demonstrate the bidirectional synchronization workflow, proving the prototype can capture user-generated "lessons learned" and post-task observations regarding unmanned platform anomalies at the edge, and successfully update the centralized enterprise database once connectivity is restored. Validate the human-machine interface and adaptive learning features with UxS maintenance personnel to ensure the system effectively tailors troubleshooting guidance to varying skill levels and accurately recognizes rapidly evolving unmanned equipment variants. Produce and validate a prototype of the Maintenance Associate application that successfully operates entirely disconnected from enterprise networks, simulating forward-deployed UxS maintenance hubs. Produce prototype hardware and software integrated systems (e.g., deploying the optimized LLM onto ruggedized shipboard tablets or maintenance laptops) ready for user-in-the-loop testing.

Deliver a functional, hardware-integrated prototype that demonstrates key functionality of a Maintenance Associate that can be scaled to multiple application domains. (Note: The preferred (but not required) application domain would be tailored for a maintainer of unmanned systems.); a comprehensive Test and Evaluation (T&E) report detailing the prototype's performance, utility, adequacy, and latency in

delivering maintainer content using stand-alone (e.g., laptop) information technology with limited network connectivity; and a Maintenance Associate System software architecture documentation including document ingestion and end-user documentation that describes document ingestion (when required), user interaction to generate a maintenance procedure and get supporting documentation out of the system, and the mechanism by which the end user would describe the outcome of the maintenance procedure for updating the maintenance associate knowledge base.

Prepare a Phase III transition and commercialization plan detailing the path for transition to an acquisition entity or integration into a Naval Program of Record.
Work in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: This topic was conceived with a primary Naval transition target of Unmanned Surface Vessel Squadrons (USVRONs) and their associated maintenance hubs for UxVs. The desired system should be appropriate for use by USVRON maintenance personnel on ruggedized tactical hardware (e.g., standard issue tablets or laptops) to diagnose and repair the complex, modular systems of Unmanned Surface Vessels (USVs) and other unmanned platforms. There is a wide range of application domains, both in the commercial and military sectors that would benefit from the maintenance associate. The general purpose of this technology is intended to be a secure, deployable and scalable generative SI enabled system capable of ingesting disparate technical data, operating entirely disconnected from enterprise networks, and providing interactive maintenance and troubleshooting guidance. The desired system would integrate experiential knowledge from users to iteratively append the knowledge base with lessons learned, best practices, tips and tricks as appropriate for use by future maintainers working on the same or similar system.

Phase III work may also orient towards commercializing the core SI maintenance technology for industries that manage complex, distributed assets in commercial domains that require disconnected or remote environments (e.g., commercial maritime, aviation, or energy/infrastructure operations).

REFERENCES:

1. "CNO Fighting Instructions, 2026." https://media.defense.gov/2026/Feb/06/2003871752/-1/-1/1/CNO%20FIGHTING%20INSTRUCTIONS.PDF/CNO%20FIGHTING%20INSTRUCTIONS.PDF
2. "Department of the Navy Unmanned Campaign Framework, 2021." https://www.navy.mil/Portals/1/Strategic/20210315%20Unmanned%20Campaign_Final_LowRes.pdf
3. Dimidov, V., Hawlader, F., Jafarnejad S. and Frank, R. "Cleaning maintenance logs with LLM agents for improved predictive maintenance." arXiv 2025. https://doi.org/10.48550/arXiv.2511.05311
4. Harbola, C. and Purwar, A. "Prescriptive agents based on RAG for automated maintenance (PARAM)." Proceedings of the International Conference on AI-ML-Systems 2025. arXiv. https://doi.org/10.48550/arXiv.2508.04714
5. Kirtania, S. et al. "STACKFEED: Structured textual actor-critic knowledge base editing with feedback." Proceedings of the 2025 Conference on Empirical Methods in Natural Language Processing: Industry Track. https://arxiv.org/abs/2410.10584
6. Koornneef, H., Verhagen, W. and Curran, R. "A web-based decision support system for aircraft dispatch and maintenance." Aerospace, 8(6), 164, 2021. https://doi.org/10.3390/aerospace8060164
7. Malyi, M., Shek, J., McDonald, A. and Biscaya, A. "A comparative benchmark of large language models for labelling wind turbine maintenance logs." arXiv 2025. https://doi.org/10.48550/arXiv.2509.06813

8. 8. “OPNAVINST 4700.7N Maintenance Policy for Navy Ships 2024. https://www.secnav.navy.mil/doni/Directives/04000%20Logistical%20Support%20and%20Services/04-700%20General%20Maintenance%20and%20Construction%20Support/4700.7N.pdf
9. 9. Wulf, J., Meierhofer, J. and Hannich, F. “Architecting human-AI cocreation for technical services: Interaction modes and contingency factors.” arXiv 2025. https://doi.org/10.48550/arXiv.2503.00356
10. 10. Zhang, R. et al. “Toward edge general intelligence with agentic AI and agentification: Concepts, technologies, and future directions.” IEEE Communications Surveys and Tutorials, 2025. https://arvix.org/abs/25084.18725
11. 11. “National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993.” https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: Agentic; maintenance; edge; associate; stepwise; adaptive; guidance; troubleshooting; repair

DON27BZ02-NV022 TITLE: Collapsible Fixed-Wing Low-Cost Unmanned Aerial System for Intelligence, Surveillance, and Reconnaissance Missions

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Integrated Sensing and Cyber;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a collapsible, low-cost, fixed-wing Group 1 small uncrewed aerial system (sUAS) capable of autonomous intelligence, surveillance, and reconnaissance (ISR) missions with a flight endurance of over one hour.

DESCRIPTION: The Navy has a growing need for a low-cost, portable, and rapidly deployable UAS to support ISR missions. Current systems are often expensive and bulky, and require significant logistical support. This SBIR topic seeks an innovative solution for a collapsible fixed-wing UAS that can be easily transported and deployed by a single operator. The UAS should be capable of autonomous flight and integration with standard flight control software (e.g., QGroundControl, Pixhawk).

Key requirements include a total cost under $5,000 for the airframe and components, a flight time exceeding one hour, a communication range of up to 10 km, and the ability to fit within a 2' x 2' x 1' case for transport. The system must support a modular nose payload, be initially equipped with an RGB camera, and have the potential to serve as a signal repeater for transmission of data. The primary technical challenge is to achieve the desired endurance and portability within the stringent cost constraints, requiring innovation in airframe design, materials, and component integration.

PHASE I: Develop a concept for a low-cost, collapsible Foldable Low-cost Expendable Wing (FLEX-Wing) sUAS. Determine the technical feasibility of the concept. Conduct trade studies for materials and components. Perform modeling and simulation to validate the aerodynamic performance, flight endurance, and structural integrity. Deliver a detailed concept design report, simulation results, field test results of the prototype, and a preliminary bill of materials demonstrating the path to achieving the cost target.

PHASE II: Design and develop a prototype through a structured, iterative engineering cycle within the appropriately distributed across the allotted Phase II timeframe to ensure feasible execution and rigorous validation. Fabricate and validate the prototype of the FLEX-Wing sUAS. Produce prototype hardware that transitions the flat-pack, off-the-shelf structural concepts into a fully integrated, flight-capable system. Deliver the physical prototype hardware (minimum of three complete kits) and associated technical data packages to the SYSCOM sponsor. (Note: The prototypes will undergo validation against the strict weight (Group 1), size, cost, and endurance metrics to verify readiness for Phase III commercialization and transition into a formal PMA-263 capability portfolio.)
The specific hardware and software to be developed and produced includes:

- The Airframe: A foldable, stackable, and bendable fixed-wing structure utilizing low-cost commercial off-the-shelf (COTS) materials (e.g., weatherproofed craft board/polymer) keeping total airframe and component costs below $5,000 per unit.
- A fully self-contained air vehicle kit that fits entirely within a compact 2 ft × 2 ft × 1 ft transit case (e.g., a Pelican case), including the folded airframe and required batteries. The Ground Control Station (GCS) may be provided separately, but must be backpack-portable (approximately laptop-sized) and capable of controlling multiple FLEX-Wing air vehicles.• Avionics & Software: Integration of a Pixhawk (or similar)-based flight controller running open-source flight software (e.g., QGroundControl).

- Payload & Communications: A modular nose-cone payload system featuring a baseline RGB camera for ISR loiter missions and an interchangeable signal repeater module. The communications suite will setup a telemetry link capable of up to 10km range.

Execution Phase Timeframe Associated Scope & Engineering Effort

1. Design & Component Sourcing Months 1-6 Based on Phase I modeling, design and develop a prototype architecture. Finalize COTS component selection (e.g., Pixhawk, 5.2GHz RF modules, RGB sensors) and establish manufacturing processes for the foldable airframe materials (e.g., die-cutting, hinge reinforcement).
2. Prototype Fabrication Months 7-12 Produce prototype hardware. Integrate the high-energy-density power systems required to achieve the >1 hr flight time. Assemble the modular nose payload bay and ensure the total system fits within the 2x2x1 ft storage constraint.
3. Integration & Software Tuning Months 13-18 Integrate flight controller firmware with QGroundControl. Develop processes, select an application (e.g., autonomous waypoint ISR and manual FPV terminal guidance), and validate the software hand-offs in a simulated environment.
4. Demonstration & Validation Months 19-24 Develop, demonstrate and validate the physical prototype in a relevant open-air test environment. Validate the up to 10km RF range, >1hr endurance, aerodynamic stability of the foldable wings, and ISR/signal-relay mission profiles.

PHASE III DUAL USE APPLICATIONS: Expected Final State of the Technology

At the conclusion of the Phase II effort, the technology will exist as a fully integrated, flight-validated Group 1 sUAS with a finalized technical data package (TDP). The final state will be a highly mature prototype characterized by a scalable, low-cost manufacturing process (e.g., die-cut stamping of the COTS airframe materials). The system will feature DoW-compliant, open-architecture avionics and a validated modular nose payload bay, consistently demonstrating the ability to meet the sub-$5,000 cost threshold and the compact 2' x 2' x 1' storage requirement.

Scale the manufacturing process for high-volume, commercial production, allowing the military to purchase the system in bulk. Tactical operators will unpack, hand-launch, and utilize the system in contested or anti-access/area denial (A2/AD) environments for beyond-line-of-sight (BLOS) ISR, target acquisition, or to establish temporary mesh network extensions. Because it is highly attritable, warfighters will employ the system aggressively without the burden of planning for asset recovery, reverse logistics, or depot-level maintenance.

Target Platform and Program of Record

The expected transition path for the Phase III technology is insertion into the Small Unit Remote Scouting System (SURSS), an Acquisition Category IV program managed by the Naval Air Systems Command, Program Manager, Air 263 (Navy and Marine Corps Small Tactical Unmanned Aircraft Systems). The FLEX-Wing will serve as a complementary, expendable platform within their broader Family of Small UAS (FoSUAS) portfolio.

Potential commercial dual-use applications include rapid damage assessment following natural disasters, environmental monitoring, agricultural and land-management surveying, infrastructure inspection, and search-and-rescue support. These applications similarly benefit from a low-cost, portable, rapidly deployable fixed-wing sUAS with extended endurance.

REFERENCES:

1. "Blue UAS Framework." Defense Innovation Unit, United States Department of Defense, 2024. https://www.diu.mil/blue-uas
2. Dronecode Foundation. "PX4 User Guide." PX4 Autopilot Official Documentation, 2024. https://docs.px4.io

3. Dufour, L., Owen, K., Mintchev, S., & Floreano, D. (2016, October). A drone with insect-inspired folding wings. In 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 1576-1581). Ieee.
4. SYPAQ Systems. "Corvo Precision Payload Delivery System (PPDS)." SYPAQ, 2023, https://www.sypaq.com.au/corvo/ppds/

KEYWORDS: Group 1 sUAS, foldable, attritable, drone, man-packable, low-cost

DON27BZ02-NV023 TITLE: Attritable Turbine for Low-Cost Attack Systems (ATLAS)

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Contested Logistics Technologies (LOG)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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

OBJECTIVE: Design, develop, and prototype a low-cost, limited-life gas turbine engine producing 150-300 lbf of SLS thrust with an estimated engine life expectancy of 10-15 hours, leveraging advanced design and manufacturing techniques to significantly reduce part count, production lead time and scaling, and overall unit cost compared to traditionally manufactured engines in the same class.

DESCRIPTION: The Department of War has an increasing need for affordable, reliable, and rapidly producible propulsion systems to support the proliferation of attritable Unmanned Aerial Systems (UAS), loitering munitions, and stand-off strike weapons. Current small turbofan and turbojet engines in the 150-300 pounds of thrust (lbf) class often rely on traditional aerospace material and manufacturing processes, resulting in high unit costs and long supply chain lead times. These factors are prohibitive for systems intended to be employed in mass or as expendable assets.

This SBIR topic seeks innovative engineering and manufacturing approaches to design a turbofan engine that meets the thrust requirements while dramatically lowering cost per unit. Proposers should consider advanced design and manufacturing techniques to produce a low-cost engine that can leverage existing industrial base capacity to reduce risk to procurement supply chains.

Key technologies and design features to consider are:

- Additive Manufacturing: Utilizing Powder Bed Fusion, Directed Energy Deposition and Direct Metal Laser Sintering (DMLS) to consolidate part count and simplify construction.
- Industrial (Non-Aerospace) Production Capacity: Leverage non-traditional aerospace manufacturing firms to reduce cost. Consider leveraging materials, casting and production techniques found in the automotive sector. Demonstrate a manufacturing pathway that enables rapid scaling and reduces supply chain bottlenecks.
- Short Life/Expendable Components: Utilizing non-traditional lubrication systems, bearings and electronic sub-components to limit cost.
- Optimized Materials: Utilize cost-effective materials suited for limited-life/single-use engine operations rather than traditional high-lifecycle aviation materials, where appropriate.

Performance metrics of interest include specific fuel consumption (SFC), thrust-to-weight ratio, and operational reliability for mission durations typical of attritable UAS or cruise munitions.
The engine will be fully operational utilizing Navy relevant fuels and demonstrate resilience to harsh maritime storage and launch conditions without significant performance degradation. The engine is expected to demonstrate functionality when subject to storage life of 6-12 months in Maritime

environments and meet minimum required performance after exposure to shore-based and shipborne launch environments.

Notional performance objectives for this SBIR topic are provided in the Tables below:
Table 1: ATLAS engine notional operational envelop and performance objectives.
Parameter Specification
Electrical Power Generation [W] 500-1500
Thrust, SLS [lbf] 150-300
SFC [lbm/lbf/hr] < 1.5
Cruise Altitude [ft] 20k

Table 2: ATLAS engine notional mass and dimensional properties objectives.
Parameter Specification
Approximate OML Diameter [in] < =10
Weight, Dry [lbm] 25-35
Length [in.] 14-24

Table 3: ATLAS engine notional storage & launch conditions.
Parameter Specification
Start Altitude Sea Level
Start Method Air Impingement
Storage Duration (Wooden Round) 6-12 months, Maritime Environment
Launch & Assist Method Rail, Catapult, or Rocket Assist

PHASE I: Conduct a feasibility study and develop a conceptual design for a 150-300 lbf. turbofan engine.

- Identify the specific advanced design and manufacturing techniques to be utilized, optimizing the finished product for cost and producibility.
- Provide preliminary conceptual design modeling and simulation data (e.g., computational fluid dynamics, structural, and thermal analysis, cycle model) to validate conceptual design.
- Develop a comparative cost analysis demonstrating the projected unit cost and production time reductions versus traditional manufacturing baselines.
- Conduct a proof-of-concept demonstration and/or test campaign of the conceptual design, components, materials and manufacturing methods utilizing component level rig testing or lab testing where applicable.
- Monitor ongoing program risk and provide status updates throughout program progression.
- Deliver a Phase II development and testing plan.

PHASE II: Refine the conceptual design based on Government feedback and develop a detailed design for a fully functional prototype engine. Transition the Phase I conceptual design into fully functioning, physical hardware and demonstrate engine operation.

- Perform detailed component and system design based on Phase I deliverables.
- Manufacture detailed design test articles (produce physical engines) utilizing low-cost supply chain suppliers.
- Build and assemble fully functioning engine test articles.
- Demonstrate a cost-effective, reliable engine start system.
- Design and integrate a cost-effective engine control solution.
- Conduct a comprehensive test and validation program including completion of the required environmental tests to demonstrate engine performance, reliability and robustness of design.
- Perform a full endurance run to operational mission profile documenting performance.
- Refine mass production cost estimates including complete cost analysis and future cost projections.
- Identify manufacturing industrial base supply chain performers.

- Monitor ongoing program risk and provide status updates throughout program progression. Prepare a Phase III commercialization/transition plan.

PHASE III DUAL USE APPLICATIONS:

- Utilize lessons learned in the Phase II outcome to perform final detailed design and design for manufacture updates to increase Manufacturing Readiness Level (MRL).
- Update and continue test campaign for finalized engine design qualification/acceptance testing.
- Deliver a comprehensive engine performance test report summarizing performance against Navy-approved ATLAS criteria.
- Provide a detailed transition plan moving from Proof of Concept (POC) to Full Rate Production (FRP),
- Monitor ongoing program risk and provide status updates throughout program progression.
- Interface with airframe producer integrate engine into a host airframe for flight testing.

REFERENCES:

1. "ONR SBIR Topic N251-056 (2025) Compact Prime Power Source for Unmanned Aerial Systems." https://navysbir.us/n25_1/N251-056.htm
2. Brendlinger, K. R., Grannan, N. D., Holley, A. T. and Muraleetharan, K. "Power Output of Small Gas-Turbine Engines." AIAA SCITECH 2022 Forum, 0063. American Institute of Aeronautics and Astronautics. https://doi.org/10.2514/6.2022-0063
3. Cukurel, B., et al. "3D Printed Jet Engines, a Micro Gas Turbine Revolution, and the Future of Energy." Technion, July 2, 2023. https://technionuk.org/news-post/prof-beni-cukurel-3d-printed-jet-engines-a-micro-gas-turbine-revolution-and-the-future-of-energy
4. Jones, A. D. and Harris, M. M. "An Overview of a Micro-Scale Gas Turbine Combustor Test Campaign." AIAA SCITECH 2026 Forum, 1566. American Institute of Aeronautics and Astronautics. https://doi.org/10.2514/6.2026-1566

KEYWORDS: Small Gas Turbine Engine, Advanced Manufacturing, Additive Manufacturing, Attritable, Disposable, Expendable Unmanned Arial Systems Propulsion, Low-Cost, 150-300 pounds of thrust, lbf, Limited Life Propulsion

DON27BZ02-NV024 TITLE: Zero-Retrofit Robotic Ammunition Handling for the MK 45 Mod 4, 5-Inch Gun Magazine

COMPONENT TECHNOLOGY PRIORITY AREA(S): Human-Machine Interfaces;Trusted AI and Autonomy

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

D 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 zero-retrofit robotic prototype capable of identifying, lifting, and loading 70-pound, 5-inch projectiles within the unmodified physical constraints of a DDG 51 class ships' MK 45 Mod 4 ammunition magazine during Sea State 5 conditions. This effort seeks a human-capable equivalent that matches the agility and operational tempo of a well-trained sailor, successfully removing human crews from the most physically exhausting and hazardous steps of the kill chain.

DESCRIPTION: The tight confines of a DDG 51 5-Inch ammunition magazine present a difficult challenge for automation. Traditional robotic arms require fixed mounting and large clearance envelopes, requiring complete compartment redesigns. To avoid extensive shipyard work, the robotic prototype must adapt to the ship. The prototype must navigate narrow aisles, step over "knee-knocker" coamings, and load ammunition into the existing hoists and stowage racks alongside or in place of human sailors.
The robotic prototype must execute capture and lift of 70-pound projectiles and their propelling charges, change their orientations while captured (i.e., pivot), move ammunition between stowage racks and hoists, and safely place the projectiles into the stowage racks and hoists in the proper orientation. Furthermore, the prototype must keep kinematic stability in high sea states (up to Sea State 5) while being able to continue to complete its tasking. The prototype must be resilient to electromagnetic interference (EMI)/electromagnetic pulse (EMP), and have a power supply architecture that enables sustained fire missions without the need for recharge or obstructive cables, and ability to rapidly swap power supplies without substantial downtime.

KEY PARAMETERS FOR ZERO-RETORFIT INTEGRATION:

- Payload Capacity: Continuous capability to lift, pivot, and load 70-pound projectiles and associated propelling charges. System must meet a minimum Threshold of 6 rounds per minute, with an Objective of 12 rounds per minute.
- Form Factor: Must fit within standard 24-inch shipboard aisles and maneuver in confined magazine spaces.
- Locomotion: Able to traverse standard deck plating, step over 6-inch coamings, and brace against ship motion.
- Stability: Maintain balance and load control up to and during Sea State 5 conditions (significant pitch/roll/heave).
- Power: Minimum 2-hour continuous operational endurance with rapidly hot-swappable battery packs (changeable in under 60 seconds).
- Hardening: Built to Military Standard (MIL-STD)-461 (EMI/EMP) and MIL-S-901D (Shock) thresholds.

- Safety/Fallback: Zero-retrofit integration (i.e., no structural alteration), ensuring the space stays 100-percent operational by human fallback crews in case of robot failure.
- Explosive Safety: Must adhere to NAVSEA OP 4 protocols for the safe physical handling of ordnance (Note: meeting specific electrical power level compliance is out of scope for this effort).

PHASE I: Develop a concept for a humanoid or pseudo-humanoid robot meeting the key parameters for zero-retrofit magazine operations. Conduct kinematic and dynamic simulations modeling the robot extracting, pivoting, and loading rounds in a virtual MK 45 magazine under Sea State 5 conditions. Perform trade studies on single-arm versus multi-arm torque constraints and bipedal versus pseudo-humanoid (quadruped, tracked, or other) stability. Prepare a report on physical design, power management strategy, and a Phase II prototyping/testing plan.

PHASE II: Fabricate a functional prototype based on Phase I designs. Assess the prototype in a land-based magazine mockup. Mount the mockup on a multiaxis motion simulator to replicate Sea State 5 roll and pitch. Demonstrate the robot successfully extracting dummy 5-inch projectiles from standard horizontal racks, navigating an aisle, and vertically seating the propelling charges and projectiles into a simulated hoist. Refine grasping effectors and stabilization software. Deliver a prototype, testing data report, and a Phase III ruggedization and integration plan.

PHASE III DUAL USE APPLICATIONS: Ruggedize the Phase II prototype to meet MIL-STD shock, vibration, and EMI/EMP requirements. Integrate the system at a live testing facility (e.g., Naval Surface Warfare Center (NSWC), Dahlgren, or NSWC, Port Hueneme) alongside a fully functional MK 45 Mod 4-gun mount. Demonstrate a sustained, full-rate fire mission using the prototype as the primary loader. Finalize production designs, deliver the testing data, and mature the prototype for transition to Navy for shipboard demonstration. Primary commercial dual-use sectors for this technology include: Power Infrastructure, Offshore and Onshore Oil Rigs, Mining, and Nuclear facilities. Ultimately, this technology establishes a commercial benchmark for removing human operators from high-risk, physically grueling industrial roles. Doing so preserves human capital for critical cognitive tasks while drastically reducing injury rates in hazardous environments.

REFERENCES:

1. Lattimer, B. Y. et al. "SAFFiR: Shipboard Autonomous Firefighting Robot." Virginia Tech/Office of Naval Research (ONR), 2014. https://www.navy.mil/Resources/Fact-FIles/Display-FactFiles/Article/2160601/shipboard-autonomous-firefighting-robot-saffir
2. Sentis, L. et al. "Design and Control of the Valkyrie Humanoid." NASA Johnson Space Center, Radford, N. A. et al. (2015). "Valkyrie: NASA's First Bipedal Humanoid Robot." Journal of Field Robotics, 32(3), 397–419.https://onlinelibrary.wiley.com/doi/10.1002/rob.21560
3. Johnson, M. et al. (2015). "Team IHMC's Lessons Learned from the DARPA Robotics Challenge Trials." Journal of Field Robotics, 32(2), 192–208 https://onlinelibrary.wiley.com/doi/10.1002/rob.21571
4. Hwangbo, J. et al. "Learning agile and dynamic motor skills for quadrupedal robots." Science Robotics, 2019. https://www.science.org/doi/10.1126/scirobotics.aau5872
5. Khatib, O. et al. "Ocean One: A Robotic Avatar for Oceanic Discovery." IEEE Robotics & Automation Magazine. 2016. https://ieeexplore/ieee.org/document/7742315
6. Vahrenkamp, N., Berenson, D., Asfour, T., Kuffner, J., & Dillmann, R. (2009). "Humanoid Motion Planning for Dual-Arm Manipulation and Re-Grasping Tasks." IEEE/RSJ IROS, pp. 2464–2470 https://ieeexplore.ieee.org/document/5354625/
7. Bostelman, R., Hong, T., & Marvel, J. (2016). "Survey of research for performance measurement of mobile manipulators." Journal of Research of the National Institute of Standards and Technology, 121, 342-366. https://nvlpubs.nist.gov/nistpubs/jres/121/jres.121.015.pdf

8. Kaneko, K. et al. "Humanoid Robot HRP-3P: A Robot Operating in the Real World." 2008 IEEE/RSJ International Conference on Intelligent Robots and Systems, Nice, France, pp 2471-2478. https://ieeexplore.ieee.org/document/4650604

KEYWORDS: humanoid robotics; pseudo-humanoid; biarmed manipulation; quadrupedal robotics; MK 45 Mod 4, 5-Inch Gun; counter unmanned surface and aerial systems, counter-UxS; ammunition magazine; ammunition handling; heavy-lift robotics; zero-retrofit integration; dr

DON27BZ02-NV025 TITLE: Innovative Shortwave Infrared High Energy Laser Source and Coupled Imager

OUSW (R&E) CRITICAL TECHNOLOGY AREA(S): Scaled Directed Energy (SCADE)

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Directed Energy (DE);Integrated Sensing and Cyber

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

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 compact, ruggedized high-energy laser source operating at the 1.9-2.5 micron wavelength with variable Continuous wave and pulsed output [zero to kilowatt kW class average powers] with a time-coupled imaging range gated imaging sensor, capable of real time or near real time doppler data collection & object visualization with ten meter (threshold) to sub-meter (objective) scale range selection, and suitable for maneuvering object discrimination at kilometers of distance at low altitudes, in a quiescent (threshold) or turbulent (objective) maritime atmospheric condition.

DESCRIPTION: The Navy desires a short wave infrared high energy laser illuminator and coupled range-gated imaging sensor, including optics, operating in 1.9-2.5 micron wavelength to increase engagement ranges in adverse marine atmospheric conditions that include absorption, Mie and Rayleigh scattering, thermal blooming, etc. and able to operate in continuous wave (CW) or pulsed operation modes – at a variable power level up to kilowatt powers (average). Adjustable wavelength tunability to match to optimal atmospheric penetration and transmission within the band specified is required. If the entire band is not accessible, then rationale must be provided for limitation or selections made. In addition, it requires these to be ruggedized, so they are suitable to be installed on maritime platforms (i.e., ships, USMC ground vehicles, and aircraft) and be in a wavelength regime that is considered “eye-safer” when considering issues of defuse reflection or scatter when nearby observers are present. Gimbal and optics development or advancements in the shortwave infrared regimes may be offered but are not the primary technical objective in consideration for this topic.

Recent advances in laser sources [Ref 1] with high beam quality at the 2 micron wavelength, using Holmium and Thulium doped fiber optic-based power gain amplifiers, have shown a potential pathways for innovation to reach higher average powers (in Continuous Wave operation) in the multi-kilowatt regime, within the 2.0 to 2.4 micron (μm) band and falling within an atmospheric spectral short-wave infrared (SWIR) transmission band due to their low absorption of light by atmospheric water vapor. A pulsed system with a pulse gated optical imaging sensor offers the unique opportunity to not only provide a simple Laser Detection and Ranging (LIDAR) capability but also provide doppler-based discrimination information on the imaged objects – which could exceed systems’ capabilities typical from the 1.0-1.6 micron near infrared (NIR) band. The marine wave boundary layer (MWBL) can have higher scattering properties when comparing NIR to the selected SWIR bands, and is considered less detectable using widely available commercial, uncooled sensors than standard visible to NIR based illumination systems.

A system that can operate in either CW or coupled pulse modes with a time resolved, range gated sensor and with high resolution windowing is the primary objective of this topic.

The Navy and Department of War seeks a unified approach with a scalable prototype device for use in evaluation for Electro-magnetic (EM) Spectrum warfare with an objective of gaining military advantages and achieving freedom of action across missions in support of maritime, surface warfare. However, the one system should show an ability to handle two separate capabilities developed through scaling. The first is development of a small, compact, lightweight SWIR (2.0-2.4 wavelength) high energy laser illuminator and coupled range-gated imaging sensor, including necessary optics suitable for short range sensing from small (group I or II) unmanned aerial vehicles or drones. While shorter ranges are acceptable for these missions (tens to hundreds of meters), the need for higher power still exists to conduct object discrimination at longer range (kilometers) and collect as much information (e.g., doppler shifts) from sensors as is technically possible. These smaller devices may diverge because of the requirements of size, weight and power (SWaP) toward a lower power-ganged diode array of microbolometers that has sufficient optical gain sensitivity to achieve doppler data, at the sacrifice of higher resolution spatial data typically obtained from devices that are based on focal plane arrays. Hybrid approaches combining sensor types shall be considered. Imaged target objects are expected to be in centimeter to meter size, and either stationary or have relatively low velocities (meters per second).

At the other end of the scale, a desire exists for a larger, fixed placement optical device on a moving or mobile platform (i.e., ground, air or sea-based vehicle) that can accurately discriminate and range objects at significantly greater distances (hundreds of meters to tens of thousands of meters) and are larger (tens of meters in length) with higher velocities (from tens to hundreds of meters per second). These systems require significantly higher source power, larger optics and higher quality vibration control, longer photonic travel distance, shorter pulse lengths, and higher peak power; have longer latency of time from emission to reception; and include the optical distortions that occur during light travel, reflection, and return. These larger devices may favor a combination of both focal plane arrays with coupled microbolometers using highly resolution time coupled range gating techniques, and significant relaxation of SWaP and include potentials for active cooling. However, the complexities of field conditions where the systems are deployed can vary greatly, with humidity (0-100%), rain, fog, particulates, and temperature variation (-55°C to +125°C) are not negotiable for either class of system. The need for higher laser power may be approached by beam combining smaller sources, but simplicity is preferred with ruggedness to dynamic shocks required under this topic, at least initially.

This effort is driven by both new threats and available and emerging technologies that have the potential to vastly improve the agility and flexibility of the Navy systems by utilizing high-energy lasers for Battle Space Supremacy and Water Space Management as envisioned by the Chief of Naval Operations (CNO). The current technology for High Energy Laser (HEL) at this wavelength for kilowatt class amplifiers is in early development. A major challenge exists for this technology to be viable for development of doped fiber for the 2 μm kW class fiber amplified systems; however, other potential laser source types will be considered. Gaseous and chemical lasers are not considered to be acceptable for this solicitation. The Navy seeks to address the manufacturability, electrical-to-optical (EO) efficiency and conduct technology risk assessments and risk reduction of this class of solid-state laser amplifier design.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by 32 U.S.C. § 2004.20 et seq., National Industrial Security Program Executive Agent and Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved by the Defense Counterintelligence and Security Agency (DCSA) formerly Defense Security Service (DSS). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances. This will allow contractor personnel to perform on advanced phases of this project as set forth

by DCSA and ONR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material during the advanced phases of this contract IAW the National Industrial Security Program Operating Manual (NISPOM), which can be found at Title 32, Part 2004.20 of the Code of Federal Regulations.

PHASE I: Develop, demonstrate, and deliver a small scale, efficient, coupled prototype high energy laser and coupled imager module system suitable for testing and evaluation on a class I or class II unmanned air vehicle or fixed ground system. Document the development, design, and if possible- demonstrate IP67 rating compliance with a scale device, where the device is completely dust-tight and protected against temporary immersion in water (between 15 cm and 1 meter deep) for up to 30 minutes as defined by the International Electrotechnical Commission (IEC) IP67 standards. Provide initial laboratory or field test results and analyses. Alternately, a benchtop experiment with a IP67 system design may be offered. Demonstrate the scalability of individual components to increase power to achieve higher output power with higher beam quality. Deliver the prototype to the NSWC Dahlgren Navy lab to evaluate the performance of the system in terms of power specifications, wavelength, beam quality and EO efficiency for a HEL prototype system that can meet Navy performance goals.

Develop and design, but do not build, a scalable prototype laser (kW class) module for long distance sensing by delivering analysis and documentation of the design as an entry for Phase II with a selected use case. Establish the feasibility of the design. Complete any required market survey needed to show sourcing of components, that the developed approach is technically sound, and that a conceptual device is deliverable at the end of Phase II. Indicate areas where specific design details may require additional technical study and testing to ensure that higher resolution imaging with long range discrimination of objects can be improved or how additional data analysis of doppler information would impact design trades. Develop a conceptual manufacturing plan related to sensor options and capabilities that include cost estimates for Phase II.

PHASE II: Develop, demonstrate, and deliver a scaled up larger, coupled prototypical high energy laser and imaging sensor and optics system suitable for field testing and evaluation mounted into a system determined within Phase I. Document the design and demonstrate environmental containment and ruggedization of the device on a shake table that emulates the motion and vibrational spectrum of the platform. Demonstrate high power output in continuous wave operation for at least 5 minutes. Demonstrate pulsed laser to sensor object discrimination and utility of individual components to achieve higher accuracy at longer ranges and compare capabilities to more traditional commercial off-the-shelf (COTS) LIDAR based rangefinders for the selected and intended use cases. Demonstrate laser output power variability while maintaining higher beam quality. Deliver the prototype to the Naval Research Laboratory or the NSWC Dahlgren Navy lab to evaluate the performance of the system in terms of power specifications, wavelength, beam quality and EO efficiency for a HEL prototype system in field testing, reaching expected Navy performance goals.

Develop, design, and build, a scalable prototype laser (kW class) module for long distance sensing. Deliver analysis and documentation of the design as an entry for Phase II. Complete any required market survey needed to show sourcing of components and developed approach is technically sound and that a conceptual device is deliverable and able to be tested at the end of Phase II at longer ranges. Indicate areas where specific design details may require additional technical study and testing to ensure that higher resolution imaging with long range discrimination of objects can be improved or how additional data analysis of doppler information would impact design trades.

Work in Phase II may become classified. Please see note in the Description.

PHASE III DUAL USE APPLICATIONS: Support Navy technologies transition for Department of War use. Show the scalability of source power from micro or milliwatt levels to multi-kilowatt class operation and beyond in the shortwave infrared regime.

Ultimately, laser sources and coupled sensor subsystems will be deployed on surface ships, ground vehicles, or air vehicles – with potentials for other Navy or U.S. Marine Corps platforms to advance the future electromagnetic spectrum operational warfighting capabilities. Both the power specifications and wavelength of operation and electrical to optical (EO) efficiency will be tested at either the Naval Research Laboratory or at the NSWC Dahlgren-Navy HEL test facility.

Potential dual use of this system: manufacturing such as cutting/welding, optical communication and use in space or airborne platform for sensing and geospatial mapping. The most important characteristics of this wavelength are it is less affected by atmospheric distortions when operated near marine wave boundary layer (MWBL) and the consideration for "eye-safer" operation when the pulsed emission is diffusely reflected or resulting from scattered light – greatly reducing the potential for eye damage from photonic energy interaction with the structure of the human eye.

REFERENCES:

1. Shaw, L.Brandon et al. "Fabrication of Cladded Single Crystal Fibers for All-Crystalline Fiber Lasers." Advanced Photonics, Optica Publishing Group, 2018.. https://doi.org/10.1364/SOF.2018.SoW2H.3
2. Wu, J. et al. "Single-frequency fiber laser at 2.05 m based on Ho-doped germanate glass fiber." Fiber Lasers VI: Technology, Systems, and Applications, Proc. of SPIE Vol. 7195, 2009, 71951K. https://doi.org/10.1117/12.809482
3. Lombard, L.et al. "Eyesafe coherent detection wind lidar based on a beam-combined pulsed laser source." Opt. Lett. 2015, 40, pp. 1030-033. https://opg.optica.org/ol/abstract.cfm?uri=ol-40-6-1030
4. Dombrowski, Mark et al. "Object discrimination and optical performance of a real-time 2-5 um hyperspectral imager." Proc. SPIE 6233, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XII, 62330Q, 8 May 2006. https://doi.org/10.1117/12.665906
5. "National Industrial Security Program Executive Agent and Operating Manual (NISP), 32 U.S.C. § 2004.20 et seq. 1993." https://www.ecfr.gov/current/title-32/subtitle-B/chapter-XX/part-2004

KEYWORDS: High Energy Laser; Short Wave infrared; SWIR; Laser Detection and Ranging; IDAR, Doppler, Optical Amplifier; Optical Efficiency; Electro Magnetic Spectrum; Marine Wave Boundary Layer; marine wave boundary layer; MWBL