DEPARTMENT OF THE NAVY (DON)
Small Business Technology Transfer (STTR)
DOW 2026 STTR BAA Release 1
Proposal Submission Instructions

IMPORTANT

- **The following instructions apply to STTR topics only:**
  - **DON26TZ01-NV001 through DON26TZ01-NV019**
- 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.defensesbirsttr.mil/SBIR-STTR/Opportunities/#announcements. Select the tab for the appropriate BAA cycle.
  - 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.
- **DON Phase I Technical Volume (Volume 2) page limit is not to exceed 10 pages.**
- Phase I Technical Volume (Volume 2) and Supporting Documents (Volume 5) templates, specific to DON topics, 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 usn.pentagon.cnr-arlington-va.mbx.navy-sbir-sttr@us.navy.mil or appropriate Program Manager 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 usn.pentagon.cnr-arlington-va.mbx.navy-sbir-sttr@us.navy.mil

TABLE 2: DoN SYSTEMS COMMANDS (SYSCOM) SBIR PROGRAM MANAGERS

Topic Numbers	Point of Contact	SYSCOM	Email
DON26TZ01-NV001 to DON26TZ01-NV004	Ms. Kristi DePriest	Naval Air Systems Command (NAVAIR)	navair-sbir@us.navy.mil
DON26TZ01-NV005 to DON26TZ01-NV006	Mr. Jason Schroepfer	Naval Sea Systems Command (NAVSEA)	NSSC_SBIR.fct@navy.mil
DON26TZ01-NV007 to DON26TZ01-NV019	Mr. Steve Sullivan	Office of Naval Research (ONR)	usn.pentagon.cnr-arlington-va.mbx.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 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 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. 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 $140,000.
    - Phase I Option amount must not exceed $100,000.
    - Costs for the Base and Option must be separated and clearly identified in Volume 3.

- For Phase I a minimum of 40% of the work is performed by the proposing SBC, and a minimum of 30% of the work is performed by the single research institution. The percentage of work requirement must be met in the Base costs as well as in the Option costs. The percentage of work is measured by both direct and indirect costs. To calculate the minimum percentage of effort 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 single research institution percentage is calculated by taking the sum of all costs attributable to the single research institution (identified as Total Subcontractor Costs (TSC) 1 in DSIP Cost Volume) 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.
    - Research Institution (numerator for Research Institution calculation):
        - Total Subcontractor Costs (TSC) 1
    - 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 sponsoring SYSCOM'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 SYSCOM 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.

  All proposing SBCs must review and submit the following items, as applicable:

- **Allocation of Rights.** Required for all SBCs proposing to STTR. In accordance with the SBIR and STTR Policy Directive section 8(b) and DFARS 252.227-7040, the proposing SBC must submit this agreement as an upload as a separate PDF file in Volume 5, Supporting Documents. The STTR Allocation of Rights template must be used and is available on https://navysbir.com/links_forms.htm. Please refer to the Proposal Preparation Instructions and Requirements section of the DOW STTR Program BAA for information on this requirement.

- 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) (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 Certification (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 Section 4 of the SBIR and STTR Extension Act of 2022 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 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 ($140,000) and Option ($100,000).
  - Must meet minimum percentage of work; 40% of the work is performed by the proposing SBC, and a minimum of 30% of the work is performed by the single research institution. The percentage of work requirement must be met in the Base costs as well as in the Option costs.
  - **Cost Sharing: Cost sharing is not accepted on DON Phase I proposals. A value above or below $0.00 is entered in the Cost Sharing field will not be considered in the Phase I contract award.**

- **Company Commercialization Report (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 Due Diligence 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.

Due Diligence Program to Assess Security Risks. The SBIR and STTR Extension Act of 2022 (Pub. L. 117-183) requires the Department of War, in coordination with the Small Business Administration, to establish and implement a due diligence program to assess 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 Due Diligence Program to Assess Security Risks will be implemented for all Phases.

Discretionary Technical and Business Assistance (TABA). The SBIR and STTR Policy Directive section 9(b) allows the DON to provide TABA (formerly referred to as DTA) to its awardees. 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; and commercializing the SBIR/STTR product or process, including intellectual property protections. Proposing SBCs may request, in their Phase I Cost Volume (Volume 3) and Phase II Cost Volume, to contract these services themselves through one or more TABA providers in an amount not to exceed the values specified below. The Phase I TABA amount is up to $6,500 and is in addition to the award amount. The Phase II TABA amount is up to $25,000 per award, is to be included as part of the award amount, and is limited by the established award values for Phase II by the SYSCOM (i.e., within the $2,000,000 or lower limit specified by the SYSCOM). As with Phase I, the amount proposed for TABA 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 STTR proposing SBC. A Phase II project may receive up to an additional $25,000 for TABA as part of one additional (sequential) Phase II award under the project for a total TABA award of up to $50,000 per project. 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 the TABA request does not include the following items the TABA request will be denied.

- TABA provider(s) (firm name)
- TABA provider(s) point of contact, email address, and phone number
- An explanation of why the TABA provider(s) is uniquely qualified to provide the service
- Tasks the TABA provider(s) will perform (to include the purpose and objective of the assistance)
- Total TABA provider(s) cost, number of hours, and labor rates (average/blended rate is acceptable)

TABA must NOT:

- be subject to any indirect costs, profit, or fee by the STTR proposing SBC
- propose a TABA provider that is the STTR proposing SBC
- propose a TABA provider that is an affiliate of the STTR proposing SBC
- propose a TABA provider that is an investor of the STTR proposing SBC
- propose a TABA provider that is a subcontractor or consultant of the requesting SBC otherwise required as part of the paid portion of the research effort (e.g., research partner, consultant, tester, or administrative service provider)

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 SYSCOM) - 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
- Phase II: A total of $25,000 per award, not to exceed $50,000 per Phase II project

If a proposing SBC requests and is awarded TABA in a Phase II contract, the proposing SBC will be eliminated from participating in the Navy SBIR Transition Program (STP) and any other Phase II assistance the DON provides directly to awardees.

All Phase II awardees not receiving funds for TABA in their awards must 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. Navy STP information can be obtained at: https://navystp.com. Phase II awardees will be contacted separately regarding this program.

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.

Partnering Research Institutions. The Naval Academy, the Naval Postgraduate School, and other military academies are Government organizations but qualify as partnering research institutions. However, DON laboratories DO NOT qualify as research partners. DON laboratories may be proposed only IN ADDITION TO the partnering research institution.

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. 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 SBCs 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 DON SYSCOM Program Managers listed in Table 2 above. For protests filed with the GAO, a copy of the protest must be submitted to the appropriate DON SYSCOM Program Manager 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. Additionally, to adjust for inflation DON has raised Phase I and Phase II award amounts. The maximum Phase I proposal/award amount including all options (less TABA) is $240,000. The Phase I Base amount must not exceed $140,000 and the Phase I Option amount must not exceed $100,000. 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 SYSCOMs 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 the 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 SYSCOM 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 STP).

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.

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DON26TZ01-NV001 TITLE: Thermally Tolerant Optical Fire Detectors

COMPONENT TECHNOLOGY PRIORITY AREA(S): Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Development and demonstration of an optical fire detector capable of an artificial intelligence/machine learning (AI/ML)-enhanced Optical Fire Detector (OFD) capable of operating in temperatures up to 400°F, enabling deployment in high-performance engine nacelles without compromising responsiveness or coverage.

DESCRIPTION: All aircraft engine nacelles require reliable and rapid-fire detection systems to ensure airworthiness and flight safety. OFDs are preferred over other technologies due to their fast response times and comprehensive coverage. However, existing OFDs are typically limited to operating in temperatures below 200°F, rendering them unsuitable for certain high-temperature nacelle environments that exceed this threshold.
Current Limitations of the Alternative (Thermally Robust Temperature-sensing Lines):
• Slower detection response compared to optical methods
• Limited coverage due to sensor placement constraints
• Lack of non-destructive calibration, increasing maintenance complexity and downtime
AI/ML Integration for False Alarm Reduction:
• Real-time signal classification to distinguish between genuine fire signatures and benign stimuli such as sunlight, engine exhaust, or infrared (IR) reflection
• Adaptive filtering based on operational context, reducing nuisance alarms and increasing system confidence
Thermal Design Enhancements:
• Material and packaging innovations to withstand prolonged exposure to 400°F (204°C) environments
• Calibration methodologies resilient to the thermal cycling, vibration, and Electromagnetic Interference common to nacelle-mounted systems
• Integration compatibility for both retrofit of legacy platforms and new platforms.
Expected Benefits:
• Improved fire detection performance in thermally extreme zones
• Increased aircraft survivability and mission readiness
• Enhanced maintainability through non-invasive self-test and diagnostic capabilities
• Improved fleet sustainability

PHASE I: Develop an innovative approach for an OFD suitable for use in a hot (up to 400°F) aircraft environment. Demonstrate the OFD detection capability of a hydrocarbon flame in a 400°F environment, as well as the ability to avoid a false alarm from other light or heat sources.
The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Develop and demonstrate practical implementation of a production-scalable OFD developed in Phase I that can function as a “drop-in” replacement for current fire detectors (mounting and wiring). Evaluate performance of production scalable unit in accordance with MIL-F-23447 and MIL-STD-810H.

PHASE III DUAL USE APPLICATIONS: Produce a functional OFD that passes all environmental and fire detection qualification testing. Prepare the OFD for installation on a selected aircraft. Deliver all needed data to verify functionality for fire detection and any limitations due to false positives. Document any software needed for fire detection used in the OFD.
Thermally tolerant and robust OFD benefits commercial aircraft by enabling mounting in high temperature areas. The increased operational temperature would increase the life of the component. OFDs

can also be used in manufacturing, chemical process, and oil refinement. High temperature environments may be needed or result in these industries. Any improvements to software detection through AI/ML would reduce the number of false positives, which results in a reduction of expensive cleanup, extensive operation downtime, and potential environmental issues.

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KEYWORDS: Optical Fire Detector; OFD; Fire protection; High temperature; Electronics; Fire; Flame

DON26TZ01-NV002 TITLE: Modeling for Frontal Polymerization Curing Process

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a multiphysics model or toolset to predict frontal polymerization phenomena and to optimize the resin additives (e,g., catalyst, inhibitor, etc.) for an optimized cure with less distortion or residual stress, while ensuring that the front does not self-extinguish.

DESCRIPTION: Frontal polymerization is the process of curing a resin monomer into a polymer with a localized self-sustaining and moving reaction zone. Frontal polymerization has many benefits over traditional resin cure methods, such as reduced cure time from many hours to seconds or minutes [Refs 1,-2], a significant reduction of the energy required to cure (in some cases over 99.5%) [Ref 3], and reduced cost associated with curing a resin [Ref 3].

Frontal polymerization has many potential applications such as increasing cure percentage for thermoset additive manufacturing processes without requiring a post cure, rapid manufacturing of composite structures, and rapid composite curing for accelerated repairs of composite structures.

Frontal polymerization is a very boundary condition dependent process. Changes in boundary conditions, initial conditions (including temperature and initiation methods), resin formulations, resin or composite thickness, as well as the addition of reinforced fibers or materials can drastically affect characteristics like front velocity, front temperature, and whether a front is sustained or terminated. This can make it challenging to predict and synthesize resin systems that can sustain a frontally polymerized cure with different initiation methods, environmental conditions, composite/resin thicknesses, and reinforcement materials.

Currently, phenomenological multiphysics modeling efforts for frontal polymerization are limited to 1D, 2D, or small 3D models, since they are very computationally demanding due to the highly nonlinear coupling of the governing equations and short timescales required for accurate solution convergence. Furthermore, many models do not predict the mechanical response resulting from the frontal polymerization process (i.e., warpage or residual stress of the polymer caused by the frontal polymerization process). Surrogate modeling can drastically reduce the time to simulate a front but often requires training to create the surrogate model in the form of many finite element analyses or experiments that can be very time consuming. Recently a mechanism-based approach has been created, allowing for prediction of frontal polymerization phenomena without requiring differential scanning calorimetry (DSC) testing to obtain properties for different resin formulations [Ref 4].

This STTR topic calls for development of a model or toolset to predict characteristics of the frontal polymerization process such as front temperature, front velocity, and cure percentage, as well as the resulting effects from the frontal polymerization process such as warpage, residual stress, or post cure mechanical strength. The model should work for multiple initiation methods (i.e., a point initiation of the front, line initiation, and planar initiation for the front (for simulating a point heat source, a line/wire heat source, and a planar heat source). The model should also be scalable, allowing for simulation of different/larger geometries without detrimental increases in computational time. This topic falls under the NAWCAD STTR focus area for in situ material detection and repair solutions.

PHASE I: Develop the framework for a model and determine if the model can predict a frontal cure of a resin with at least one experimentally cured front of a resin as the starting foundation for validation of the model. The model should predict characteristics such as cure percentage, thermal gradients, and front velocity.

The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Use a model or framework to optimize additive concentrations (e,g,, catalyst wt%, inhibitor wt%, etc.) to reduce distortion, front temperature, or residual stress for a frontally cured polymer, while ensuring that the front is sustained leading to a fully cured polymer. Use a model or have a framework for simulating or predicting the curing of a fiber reinforced resin. Optimize the additive concentration percentages to reduce distortion of a frontally cured composite patch or panel, while maximizing the percent fiber volume fraction, and ensuring a sustained front/cure. Experimentally validate the model via frontally cured resin and frontally cured composite samples. Optimize the frontal polymerization process for a successful composite cure for different boundary or initial conditions (i.e. ambient temperatures, thicknesses of composite, initiation methods, etc.).

PHASE III DUAL USE APPLICATIONS: Fully develop the model and transition the model and frontal polymerization technology targeting repair applications for NAVAIR. Create representative panels and/or repair patches that meet specifications required for Navy adoption of the technology.
This technology could benefit the private sector by reducing time and cost associated with curing composite structures or performing composite repairs. This could lead to a reduced cost for cured composite structures. Potential secondary applications include reduced cost automotive composite manufacturing, marine/boat composite manufacturing, and renewable energy composite manufacturing.

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KEYWORDS: Frontal Polymerization; Finite Element Analysis; Composites; Rapid Manufacturing; Rapid Repair; Multiphysics Modeling; Polymerization

DON26TZ01-NV003 TITLE: Advanced Liquid Hydrogen Storage and Employment Methodologies for Unmanned Aerial Systems

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a cryogenic liquid hydrogen storage and delivery solution that can achieve high hydrogen mass fraction and a low boil off rate. Demonstrate that the cryogenic liquid hydrogen storage system improves endurance, range, and continuous payload power in an unmanned aerial system (UAS).

DESCRIPTION: Hydrogen fuel-cell-powered air systems are becoming more prevalent in aviation [Refs 1-4]. Although compressed gaseous hydrogen has traditionally been employed to power these systems, cryogenic liquid hydrogen has recently started gaining traction [Refs 5-8]. Overall, liquid hydrogen storage provides added benefits such as reduced weight and volume compared to gaseous hydrogen storage, but there are still challenges to air vehicle integration and long-term use due to the extreme low temperature and other properties of liquefied hydrogen [Refs 9-10].
This STTR topic is seeking a liquid hydrogen storage and delivery solution that achieves high performance metrics while also maintaining longevity, safety, and usability for US Navy and US Marine Corps UASs. The performance metrics of interest for the delivered solution include a gravimetric hydrogen storage efficiency = 40% and volumetric hydrogen storage density of > 40 g/L. The integrated solution must also maintain a hydrogen boil-off rate of < 10% mass per day, as well as a gaseous hydrogen delivery system that can meet the flow and temperature requirements of the fuel cell. A liquid hydrogen filling method and procedure shall be defined with an emphasis on minimizing loss of hydrogen. Additionally, the storage vessel shall be reusable and able to achieve > 100 fill cycles. The storage solution and filling procedure must also meet standard safety requirements such as those called out in DOC 06/02/E on the H2 Tools website [Ref 11].
Additionally, consideration should be made for integration into a range of UAS sizes from a Group 2 to Group 5. This shall include considerations for fuel level monitoring and sloshing effects during flights, as well as meeting necessary environmental (basic hot and basic cold), shock, and vibration requirements called out in MIL-STD-810-H [Ref 12]. Ability to demonstrate that the new cryogenic liquid hydrogen delivery system can manage and mitigate thermal loads of UAS mission systems is of particular interest. Finally, cryo-compressed hydrogen solutions will also be considered if it meets the key performance parameters outlined here.

PHASE I: Develop a design for a holistic liquid hydrogen storage and delivery solution that is validated through material analysis and/or modeling and simulation. The design should include a trade study that demonstrates how metrics such as size, weight, and volume affect the overall boil-off rate as well as gravimetric and volumetric storage efficiency. The analysis should assume normal hydrogen and include expected liquid hydrogen fill rate, precooling requirements, and storage vessel cycle life. UAS load profile and fuel cell requirements will be provided by the Government and/or UAS supplier and should be incorporated into the heat leak rate and hydrogen flow requirements to optimize design. Incorporation of a battery to meet peak loads can also be considered in the optimization trade study. Investigation should emphasize UAS integration, be performed over a range of liquid hydrogen storage amounts from 0.5 kg up to 100 kg and consider thermal management opportunities such as cooling UAS systems like payload and avionics. Overall, incorporation of test data to validate analysis is encouraged.
The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Build a prototype liquid hydrogen storage vessel and gaseous hydrogen delivery system and demonstrate a filling procedure. Complete an end-to-end bench test of the overall system to demonstrate operational performance in a relevant environment. Collaborate with a UAS manufacturer chosen by the Government to integrate the storage and delivery system.

PHASE III DUAL USE APPLICATIONS: Demonstrate the manufacturing maturity of the integrated storage, delivery, and filling system. Develop the operation, maintenance, storage, and safety procedures for using the system in an unmanned aerial vehicle. Demonstrate that the system meets all UAS requirements while also improving its operational capabilities such as endurance, range, and continuous payload power.
This technology is highly relevant to the commercial urban air mobility market. A high-performance hydrogen system would have improved range and flight time compared to current platforms that rely on batteries.

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KEYWORDS: Hydrogen; Liquid Hydrogen; Cryogenics; Storage; Fuel Cell; Unmanned Aerial System; UAS

DON26TZ01-NV004 TITLE: Non-Proximate Chemical Analysis by Field Portable Mass Spectrometry and Robotics

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Design, build, and operate a portable mass spectrometer outfitted for proximal detection with a flexible inlet on a land-based robot, to collect real time mass spectra and chemical data at the source.

DESCRIPTION: Mass spectrometers provide unparalleled chemical detection and identification, specifically by use of high-resolution system or tandem mass spectrometry (MS/MS). Field portable mass spectrometers have been commercialized for decades and have led to the ability to detect chemicals of concern at the source. Unlike traditional mass spectrometry where sample preparation is required to get analytes into a form factor amenable for analysis, ambient ionization mass spectrometry has demonstrated proximate detection, with no sample preparation, if the test subject can be placed in front of the mass spectrometer inlet. A plethora of ambient ionization sources for drug, chemical warfare, explosive, and environmental detections of bulk objects in their original form factors with no sample preparation.
Not every test subject however will fit in front of the mass spectrometer's inlet, nor can the ionization source be positioned in such a way to accommodate the test subject. Other ionization sources such as swabs and contact transfer touch sprays have been developed to sample an area and bring the sample to the mass spectrometer. This requires a trained user and sampling error can often be the largest challenge in these samplings.
Non-proximate methods, essentially changing the inlet of the mass spectrometer, have been developed and demonstrated. For example, sampling explosives and chemical warfare agents from ambient surfaces at distances of up to 3 meters from the mass spectrometer has been demonstrated [Ref 9]. However, this method was performed with a rigid inlet and while non-proximate distances were achieved, the flexibility of the sampling was limited, and it would be difficult to adapt to a robotic arm on a rover such as those used by Explosive Ordnance Disposal (EOD).
The objective of this STTR topic is to demonstrate a portable mass spectrometer that has a flexible inlet that could be brought to the test subject and manipulated by a robotic arm platform to collect chemical data at the source. The inlet and the subsequent ionization source combination must be ruggedized and manipulated by a robotic arm to move both to position for sampling. The mass spectrometer must provide remote red light / green light results to the operator from a standoff distance. It must be operational in varying levels of humidity, temperature, and ability to detect a wide array of chemicals.

PHASE I: Design a detailed model and parts inventory for a non-proximate mass spectrometry inlet or ion transport device that is flexible and positionable by a robotic arm. Detail ionization source that will be selected to interface with mass spectrometry inlet and demonstrate that it can be moved by a robotic arm. Design a detailed model and parts inventory for a field portable mass spectrometer (MS) that will couple to the flexible non-proximate inlet, taking into consideration Size, Weight and Power (SWaP) requirements and how it will interface and operate on a robotic arm on a rover. Adaptation of commercial field portable mass spectrometer to interface with a flexible inlet is also appropriate.
Provide a parts list with material type and weight for each component (required). The battery for the MS should last at least 3 hours before needing to be recharged. The casing of the flexible inlet, ionization source, and MS should be ruggedized, water resistant, and ensure that the instrument is not damaged upon movement. The MS must be operational during and after movement. Additionally, the MS must be operational at a temperature range of -25 °F to 120 °F (Threshold (T)), -35°F to 135°F (Objective (O)). Consult MIL-STD-810 Test Methods: 501.6 High Temperature, 502.6 Low Temperature, 507.6 Humidity, and 510.6 Sand and Dust when designing and selecting the material and layout of the system.

The overall layout of these components for the final system should be sketched and the overall size should be as compact as possible. The communication of the MS to the control system at the operator should be detailed. The MS should have an operating mass range at least from m/z 50 to m/z 500 to detect a wide range of chemical threats. Detection limits for chemical threats must be less than 100 ppb (T), in the ppt range (O).
The Phase I Option, if exercised, should be used to further develop and improve the design and, possibly, to demonstrate key components.
The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Construct the non-proximate inlet and interface with field portable MS with the aforementioned operational specifications from Phase . Interface the non-proximate inlet and ionization source with a commercial off-the-shelf (COTS) robotic arm that could be mounted to a rover for sampling remote and hard to reach locations. The MS should be able to be operated remotely and have a database capability of providing red light / green light results to the operator based upon both mass spectra and tandem mass spectra. The system must provide remote results and be fully operational while the robotic arm is in motion. Demonstrate the detection of three target chemical threat simulants from surfaces that cannot be moved to a traditional stationary inlet. Guidance will be provided to threat simulants at the start of Phase II, but they will be within the required mass range. Deliver one operational unit to the Navy.

PHASE III DUAL USE APPLICATIONS: Final testing and demonstration / evaluation would be conducted in theater and on forward operating bases. Scenarios could be standoff detection of unknown objects and suspected hazardous threats, gathering chemical information from object difficult to sample that may have moved through a hazardous environment (under side wing of an aircraft), or when human / physical interaction with a sample is not ideal.
Ample forensic applications for this technology exist in drug, chemical warfare agent, and explosives detection. There are also potential dual use applications in the pharmaceutical and industrial processes such as inspecting the inside of a chemical reactor / checking the cleanliness after a process or within quality control areas. There are also environmental dual use applications for traversing hard to sample locations and instead being able to send the rover and sampling apparatus into the space.

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KEYWORDS: Mass spectrometry; Non-proximate detection; Rover; Field portable; Automation; Chemical analysis

DON26TZ01-NV005 TITLE: Automatic Cable Tester

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a low-cost and user-friendly automatic cable tester capable of universally testing continuity, resistance, and isolation of both Copper, Radio Frequency (RF) cables, and the impedance of Fiber Optic cables via Optical Time Domain Reflectometry (OTDR), while rapidly generating easily read quality assurance reports.

DESCRIPTION: While a DDG 51 Class Ship is undergoing modernization, significant time is spent testing continuity, resistance, and isolation on large numbers of Copper, RF cables, and impedance of Fiber Optic cables. For example, within the combat systems alone, there are over 2,900 interfaces that require such testing. With the numerous amounts of cables needed to be tested on board a ship, manual testing of each cable can take several hours compared to several minutes or less with utilization of an automatic tester.

While approximately 175 adapters and kits are available for automatic cable testing, there are no universal devices capable of testing Copper, RF, or Fiber cables. The automatic tester must be equipped with low-cost software and adapter kits for both the “local” and the “remote” sides of the varieties of copper cables and connectors under test. The Navy needs a cable analyzer that can perform a variety of multi-pin connections along with a Fiber Optical Loss Test Set (OLTS)/ OTDR tester capable of utilizing the existing and approved testing standards or featuring an innovative unconventional low-cost means of examining each cable and loopback.

The Navy seeks an automatic cable tester capable of testing the connectivity, continuity, and isolation of both Copper, RF and Fiber Optic cables. The development of an inexpensive, portable, universal cable tester system, able to portray data in real time is desired. The tester must be able to easily connect to the variety of connectors on the cables previously mentioned and reduce both the number of test-connectors necessary to operate as well as the overall cost of the prototype/production system. The software used by the tester should be able to be either Microsoft-based software or one easily convertible into an Excel format for recording test data. The solution should be easily transported by one sailor to allow for convenient movement through tight hatchways and spaces found within a DDG 51 Class Ship. The prototype developer should also document specifics of a life cycle management program both for the tester and all components. The developed solution should shorten the length of time required to test all connections on a ship undergoing modernization.

PHASE I: Develop a concept for an automatic cable tester and demonstrate that the concept meets all parameters in the Description. Demonstrate the feasibility of the concept in meeting Navy needs by component evaluation and analytical modeling. The Phase I Option, if exercised, should include the initial layout and capabilities to build the prototype in Phase II. Prepare a Phase II plan.

PHASE II: Develop and deliver for evaluation and testing a prototype accompanied by a complete connector kit for Navy testing. Design all system components to meet all standard Navy environmental testing. The prototype will be evaluated and tested to determine capability in meeting the performance goals defined in the Description. Develop device designs that can be efficiently fabricated/assembled and detailed plans for fabrication intended to reduce the number and/or cost of test-connectors/ devices across the spectrum of cables mentioned in the Description. Identify software concepts that can be used for testing at minimum continuity and insulation resistance testing of copper and fiber optic verification testing for performance, insertion and return loss for both single and multi-mode fiber cabling. Product performance will be demonstrated through prototype evaluation, modeling, and demonstration over the required range of parameters. An extended laboratory test will be used to refine the prototypes into a design that will meet Navy requirements. Prepare a Phase III manufacturing and development plan to transition the system to Navy use.

PHASE III DUAL USE APPLICATIONS: Support the Navy in transitioning the Automatic Cable Tester to Navy use. Develop installation, maintenance, and operations manuals for the Automatic Cable Tester to support transition to the fleet.
The finished product has potential commercial applications for commercial communication maintenance personnel.

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KEYWORDS: Radio Frequency; Automatic Cable Testing; Fiber Optic Cable; Continuity Testing; Test Connectors; Resistance Testing

DON26TZ01-NV006 TITLE: Waste Heat Recovery

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

COMPONENT TECHNOLOGY PRIORITY AREA(S): Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a low-cost waste heat recovery system capable of converting the heat energy within DDG 51 main engine exhaust into electrical power.

DESCRIPTION: LM 2500 gas turbine engines' maximum thermal efficiency is approximately 38%. This means at least 62% of the energy in every drop of fuel consumed by the process of propelling a DDG 51 Class ship is unused and available for harvesting as it is being expelled in the form of heat via engine exhaust. Significant energy that is currently "wasted" could be recovered from exhaust to save on fuel costs and increase the range of surface combatants. To effectively utilize all resources, the Navy seeks to capture this waste heat as usable energy source.

In the past, the Navy recovered this heat energy via the Rankin cycle to heat galley appliances with steam. However, there has never been a durable, effective, weight- and space-economizing system that utilizes waste heat to produce electrical power on a Navy ship. Within the context of enhancing the environmental record of the Navy, this initiative would productively tap an "alternative" energy source to reduce fuel consumption and subsequent emissions.

The Navy seeks a solution that provides an innovative system for waste heat collection and utilization that maximizes capture and use of thermal energy while minimizing impacts on any other ship system or prominent feature (especially the main engines). Also important to the Navy is an emphasis on moderating use of or impacts to the ship's profile and/or Radar Cross Section, available onboard space, and any serious impacts to weight and stability characteristics. Keeping these difficult limitations in mind, it is the Navy's goal to produce the greatest possible amount of electrical power from harvesting the abundant thermal energy from every ship's main engine exhaust. While the DDG 51 Class Gas Turbine Generators (GTGs) also have similar thermal efficiencies and the scope of this STTR topic may become inclusive of GTGs in the future, the immediate focus of the topic is on the waste heat from the LM 2500 main engines.

The proposer should quantify the level of stress the material can incur while in an operational environment, and provide a preliminary concept design and validation plan and an in-depth examination in scalability and the potential for miniaturizing any technologies highlighted within the feasibility study, as these proposed technologies will need to create a system able to fit and effectively/safely operate within the DDG 51 Class footprint(s) and meet weight and stability requirements.

PHASE I: Develop a concept for waste heat recovery of the LM 2500 engine that accomplishes the requirements listed in the Description. Demonstrate the feasibility of the concept with a development plan and proposed test plan that will include testing to failure and compliance with environmental standards. Accompany the feasibility study with a recommendation of how the technology could be best incorporated into DDG 51 Class ships. The Phase I Option, if exercised, will include the initial design specifications and capabilities description to build a prototype solution in Phase II. Prepare a Phase II plan.

PHASE II: Develop and deliver a prototype and/or a comparable simulation able to demonstrate the conformance with power-generation industry standards and according to actual operating specifications, conditions, and DDG 51 Class footprints. A high-fidelity industry-standard computerized predictive model/simulation of the system displaying all significant data points of the system while in operation is needed and/or a high-fidelity (to no less than 1/32 scale) working prototype of the system. The simulation must validate the functionality/effectiveness of the system. A comprehensive installation plan, itemizing any required materials and their sources, recommending the safest and most cost and time-effective installation techniques will also accompany all Phase II documentation as a deliverable. Conduct a thorough examination and estimate of potential electrical output across the range of ship speeds and engine conditions to include idle.

PHASE III DUAL USE APPLICATIONS: Support the Navy in transitioning the technology to Navy use. The product will be validated, tested, qualified, and certified for Navy use.
There are any number of industries that utilize gas turbines, and this technology will likely be applicable to many of those industries where abundant spare electrical power can and would be fully utilized.

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KEYWORDS: Energy Recovery; Fuel Efficiency; Heat Recovery; Gas Turbine Generators; Electricity; LM 2500 Turbine Engine

DON26TZ01-NV007 TITLE: Novel Computing for Streaming Radio Frequency in Low Size, Weight and Power Environments

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Create a small and computationally powerful Radio Frequency (RF) sensor that meets or exceeds the requirements of extremely limited low size, weight, and power (LOW SWaP) platforms. This computational engine should weigh < = 1.5 lbs., require < = 100 watts of power, and be able to ingest and process > = 2 GHz of instantaneous bandwidth of RF spectrum continuously.

DESCRIPTION: Today's electronic processing technology is not keeping pace with the DOW's computational demands. Growing networks of new higher resolution and higher fidelity sensors yield vast quantities of data, and deep neural networks are being deployed to reduce these data streams to actionable information for the warfighter. Concurrently, the constraints imposed by network capacity, latency, and data security are driving this sensor processing to the tactical and network edge where the data is collected. This transition is compounding processing throughput shortfalls because of edge platform challenges.

In today's battle space, the concept of putting payloads on smaller and smaller unmanned platforms is a huge need. This STTR topic focuses on extremely low SWaP RF sensors that can be less than 5 lbs. The critical piece is the computational engine that will turn streaming Intermediate Frequency (IF) (with an Instantaneous Band Width of > = to 2 GHz) and perform the detection and data product formation for RF analysis and eventual classification and localization of emissions in the extremely broad RF spectrum. For these payloads to go on Group 2 or smaller Unmanned l Aerial platforms, the entire sensor package must weigh less than 5 lbs. and the processing engine is allocated less than 1.5 lbs. of this total weight and consume less than 150 Watts. The critical component is a computational engine that is small enough yet computationally powerful enough to make these payloads a reality.

The Navy seeks a single chip and infrastructure that is less than 1 lb. and less than 3 mm on either side. This will include the input/output (I/O) to the sensor data sources, the memory, the computational devices, and the I/O to the operator or decision engine (preferably the decision engine would be part of this device).

These computational engines must meet an extremely high performance metric while being extremely lightweight and energy efficient. The products resulting from this STTR topic will be utilized in Group 1 and 2 UASs as well as buoys that are less than 3 inches in diameter. These devices must be able to be zeroized and support data at rest encryption standards.

Work produced in Phase II is expected to 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 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 and provide a detailed schedule out through Phase II Option periods and a detailed technical description as to how they will achieve success.
Participate in a kickoff meeting during which details on how to get to the final briefing and its specifics will be presented.
If the Phase I Option is exercised, showcase software modules and fundamental breadboard designs.
The final briefing showing specifically how they will meet the following requirements:
- Less than or equal to 3 mm by 3 mm size
- Meeting class B shipboard installation Environmental Qualification Testing (EQT)
- Less than 100 watts energy consumption
- Demonstrate the ability to move 2 GHz of IBW continuously through the pipeline and show what higher order data products will come out the backend
- Data at rest security requirements
- Non-Volatility certification requirements
- Networking architecture demonstrating ability to configure to multiple types of networks.
- Interface descriptions on how external systems will interface and operate the prototype device remotely and locally
- Examples of the user interfaces and the schema for formatting, recording, librarying, and playback
- Cost and schedule program management plan

PHASE II: Participate in a kickoff meeting and present a detailed development plan including costing (recurring and non-recurring separated) development, security and testing plans.
These plans will include:
- detailed technical plans
- detailed security plans
- detailed EQT plans
- detailed lab testing plans (both at developers facility and at government labs) utilizing different types of RF sensors.
- detailed ship installation and at sea testing (Phase II Option will be integration and testing at sea)

After the kickoff meeting and with government concurrence of the plan, focus on developing the solution meeting all the security, environmental qualifications, and performance requirements agreed to.
The system to be developed shall meet the following requirements (as stated in the Phase I section):
- Less than or equal to 3 mm by 3 mm size
- Meeting class B shipboard installation Environmental Qualification Testing (EQT)
- Less than 100 watts energy consumption
- Demonstrate the ability to move 2 GHz of IBW continuously through the pipeline and show what higher order data products will come out the backend
- Data at rest security requirements
- Non-Volatility certification requirements
- Networking architecture demonstrating ability to configure to multiple types of networks.

The prototype system:
- will show compliance with shipboard installation environmental qual requirements
- shall show the ability to perform data at rest encryption and the ability to meet volatility requirements for system posture changes.
- shall show the ability to consume data from a defined sensor and parse and tag this data.
- shall demonstrate the ability to record and playback from both local and remote users

Perform a minimum two lab demonstrations at the developer’s facility and one integration and demonstration at a government lab. The government lab will provide testing and validation of the

capabilities and provide immediate feedback to the developer for further refinement of the prototype.
Work with the government lab to develop a shipboard installation and testing plan.
The Phase II Option, if exercised, will focus on readying the prototype system to be installed and tested at sea during a government-defined testing event.
It is probable that the work under this effort will be classified under Phase II (see the Description section for details).

PHASE III DUAL USE APPLICATIONS: Clearly and in detail describe how this capability will transition to a Navy program of record (POR). This plan will also describe how it will be used in the POR and the initial concept of what data products will be recorded and how.
The government feels that any commercial industries needing real time video / data compression, or greater than 4K video streaming capabilities will benefit from this technology.

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KEYWORDS: RF Spectrum sensing, RF Payload processing, optical computing, Photonic Convolution, Adaptive processing, Signal detection

DON26TZ01-NV008 TITLE: Automated Software Test Generation and Augmentation for Improved Debloating

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

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Computing and Software;Integrated Network Systems-of-Systems;Integrated Sensing and Cyber

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop an automated solution for developing, enhancing, expanding, and augmenting software tests to more safely broaden the employment of proactive cyber techniques such as debloating and post-construction software refactoring. Technology is needed to refine a suite of tests to a level such that it may serve as a practical expression of a software transformation objective to drive other tools as well as validate their output. Technology should leverage multi-modal methods such as ingesting code and documentation as well as be compatible with DevOps processes.

DESCRIPTION: Modern software development practices such as industrialized code reuse and artificial intelligence (AI) assistance enable developers to produce increasingly complex and capable software more quickly and cheaply than ever before. The tools to ensure that all this software is well-tested and that all of the included code is well-tailored to the deployment scenario, however, have lagged by comparison.

Modern applications often include hundreds to thousands of libraries and other dependencies, with often only a small portion of the code in each being ever needed by users in each deployment scenario. The excess code that remains often tends to be less used in general, less well-scrutinized, and full of obscure features that will often be found (sometimes only years later) to contain vulnerabilities. To address this problem, numerous tools have been developed to identify bloat and then modify the software by removing unneeded code [Ref 1]. Configurations, usage logs, and tests that are fed as inputs to code transformation tools to tell them what to cut are referred to as the debloat specifications [Refs 1, 2].

Because the economics of code reuse will continue to drive library and package developers to maximize generality, debloating must happen through a separate process that begins after those components are built into a specific application. The fact that another process will be modifying code separate from the original one that designed, implemented, and tested those components adds risk—it is not uncommon to see flawed or incomplete transformations. Evaluation results in [Ref 2] showed that 37% of the debloated binaries they created failed to correctly execute the functionality they were intending to retain.

Many factors can contribute to a transformation yielding a broken application, but one of the biggest is a low-quality debloat specification. Developer-authored tests are often limited and the users of debloating tools rarely can specify in exact detail all the features they actually need for a given deployment scenario. These incomplete specifications can lead tools to be overly aggressive in things like security checks and exception handlers that are critical to application safety and robustness [Ref 3].

To better address the problem of low-quality and incomplete debloat specifications, new technology is needed to more fully incorporate and automate the capturing of desired software behaviors for input to a debloat tool. The technology should be able to take advantage of code analysis as well as analysis of related artifacts such as documentation, build configs, existing tests, and even user input, as long as it can be made practical and easy for a user to answer. Various works have explored methods and techniques for capturing exception handers [Ref 3], balancing reduction with a targeted amount of generality [Ref 4], and leveraging AI to incorporate new tests [Refs 5, 6, 7]. All may inform strategies for automated test generation and augmentation that can lead to higher quality debloat specifications.

PHASE I: Define and develop a concept for automated multi-modal processing of code and other DevOps repository artifacts such as user guides, etc. to generate and augment a suite of tests that can serve as the inputs to proactive cyber security tools, namely debloating. Work toward a design that can develop tests based on unstructured documents and interact with a user to refine the tests. The Phase I Option, if exercised, would develop the initial test augmentation capability to create the full prototype in Phase II.

PHASE II: Develop a prototype containerized test augmentation capability to validate the concept defined in Phase I. Demonstrate the automated multi-modal processing of code, DevOps repository artifacts, and, if necessary, user interview inputs, into developing, enhancing, expanding, and augmenting software tests by the prototype. Ensure that the prototype is deployable in a software factory environment and able to develop many tests to sufficiently, reliably, and robustly enable the debloat of (1) an application using only its existing limited test suite, (2) unstructured program documents like user guides, and (3) real-time user input at the non-expert level by the end of Phase II.

PHASE III DUAL USE APPLICATIONS: Integrate the Phase II developed test augmentation capability with Program of Record systems and their applications. Field containerized solutions that integrate with existing build pipelines.
Potential commercial applications include automated software testing and fuzzing harness generation, a growing need due to the proliferation of AI-generated code.

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KEYWORDS: Cyber; Software Testing; Automation; artificial intelligence; AI; machine learning; ML; large language model; LLM; Debloating; Feature Specification

DON26TZ01-NV009 TITLE: Robust Universal Adaptive Denoising Technology

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop robust denoising approaches that are highly adaptive and effective.

DESCRIPTION: Signal denoising has shown to be highly effective in improving performance of signal processing radio frequency and acoustic sensing systems. The main hindering signal in these applications is noise as it degrades the ability to sense low level signals masked by ambient noise sources which may be external to the sensor or generated by the sensor itself. The main goal of this SBIR topic is to develop a denoising technology that suppresses noise while preserving the underlying signal features. Traditionally, denoising methods have struggled to maintain performance when presented with highly non-stationary or complex noise patterns. The traditional approaches typically require extensive and time-consuming tuning to achieve desired performance. On the other hand many of learning-based methods have demonstrated excellent denoising performance but suffer from limited robustness. Therefore, the method's performance will drop if the training conditions do not adequately reflect the characteristics of the operational environment. The Navy seeks improvements in denoising performance greater than 10 dB.
For such a system installed on an aircraft, it will experience both wind- and aircraft-generated noise. That noise has components that are narrow band (< 10 Hz wide) and broadband (10s to 100s of Hz wide). The spectrum of interest for sensing extends from approximately 10 Hz to 1000 Hz. When compared with more traditional active noise cancellation techniques, the denoising approach should be capable of providing 6 dB of additional cancellation and show potential to deliver 10 dB or more cancellation.

PHASE I: Develop concepts for a robust denoising approach requiring minimal training and are effective in highly non-stationary or complex noise environments. Modeling and simulation to include laboratory measurements to assess the efficacy of the approach based on an in-air or ground-based mobile acoustic sensing system is desired. Consider how the approach may be extended to a radio frequency (RF) system operating in the 1-10 GHz range. The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Develop and demonstrate an end-to-end denoising approach on an acoustic frequency sensing system in a laboratory environment and ultimately in a representative operational environment. The prototype assessment should include narrow and broadband noise removal performance while preserving desired signal characteristics, robustness in the presence of non-stationary noise environments. At least 10 dB of noise cancellation is needed with 15 dB desired over traditional active noise cancellation techniques. Consideration for the ease of integration and fielding should be made. Demonstrating the efficacy of the denoising approach on a variety of host platforms is desired. Further refine the extension of the denoising technique to use by RF sensing systems.

PHASE III DUAL USE APPLICATIONS: Support the transition to Navy use.
A universal highly adaptive denoising approach could find applications across remote sensing, communication systems, biomedical signal processing, audio restoration, and image enhancement.

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KEYWORDS: Denoising; Signal Processing; Deep Learning; Non-Stationary; Acoustic; Radio Frequency

DON26TZ01-NV010 TITLE: Next Generation Tropical Cyclone Analysis, Forecasting, and Dissemination Tactical Decision Aid Software

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: Demonstrate an improved automated tropical cyclone forecasting, analysis, and dissemination tactical decision aid capability that uses a modern containerized software backend/frontend and is able to easily integrate legacy and novel component algorithms, models, databases, and Application Programming Interfaces (APIs).

DESCRIPTION: Domestic operational tropical cyclone forecasting at the Joint Typhoon Warning Center (DOW), Fleet Weather Centers (DOW), and National Hurricane Center (NOAA) have relied on the Automated Tropical Cyclone Forecast System (ATCF®) software suite for end-to-end tropical cyclone analysis, forecasting, and product dissemination for over three decades. This one-stop-shop for all data, modeling, post-processing, and user interaction for tropical cyclone information has endured due to its robust assured infrastructure, reliability, speed for executing actions, and long continuity even as forecasters and information have evolved. However, as compute environments and programming languages have changed, it has become more difficult to maintain and upgrade legacy software to take advantage of new capabilities.
This STTR topic seeks the development of a prototype software suite that can learn lessons from the success of ATCF®, but is architected in a modern software ecosystem to mitigate current workflow disadvantages. Fundamentally, the goal is a modular and containerized software application that can variously interact with legacy, current, and future software suites such as components of ATCF®, the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) program, the NOAA Advanced Weather Interactive Processing System (AWIPS), and other back-end and front-end APIs. The software architecture must be designed from the outset to comply with DOW DevSecOps principles and prepare the system for the Risk Management Framework (RMF) process. Desired software requirements include design in a modern broadly supported and maintained open programming language that can run online or offline on premises or in a cloud compute environment; hardening against connectivity and bandwidth issues; separation of functionality between logic, database, analysis algorithms, forecast generation , user interface, and dissemination layers; modular component development where different parts can interoperate with other software; and the ability to quickly address software updates and functionality and revert on the client side.
A dual-pronged approach to improving workflow for the tropical cyclone forecast process is envisioned, with parallel development tracks for software architecture creation and decision support aid integration. While the focus of tropical cyclone tools in the 1980s through 2000s was on track and intensity prediction, the forecasting mission has increasingly expanded. This includes the ability to track before storms have formed; 3D storm structure and rainfall evolution; ocean and wave field information; storm surge and hazards; probabilistic uncertainty; and emerging machine learning tools. The software should be capable of generating and disseminating an automated, objectively optimal analysis and forecast product from available data — that is, without significant manual human effort. It is not expected that all these efforts are achievable within the scope of this STTR effort; however, the priority development schedule must be justified, and the software solution must be able to accommodate all of these components within a future strategic plan.
Back-end capability should include: (1) a modern development software framework that can easily include or remove proprietary and open source algorithms as desired and is built and deployed as a

containerized architecture; (2) a robust state management (e.g., database) for storm information and aids with backwards compatibility and export for current ATCF® “deck file” formatting; (3) concurrency for data fetching and processing to reduce data latency for time-critical forecast workflows; and (4) defined APIs to provide data access to clients, such as front-end graphical user interfaces (GUI) or downstream machine-to-machine programs. Further, the back-end capability should support backup capability, likely through a distributed system of servers.

Front-end capability should include: (1) thin client(s) for use on desktop workstations and possibly within web browsers, facilitating both on-site and remote operation with both client-side and server-side rendering tested for DOW network responsiveness; (2) flexible means of calling external scripts/functions/APIs with configurable input data, allowing forecasters to trigger different production pipelines and workflows that could be defined externally; (3) editable runtime configuration facilitating separate profiles for different operational systems or users; (4) means to integrate with internal and/or external AI systems or agents to facilitate future workflows; and (5) GUI and storm management capabilities consistent with ATCF®, with additional emphasis on performant map navigation and rendering, multi-product and format overlays (from gridded and sparse data, such as from kml, kmz, ShapeFiles, GeoTiff, HDF, netCDF, GRIB2, Zarr, GeoJSON, etc.), and dynamic filtering and alerts for data as they populate in real time. It is imperative that software developed be done so with an emphasis that support does not require skills beyond those currently required and normally used by support staff at forecast centers.

PHASE I: Design and develop an architecture concept for an improved tropical cyclone software capability, identifying the most challenging technical components. Present a demonstration for viable solutions to the technological problems. Capabilities should be contextualized and contrasted with current ATCF functionality and forecasting requirements. Integration of emerging technologies should be explicitly described, and include machine learning prediction methods, higher resolution or local forecasting, and new machine learning tools to develop and publish a product. Required Phase I deliverables include the reporting documents on progress and outcomes, the final proposed architectural solution with justifications and risk/mitigation analysis, and a description/demonstration of the unique methods to address the development challenges.

PHASE II: Develop, demonstrate, and validate a prototype software suite. Effort should focus on proving back-end and front-end capabilities from the above topic description that address greatest needs from the concept developed in the Phase I. It is expected that regular engagement with Naval users and frequent software demonstrations and side-by-side comparison with other operational software suites will be performed throughout software maturation. The outcome by the end of the Phase II should be an end-to-end prototype (not expected to be feature complete) that addresses substantial aspects of the ATCF mission requirements and is able to be run robustly for real-time operational usage.

PHASE III DUAL USE APPLICATIONS: Focus on continuing development of software capability, while ramping up integration with other decision support tools in the operational environment. Performance equivalence with, or superiority to, ATCF is expected and should be demonstrated on different compute platforms, cloud systems, and classified systems. Performance metrics include: graphical rendering latency (both locally and over remote display protocols) and the time required for a user to complete a standard set of storm analysis and forecast tasks within the software. Acceptance of new data, analysis, and model capabilities from internal and external partners are expected. Awardee should be prepared to deploy as a stand-alone system with thin client interface, as a component backend in a thick client front end, and/or as a module in a multi-software system.

Beyond DOW, interaction and potential transition with NOAA is expected. There is potential for supporting multiple commercializations, such as supporting academic and basic open-source software community, software sales to commercial forecasting and risk companies, and further government capability development.

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KEYWORDS: Tropical cyclone; typhoon; Automated Tropical Cyclone Forecasting; ATCF; user interface; algorithms; modular; refactor; cloud; database; container; Application Programming Interface; API; graphical user interface; GUI; software

DON26TZ01-NV011 TITLE: Field Deployable Welding Technologies for In-Situ Repair of Thermoplastic Composites Components on Naval Aviation Platforms

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop and transition a portable induction welding system capable of in-situ repair of thermoplastic composite components on naval aviation platforms enabling rapid, field-ready maintenance capabilities for next-generation naval aircraft.

DESCRIPTION: Modern aviation platforms are increasingly using high-performance thermoplastic composites such as PAEK, PEEK, PPS, or PEI reinforced with Carbon Fiber for structural and semi-structural components. Their attractiveness is due to their superior damage tolerance, impact, and ability to be reworked for repair. Unlike traditional thermoset composites, which can only be repaired by bonded patches or bolted panels, thermoplastic composites can also be repaired by welding, which restores strength without the need to remove additional material. However, currently available welding systems have a large footprint and are available mostly with OEM and only suited for deployment at the Depots. Thus, without field deployable technofixes, repairs will result in long downtime for repair and likely higher scrap rates.
This STTR topic seeks to leverage the research expertise of academic or government labs in thermoplastic processing and electromagnetic heating to partner with a small business in designing a rugged, portable induction welding system that can be deployed shipboard and/or in Aircraft Intermediate Maintenance Detachments.
The proposed system should: (1) be capable of welding aerospace-grade thermoplastics (at temperatures up to 400°C); (2) be lightweight and field operable, including on aircraft carriers; (3) be electromechanically ruggedized and safe to operate near avionics and flight-critical systems; (4) have a closed-loop thermal control for temperature; (5) be able to repair skins, fairings, panels, and access doors; and (6) have a weld strength of at least 70% of the parent material.

PHASE I: Identify key thermoplastic components and repair scenarios relevant to Navy and Marine Corp Aircraft; develop preliminary induction welding system architecture; build and integrate a TRL 3-4 configuration in collaboration with the research institution; and conduct an initial weld strength test. The weld strength should be at least 70% of parent material. Additionally, the awardee should assess the electromagnetic compatibility and ergonomics of the system.
While this is not an allowable developments program, the awardee may propose a limited amount of testing for calibration and validation of the prototype. The awardee should note that the Phase II down select is based on the performance and final deliverables of the Phase I Base period – so plan accordingly.
The Phase I deliverables should include at a minimum: (a) a Weld Feasibility report which should include results of weld trials meeting the key parameters stated above. It should also include assessment of the thermal profile, fusion quality, and repeatability; and (b) a preliminary system concept and architecture that will meet the topic’s goals.

PHASE II: Build and validate a ruggedized TRL 6-7 prototype system. Integrate smart controls and thermal feedback into the prototype. Adapt tools and fixtures for real world geometry and repair location. Validate the tool on a sub-element level aircraft part. Demonstrate mechanical integrity of repairs by mechanical testing and nondestructive inspection (NDI). Demonstrate that it meets full EMC qualification per appropriate MIL STD [Ref 3].
Ensure that the prototype meets the Phase II goal (stated in the Description).
Provide a test report summarizing all tests done in Phase II, and an electronic user instruction manual for the prototype and a maintainability and support plan for the delivered prototype.

PHASE III DUAL USE APPLICATIONS: Support the transition to Navy use. Expected transition within government is to fleet resource centers servicing MQ25 and next gen platforms including Maritime Strike.
Additionally, the awardee will be encouraged to transition to commercial maintenance depots.

REFERENCES:

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KEYWORDS: induction welding; field deployable system; automated process control; forward deployed repair; shipboard repair; structural repair

DON26TZ01-NV012 TITLE: Sensing to Measure and Validate Corrosion in Naval Systems

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop and deliver a sensory tool that can be used to monitor and assess several modes of corrosion activity as a function of time within Navy ship systems and subsystems. The sensory tool will incorporate artificial intelligence (AI) identify and estimate component life in a given platform/system for a given material selection, CAD geometry, and environment during the ship operations. AI can incorporate a set of mathematical models that will detect when the error happens and when to do maintenance. The main objectives of AI are to reduce maintenance time, production downtime, and the cost of component supplies.

DESCRIPTION: It is increasingly important for corrosion rate analysis to be performed on steel structures such as ships, offshore platforms and bridges to determine their safe operating life and for the development of effective and efficient maintenance practices. Optimal timeframes for asset availability and for planned redundancy also demand information about corrosion rates. Corrosion loss affects the effective load capacity of steel plating through causing plating thickness loss. The design of steel ships typically incorporates a corrosion allowance, i.e., an amount of corrosion loss that can be tolerated before the structural system is considered compromised. Corrosion protection measures include paint coatings and sacrificial anode systems for immersed areas. However, these methods are not always wholly effective, and continual maintenance usually is required but not always applied. In extreme cases, repair and replacement of structural details may be necessary, incurring very considerable cost penalties due to direct repair costs. It follows that the estimates of the expected rate of deterioration are important inputs for optimal maintenance and repair decisions for ships.

Naval ships are exposed to a range of corrosive environments and as a result the patterns of corrosion vary widely. The structural details and the orientation and position within the space within a given environment also will cause different corrosion patterns and rates. For immersion environments, influences on corrosion include chemical factors such as salinity, oxygen content, pH, and presence of pollutants; physical factors such as temperature and pressure; and biological factors such as bacteria and biomass. For ballast tanks the immersion environment usually is considered the most critical but in modelling the corrosion process attention might also need to be given to the occurrence of repeated wet/dry cycles as a result of the tanks being filled and emptied to adjust the freeboard trim of the ship. In addition, the presence of sacrificial anodes may have some influence, although they are effective only under immersed conditions and for uncoated areas. Thus, a de-ballasted tank will not be protected. It follows that the amount of corrosion in a ballast tank is a function of the environment, the type of corrosion protection, and the tank status. Apart from corrosion protection and operational practices, the main influence on the environmental parameters is the result of the conditions encountered during operations – what might be called the trading route, including geographical influences.

The number of hours a ship is generally in an operating or training status have decreased. Navy corrosion maintenance costs continue to escalate, reaching upwards to nearly $10B/year. Roughly 40% of those costs are caused by corrective maintenance that can be attributed to the improper selection of materials, usually from design process decisions that addressed system requirements without considering materials corrosion behavior in environments for which they are planned.

The application of a resistant coating on ships, offshore structures, and pipelines is the primary prevention method of corrosion wastage in the marine industries. To guarantee coating integrity and to be able to thoroughly survey for corrosion wastage on marine structures, new advanced nondestructive methods are being sought. The requirements of convenient and rapid determination of corrosion wastage on coated structures, even in the difficult spatial positions of the structure, will require advanced technologies which are being developed for other industries that also require very high structural integrity. Corrosion detection and monitoring are essential diagnostic and prognostic means for preserving material "health" and reducing life-cycle cost of industrial infrastructures, weapon systems, ships, aircraft, ground vehicles, pipelines, etc.

Sensor system attributes of small size, low weight, open plug-and-play interface architecture, self-diagnostics and validation make this a valuable interface and controller platform for other industrial and military monitoring applications. The system simplicity and low cost allows for wide area coverage by monitoring multiple sites on an individual structure and for fleet-wide vehicle condition monitoring. Other than Military vehicles, the smart sensor system has market potential in stationary structures, industrial processes, and civil and commercial transportation. By collecting and consolidating datasets into a fleet management system, DOW can better allocate maintenance resources and increase availability and service life objectives for these platforms. The collected data drive sustainment analytics and fleet management by increasing the accuracy of predictive maintenance schedules and decreasing inspection intervals and unnecessary preventative maintenance.

Artificial Intelligence (AI) plays a pivotal role in interpreting the vast amounts of data collected by drones. Machine learning (ML) algorithms analyze the images to identify patterns of corrosion, thereby enabling more accurate and timely maintenance decisions. This level of automation reduces human error and ensures that Navy vessels remain in optimal condition. AI is a machine's capability to impersonate human behavior, respond perceptively, solve problems, and make decisions automatically without human interference or with less human interference. The main objective of AI research involves general intelligence, automated planning, perception, natural language processing, knowledge representation, and robotics.

PHASE I: Explore the various non-destructive and electrochemical technologies through a literature search and downselect to the two or three most promising evaluation options that are capable of sensing the most corrosion degradation mechanisms. Non-contact technologies are preferred if degradation sensitivities are not lost. There is a critical need for the development of a real-time monitoring capability for U.S. Navy assets that has the potential to identify the onset of various corrosion modes like pitting as well as actively characterize stress corrosion (SCC) initiation and progression.

Optimization of quasi- and fully- distributed fiber optic sensing hardware for corrosion and SCC monitoring in Navy-relevant environments, including ultrasonic acoustics. Employ laboratory corrosion and SCC experiments on instrumented structural alloy coupons to develop a correlation between acoustic emission and corrosion/SCC signatures. Create physics-based modeling of both ultrasonic guided wave non-destructive examination (NDE) and acoustic emission to develop a training set for the AI-classification framework. Improve correlations by using training and validation of AI-classification framework and application for identification, localization, and classification of various corrosion modes and SCC in relevant alloys.

The NDE or electrochemical methods should be assessed as to the quality and accuracy of the objective measurements. The speed at which the requisite information can be obtained (ft2/minute) will also be an evaluation parameter. Offerors must show at least one technology that can reliably characterize the quality of the materials interface and bulk interior, assess the spatial resolution of the technique, and assess the substrate surface conditions such as corrosion including sites with significant surface roughness.

PHASE II: The technology(ies) selected in Phase I should be further tested using larger uncoated and coated coupons of various alloys to better gauge what the speed (ft2/minute) of detection of decohesive sites, coating defects, and substrate corrosion, if present. Work with a Navy laboratory for collaborations in assisting the offeror in maturing and transitioning the technology(ies). Further modeling validation in select field Navy environments. This will be required to assert the reliability and sensitivity of the selected technology will be needed. Other acceptance testing as dictated by the Navy Laboratory should also be done and the evaluation/monitoring technology must be assessed as to its compatibility.

PHASE III DUAL USE APPLICATIONS: The ability of some NDE and electrochemical methods to penetrate most non-metallic materials allows non-contact examination of materials. The properties of interest across the industries may be broadly categorized into three areas—layer thickness, defects and contamination, susceptibility to SCC, and material characterization. Commercial and military ships both operate in a marine environment, and although they operate in different duty cycles, both are exposed to the aggressiveness of seawater and associated micro-marine environments. Both commercial and military ships suffer from similar corrosion failures.

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KEYWORDS: Electrochemical; monitoring; marine; corrosion; ship; mechanical failures; artificial intelligence, performance; protection

DON26TZ01-NV013 TITLE: Flexible Printed Thermoelectric Cooling Film

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a low-cost and lightweight thermoelectric cooling film that could be used to cool the warfighter (small scale) or surfaces on military platforms (larger scale) using printed organic semiconductors. The flexible cooling films should have a bending radius of less than one inch to easily wrap around pipes, wrists, and ankles, and be able to conform to complex curvatures on larger surfaces.

DESCRIPTION: Thermoelectric cooling devices based on narrow bandgap semiconductors such as bismuth telluride are commercially available. They are solid state devices and thus do not have the large footprint and moving parts associated with vapor compression refrigeration systems; however, they operate with lower efficiency. They are well-suited for cooling small flat surfaces where one is more concerned with the form factor than efficiency. For many practical applications, these square ceramic tile thermoelectric devices are heavy and too rigid, and do not offer conformal contact to curved surfaces. Over the past fifteen years, a lot of progress has been made on organic thermoelectric materials. Though the thermoelectric figure of merit (ZT) has not caught up to that of bismuth telluride and other inorganic materials, the potential to make low-cost, lightweight, and flexible devices has opened a new application space for thermoelectric cooling where flexibility and large-area conformal contact are prioritized over efficiency. For instance, lightweight headbands and wristbands only need to remove a small amount of heat to provide significant cooling sensation to the user. Likewise, there are diffuse, large surface area applications with similar cooling needs. Prior research was summarized in a recent review article by Segalman [Ref 1].

The conducting polymer Poly(3,4-ethylenedioxythiophene) [PEDOT] was identified as a strong candidate for the p-type leg in the p-n device, but device performance has been limited by the lack of suitable n-type materials. The organic electronics community has long wrestled with n-type materials due to potential oxidation of the electron carriers. A number of inherently stable and high performing n-type polymers have recently been developed [Ref 2] that should complement the available p-type materials and enable significantly improved thermoelectric cooling device performance. New device designs obtainable with simple fabrication must be developed to take advantage of the anisotropic thermal conductance and charge transport in these materials, which is typically maximized in-plane and along the polymer molecular backbones, such that measured thin film behaviors successfully translate into device performance. A number of design and fabrication strategies have been demonstrated but much more innovation is possible [Ref 1]. It is an appropriate time to develop lightweight, flexible thermoelectric cooling devices for these niche applications.

This STTR topic is for low-cost, lightweight, and flexible thermoelectrics for personal cooling as well as for large area applications.

The flexible cooling films should have a bending radius of less than one inch to easily wrap around pipes, wrists, and ankles, and be able to conform to complex curvatures on larger surfaces. The stated applications are near-ambient temperatures though the conjugated polymers should be able to handle temperatures up to 200°C. Composite approaches that are appropriate are welcome. This topic is not soliciting a fabric-based solution.

PHASE I: Select n and p type materials. Demonstrate that the selected n and p type materials can be processed (and doped) into films with reasonable Seebeck coefficient, thermal conductivity, and electrical conductivity in device relevant materials planes. Measure these properties in device relevant planes. Prepare a simple thermoelectric device and characterize performance. Model this simple device structure and compare with achieved performance. Model novel device geometries that could be manufactured with low cost processing approaches for both the personal cooling (small area, 4 kelvin gradient) and surface cooling (large area, 20 kelvin gradient) applications. Describe material and processing advances that would be accomplished in Phase II to enable these devices.

PHASE II: Optimize materials properties and device designs for personal and surface cooling applications. Model new designs as necessary. Make prototypes for both application s and start work towards commercially relevant device fabrication processes. In year two, prepare larger devices (10 square inches) by using commercially relevant processing methods and fully characterize device performance including achievable temperature gradients and efficiency. Model power requirements for both applications. Compare performance against commercial thermal electrics for ambient cooling applications. Prepare the cost analysis and business case for the two products.

PHASE III DUAL USE APPLICATIONS: Support transition to Navy use.
Both wearable thermoelectric coolers and large area films should have commercial and military applications. For wearable devices, performance metrics (power requirements) should be known for the Phase II prototype and there would be a lot of work to optimize the product for skin contact. In the longer term, some level of elasticity to the substrates would enable better contact and comfort. For the surface cooling film, a modestly stretchable substrate would also enable better contact with the large, curved surfaces of military platforms. An adhesive backing would be needed for large area applications.
In addition to directly developing products to keep warfighters cooler, industry that provides clothing and accessories to construction workers, law enforcement, and agricultural workers could develop appropriate products. Larger area devices could cool and heat automobile seats and outdoor surfaces.

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KEYWORDS: Thermoelectric cooling; Peltier effect; organic electronics; PEDOT; n-type polymer; p-type polymer

DON26TZ01-NV014 TITLE: Low Power Seawater Converter for Aircrew Survival

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

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop a lightweight, compact, rugged, and reliable device that can convert seawater into safe, drinkable water. The device should minimize bulk and human energy expenditure, while maximizing output.

DESCRIPTION: Survival in a life raft on the open ocean depends greatly on the availability of potable water. Naval aircrew currently carry prepackaged water in soft packets placed within the ejection seat survival kit and aircrew survival vest sufficient to sustain life for less than one day. Reverse osmosis desalinators and forward osmosis nutrient packs are commercially available to the recreational seafarer. However, neither of these approaches are designed to maximize the amount of drinkable water while minimizing the amount of human energy expended, while constrained by limited space within a survival kit. Manual Reverse Osmosis Desalinator (MROD) devices are labor intensive, requiring more than 2500 pumps to produce one liter of water in one hour. Such human powered devices may require more energy expenditure than the calories available to stranded aircrew. Forward osmosis products available for the recreational sailor can produce potable beverages with little manual effort, but the total output capacity for aircrew is limited by the storage volume of the ejection seat survival kit. Current options for supplying sufficient drinking water to sustain life throughout extended rescue durations are inadequate.
Innovative solutions will minimize or eliminate aircrew physical activity/exertion, while producing at least one gallon of drinkable water per day, with a minimum salt rejection of 95%. Concepts utilizing novel chemical processes or nanotechnology are preferred over simple refinements of current osmosis technology.

The device should:
a) fit within a Naval Aircraft Common Ejection Seat (NACES) survival kit (an envelope approximately 6½"x14½"x4½") along with an Emergency Oxygen System (EOS) and an LRU-38/P life raft, but not exceed 114 cubic inches.
b) operate in near freezing brine water/freshwater/saltwater.
c) operate in turbulent or calm water conditions.
d) operate reliably in cold and hot ambient air from -40° to +125°F (-40° to +51°C).
e) operate after exposure to temperature extremes from -65° to +160°F (-54° to +71°C).
f) operate after exposure to mold, mildew, flame, and salt fog.
g) not create hazards (i.e., burn, injury, Foreign Object Debris (FOD), snag/trip, and static discharge) inany mission or survival operations.
h) operate following a 600-knot seat ejection.
i) operate after repeated exposure to altitudes up to 70,000 ft (0.65 psi).
j) operate after exposure to typical fixed-wing ejection seat aircraft vibration levels, at frequencies from 5 Hz-2000 Hz).
k) provide resistance to environmental contaminants (i.e., sand, petroleum, oil, lubricants, and solar radiation).
l) not interfere with survival vest or mounted gear, armor/armor release, seat harnesses, helmets or head mounted gear.
m) be capable of operating after 15 months in a packed state (360-day inspection cycle plus 90 day shelf life) while exposed to temperature ranges of -65° to 160°F (-54° to +71°C).
n) weigh less than 2 lbs.

o) use Berry Amendment-compliant materials and manufacturing techniques.

PHASE I: Design and determine the feasibility of a concept seawater conversion device that meets the requirements provided in the Description. Demonstrate feasibility through analysis, modeling, simulation, and limited laboratory demonstrations. Provide performance, size, weight, cost and reliability estimates.

PHASE II: Develop, demonstrate, and validate a prototype seawater conversion device based on the design concept created in Phase I. Demonstrate device operation and capabilities in laboratory and simulated ocean environments. Provide draft design specifications, engineering drawings, and cost-benefit and life-cycle analyses.

PHASE III DUAL USE APPLICATIONS: Fabricate, validate, and deliver additional prototype devices for testing in open ocean environments. Provide support in transitioning the technology to Navy use. Provide a technical data package including a performance specification, an interface control document, and engineering drawings in accordance with military standards. Develop and assist with required qualification testing and training. Document the quality assurance test program in accordance with industry best practices.
The transfer and modification of commercial technology can benefit other military and recreational seafarers, as well as industrial, merchant, and marine operators and their crews or passengers.

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KEYWORDS: survival; osmosis; desalinate; portable; seawater; life raft

DON26TZ01-NV015 TITLE: Advancing Human Modeling Tools for Enhanced Performance and Survivability in Austere Environments

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Human-Machine Interfaces;Sustainment

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop an advanced suite of parametric human modeling tools incorporating USN/USMC aircrew anthropometric databases, empirical posture data, and 3D scans.

DESCRIPTION: The goal of this STTR topic is to leverage newly available data and advances in digital human modeling to improve modeling fidelity for USN/USMC and other DOW aircrew to improve acquisition outcomes. Resulting improvements to operational and environmentally appropriate protective clothing and equipment size, design, and tariffing (i.e., determination of how much of each size needs to be procured and distributed) will yield significant benefits to Fleet readiness and sustainment, safety, performance, protection, and affordability.

Digital Human Modeling (DHM) applications and tools are used to design and assess items for the DOW including protective clothing, footwear, body armor, flight equipment (e.g., helmets, oxygen masks, survival vests, G-suits, torso harnesses, etc.), seating, restraint systems, workstations, cockpits, controls, ground vehicles, and much more. Using this technology early in the product lifecycle is essential to reducing development cost and schedule and informing design tradeoff decisions. Historically, use of DHM has been subject to a variety of limitations that affect model fidelity, which is how well the model represents reality. These limitations result in reduced utility of the technology when the limitations are understood, but more concerning are the potential adverse outcomes where the limitations have either not been understood or have been ignored. This is concerning for all types of design applications, but especially problematic in aviation where safety of flight is crucial. There is an abundance of feedback from aircrew regarding poor fit or lack of availability of the sizes of protective clothing and operational equipment they need. They experience pain and injury, reducing performance and impacting readiness. There is now the potential to exponentially improve DHM capabilities due to a variety of advances in 3D scanning, model development, and availability of aircrew population specific anthropometric data and empirical posture data representing real-world conditions for military aircrew.

Limitations to current DHM capabilities related to the users include issues with intuitiveness of the tools, the degree of expertise required for effective use, and the significant amount of time it takes to develop expertise. There is a shortage of expert users in both the DOW and industry. Manikins used in DHM analysis are commonly selected from built-in software libraries with inappropriate anthropometric measurements for the population and/or design being evaluated. DHM users with a poor understanding of anthropometry often fail to consider the multivariate nature of anthropometric accommodation ignoring the need to consider more than one measurement at a time and neglecting the critical interactions of the measurements. Users positioning/posturing manikins routinely use guesswork in the absence of empirical data to account for clothing and flight equipment, restraint systems, cushion compression, flesh compression, and postural variation. They often have a limited understanding of aircrew operations and/or environment leading to incorrect assumptions when setting up their models.

For some DHMs the anthropometric measurements that can be adjusted are not the ones that matter for design application and the underlying anthropometric data used in the application may not represent the target population. Multivariate use cases have been developed and in use on DOW aircraft acquisition programs since the mid-90s [Ref 1], but manikins representing the use cases are often not included in DHM manikin libraries causing users to default to inappropriate use of the manikins that are available.

Until recently, the only USN/USMC aircrew anthropometric data available was from a 1960s database that did not include women. Currently, there are no DHM applications that include USN/USMC aircrew anthropometric data or associated multivariate use cases.

Another important consideration is that the commercially available DHM applications allow for analysis of one or more manikins, to include a family of multivariate use cases, but do not allow for parametric modeling of an entire population needed to accurately quantify the accommodation levels of a design. The NAWCAD Human Systems Engineering Department has recently completed an aircrew/aviator anthropometric survey and is also collaborating with the USAF on the Seat Specific Posture Model (SSPM) Project to collect empirical posture data to improve modeling fidelity. This project was initially intended for the purpose of developing an aviation specific postural analysis tool in the RAMSIS DHM but will be useful for other applications as well. One example that this STTR topic proposes is that this aircrew data be used in in the development of aviation-specific parametric accommodation models. The US Army has successfully developed this type of modeling tool for ground vehicles with a great many advantages to their acquisition programs and alleviation of many of the limitations documented above [Refs 2,3,4].

There have also been significant advances to head, hand, and body models that can be leveraged to greatly improve DHM state of the art and acquisition outcomes [Refs 5-11]. Integration of aircrew-specific anthropometric and 3D scan databases would ensure modeling efforts reflect the intended population. Aviators are a distinctly different population and appropriate representation of them in modeling applications is essential. Model input parameters can be adjusted to represent the goals of the modeling effort (i.e., desired accommodation levels and target population or subpopulation) with adjustable demographic variables such as sex, age, and race/ethnicity. Modeling tools can incorporate the ability to consider not only traditional 2D anthropometric measurements, but 3D shape and/or non-traditional measurements with the goal of improving size design and fit prediction [Refs 12, 13]. Through new and affordable 3D body scanning technologies [Refs 14,15], it is possible for an individual's specific anthropometry as well as their feedback on fit and preferred size to be run through an artificial intelligence (AI) algorithm to allow for ongoing improvements in size design, fit prediction, and tariffing. There have been advances in the development of head models that do not include hair artifacts [Ref 16], an important consideration in design. Improvements of head and hand models for dynamic or functional fit can improve the ability to digitally evaluate if masks maintain a seal when pilots talk or change facial expression and if gloves are designed appropriately for all pilot tasks, not just one static hand position. Posable manikins representing intended individuals or populations (multivariate use cases) can be easily customized and imported into any CAD environment or DHM software application for a variety of uses. It is important to note that the proposed tools are meant to be supplemental not duplicative of other modeling tools currently available or in development. Having these proposed modeling tools be interoperable or integrated with existing or emerging tools is highly desirable.
What makes these tools unique from existing/emerging modeling tools:

- Inclusion of USN/USMC aircrew anthropometric databases and 3D scans.
- Inclusion of SSPM project aircrew posture and reach data.
- Solution is not computationally and/or time prohibitive to use.
- Fills a gap in providing a solution that does not require an artisan modeler to make use of the models (easy to learn, simple user interface).
- Leveraging existing models/methods for expeditious transition.
- Models to be exported in common file formats to be interoperable with a broad range of CAD/DHM applications. No specific software applications are required.
- Not strictly PPE focused but also applicable to clothing design.
- Includes accommodation modeling tool for aircraft cockpits and workstations.

- Will represent digital twins of individuals like other modeling tools, but will also provide population virtual assessment of fit, size design, tariffing recommendations, and report population accommodation levels.
- Will allow for principal component analysis on a population and representation of boundary cases customized for specific applications.
- Includes ability to import anthropometric data for a group of participants and create bivariate plots for visual comparison to aircrew population data.
- Models will be web-hosted and freely/easily available to DOW civilians and contractors.
- Intention is to have web-hosted instructional materials, user forum, document library, and subject matter expert information to encourage best practices and collaboration.
- Framework will be built in to allow import of other population databases so other military populations including foreign military partners can be represented.

The proposed suite of tools would need to be easy to use, affordable, and easily accessed (e.g., hosted webapps and/or downloadable standalone applications) to facilitate practitioner usage and standardization. Accompanying guidance in the form of teaching materials, a user forum, links to relevant papers and reports, and a registry for subject matter experts and facilities wishing to be listed would be beneficial inclusions. The ability to create visualizations should also be considered. Allowing the import of anthropometry in a .CSV file for overlay with existing anthropometric databases in the form of bivariate plots of key anthropometric measurements is extremely helpful for population comparisons as well as confirming that human participants used for physical assessments adequately represent the target population. This proposed effort also seeks to put a framework in place that will allow incorporation of data from other populations and use of the models for other applications and users to include the entire DOW, foreign military partners, NASA, industry, and academia.

PHASE I: Identify, discuss, and demonstrate an approach to develop new or update existing models to create a suite of tools that will improve modeling fidelity for aviation applications. Ensure that the approach would seek to address limitations of the current state of the art as well as leverage recent improvements where feasible within the scope of this topic. Include plans for development and testing of prototypes to be developed during Phase II.

PHASE II: Develop and demonstrate prototype parametric aviator head, hand, and body shape models as well as an accommodation model tool. Provide access to the prototype for evaluation by end-user DOW subject matter experts (SMEs).

PHASE III DUAL USE APPLICATIONS: Upon completion of modeling tool development, the tools will be web hosted and made freely available to DOW users (civilian and contractors), vendors, and academia. They will have immediate benefit to numerous programs/platforms (e.g., PMA-202, Joint Strike Fighter), Human Systems SMEs, and DOW manufacturers/suppliers. Accompanying guidance in the form of teaching materials, a user forum, links to relevant papers and reports, and a registry for subject matter experts and facilities wishing to be listed are desired inclusions. The USN will not incur an ongoing webhosting cost. Model improvements (e.g., incorporation of new/additional scans and anthropometry, customization or new development of a tool for a specific application that was outside the scope of the STTR, etc.) may provide follow-on funding opportunities by Program Offices or other DOW entities. The STTR partners may choose whether they would like to make the tools freely available to the public or charge a fee for use for other organizations that may find the tools useful.
Other commercial opportunities include expanding the populations represented by the tools to include foreign military and civilian populations.

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KEYWORDS: Digital Human Modeling; Human Systems; Protective Clothing; Protective Equipment; Cold Weather Gear; Aircrew

DON26TZ01-NV016 TITLE: Nudging Behaviors for Better Sleep

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)

OBJECTIVE: Develop software for personalized and adaptive behavioral interventions (i.e., nudges) using commercial off-the-shelf (COTS) wearable hardware devices to promote and improve sleep outcomes and human performance in dynamic environments.

DESCRIPTION: Despite extensive research on the mechanisms of sleep and behavioral modifications to improve sleep, relatively little is known about how context-sensitive behavioral nudging systems—those that dynamically suggest small, adaptive changes based on real-time data—can improve sleep quality and overall performance outcomes in complex, high-stakes settings. Fatigue caused by inadequate sleep negatively affects service members' performance and has contributed to accidents—resulting in deaths and hundreds of millions of dollars in damage to ships, vehicles, and aircraft [Ref 1]. "Nudging" refers to subtle interventions that steer behavior without restricting choices [Ref 2]. For example, non-obvious changes in how options are presented (e.g., ordering, timing, framing) have been shown to significantly affect sleep behaviors and dietary choices [Ref 3]. Recent advances in wearable sensor technology (e.g., smartwatches, rings, sleep trackers, etc.) allow for continuous collection of physiological and behavioral data. Many hardware devices are coupled with software that provide notifications, advice, and suggestions, but these are often canned, static statements that are simply pushed to the user (i.e., a one-way notification) and are not personalized to the user and/or their data.

Delivering adaptive behavioral nudges that learn and track the user's state and responses, evolve over time, and promote sustained positive behavior change is also critical for mitigating the impact of sleep on operations. The objective of this STTR topic is to develop personalized and adaptive behavioral interventions (i.e., nudges) using COTS wearable devices to promote and improve sleep outcomes and human performance in dynamic environments. Achieving this objective requires: (1) research into integrated theoretical frameworks for personalized behavior change, grounded in cognitive, physiological, and contextual variables, and informed by mathematical tools such as dynamical systems modeling; (2) the development of adaptive algorithms that leverage Machine Learning (ML) and Artificial Intelligence (AI) to integrate with existing wearable and embedded sensors to identify optimal timing, modality, and content for real-time, minimally-intrusive, adherence-supporting behavioral nudges across diverse user states and operational contexts; (3) the exploration of human-centered communication strategies for delivering behavioral insights and recommendations, ensuring interventions are not only well-timed but also subtle and capable of supporting an ongoing user-system relationship built on trust and voluntary engagement; and (4) empirical testing in ecologically valid environments, including experiments that collect sleep and performance metrics to evaluate effectiveness, generalizability, and long-term behavioral impact.

Equal emphasis will be placed on (1) advancing theoretical models of behavior change, sleep regulation, and performance adaptation and (2) developing AI/ML systems and communication strategies for delivering behavioral nudges.

This topic focuses on sleep behavior due to its broad applicability to the general population, its foundational role in human performance, and the relative ease and reliability of measurement. Proposed efforts should aim to develop generalizable algorithms that integrate complex mathematical modeling and

ML with cognitive-behavioral theory to drive adaptive behavioral interventions. These interventions must be compatible with existing wearable and embedded sensor ecosystems – this topic explicitly does not aim to develop new hardware, but instead to maximize the utility of currently available commercial sensors as inputs to a personalized, adaptive nudging system.

PHASE I: Develop early research plans, concepts/prototypes, and requirements for investigations into: (1) theoretical models of real-time behavioral change, intervention receptiveness, and nudging effectiveness that combines psychology (e.g., behavioral, cognitive, decision sciences), mathematics (e.g., dynamical systems), computer science (e.g., AI/ML, human-computer interaction), physiology (e.g., sleep science, chronobiology), and communications (e.g., persuasive communication, dialogic interaction systems; (2) develop a system that integrates AI/ML decision engines that dynamically adapts nudge timing, content, and delivery method based on physiological, cognitive, and contextual data and measures nudge compliance and effectiveness all in service of positively impact sleep behavior.

Tasks and environments should reflect the unique operational demands of the naval context, including irregular sleep schedules, sustained attention during extended operations, and decision-making under fatigue. Critical elements of the Phase I effort are to describe the research and engineering plans that would be executed during a potential Phase II and provide evidence of the feasibility of the approach, emphasizing the current state of the research and how the approach is both innovative and achievable. Prepare Phase II plans that should include key component technological milestones and plans for at least one operational test and evaluation to include user testing.
Due to the potential for long review times involved, formal human subject research is prohibited during Phase I.

PHASE II: Conduct and implement interdisciplinary research in the fields of psychology, physiology, mathematics, and computer science to develop and evaluate a prototype system with sailors (coordination aided by ONR) outlined during the Phase I. Include parallel but interrelated research and engineering tracks that will deliver iterative prototypes that will undergo design and testing reviews, to include usability assessment and effectiveness evaluations where appropriate. Collect both subjective and objective metrics regarding nudge usefulness, compliance, sleep quantity and quality through the development process. Perform all appropriate engineering tests and reviews, including a critical design review to finalize the system design. Produce the following deliverables: (1) additional research into development, adaptation, and delivery of behavioral nudges with a particular emphasis on sleep and fatigue; (2) a working prototype of the system that leverages existing COTS sensors, wearables, and hardware; (3) evaluation of system usability and compliance regarding effectiveness of nudges; (4) a system effectiveness evaluation of system capabilities to produce improved sleep quantity and/or quality. DON will provide Phase II awardees with the appropriate guidance required for human research protocols. Institutional Review Board (IRB) determination as well as processing, submission, and review of all paperwork required for human subject use can be a lengthy process. As such, no human research will be allowed until Phase II and work will not be authorized until approval has been obtained, typically as an Option to be exercised during Phase II.

PHASE III DUAL USE APPLICATIONS: Support the Navy in transitioning the technology for fielding. Develop the software for evaluation to determine its effectiveness in operational settings. As appropriate, focus on broadening capabilities and commercialization plans. Development of affordable, scalable, non-proprietary technologies are needed to take data generated by COTS hardware and sensors into actionable information that can be delivered as personalized nudges.

The commercial sector is developing some of these AI-enabled sleep technologies, but they often do not deal with critical issues regarding complex environments and dynamic contexts, do not address encryption and classification requirements, and often come with prohibitive licensing and usage fees. This technology will have broad application in the commercial sector.

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KEYWORDS: behavior change; adaptive systems; human performance; sleep and fatigue; dynamical systems modeling

DON26TZ01-NV017 TITLE: High Energy Laser Optically Rugged Maritime Beam Director Components & Subassemblies

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

COMPONENT TECHNOLOGY PRIORITY AREA(S): Advanced Materials;Directed Energy (DE);Microelectronics

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop new, innovative processes and methods of reproduction, and deliver prototypical end item high precision optics suitable for use with high energy lasers in beam directors - as scalable components and/or subassemblies, through automated and additive manufacturing techniques for structures, optics, and mirrors (flat and parabolic) - including any required finishing processes, (e.g., coating and polishing processes) to develop, document, achieve and demonstrate “end item” durable, rugged, reliable, tested components and/or products.

DESCRIPTION: Highly precise, small to large diameter (10 to 50 to 100cm) high energy laser optics and mirrors have very long lead times often exceeding individual fiscal year funding, and experience a high rejection rate due to complex, multi-step processing between multiple dislocated facilities. Resulting optics have high defect rates and low ruggedness requiring depot supplies of spares and replacements, creating logistical shortages and non-availabilities which impact readiness and capacity.
Creating multiple kinds of components for a notional or specific beam director that offers a series of developmental components and elements toward a finalized ruggedized beam director, suitable for at-sea deployment for up to ten years without maintenance is the objective. Threshold shall be the development of an optic that provides initial research and development value that can be tested in multiple laser inducted damage tests (LiDT). Examination of capabilities for scale, with optics from 10cm to 50cm or 100cm diameters, is expected.

Specifically, there is a very high interest in creating components from bulk materials with finished or near finish high quality optical surfaces and properties, transmissive or reflective, at a greatly reduced cost compared to traditional optical components (e.g., an optical transformation lens, a simple transmissive optic, or a fast steering mirror) utilizing “on-demand” adaptive, additive 3-D printing, etching, and highly automated finishing techniques. High interest exist in optical elements from 40 to 50 centimeters in diameter (e.g., ceramic, metal or other optical materials), small lightweight optics (e.g., from plastics or ceramics), and items that are completed to form a fully finished component through “no touch” human intervention processes or via fully automated decision-based manufacturing and processing (e.g., including finished robust optical coatings suitable for sea water based atmospheric exposure – such as fog or sea water splash contamination).

The Navy seeks a capability to create custom optical components, potentially including required integrated subassemblies, from processes that result in highly precise end item optics for high energy laser beam directors and laser weapons systems, either as components, replacements and/or subassemblies, through automated and additive manufacturing techniques for structures, optics, mirrors both shorten timelines for availability, and also enable innovative laser architectures - including or beyond current state-of-the-art modular architecture designs. Especially those where limited lifetimes due to environmental exposure require unique materials and innovative generational designs that change based on emergent requirements and increased commercial capacity. These can potentially open new avenues that enable new, innovative laser architectures - including capabilities or beyond current state of the art modular architecture designs, such as “ball on gimbal”, heliostats and celiostats – but the focus is on the processes and means to scale component designs, rapidly prototype multiple initial designs, and then move to quickly produce production grade high quality optics for initial use or as replacement utility spares. Preference shall be given for use of existing, commercially available materials, starting feed stock, or machine tooling. Similarly, preference shall be given for use of existing or modified “open system, open software” code and manufacturing methods.

The Navy has special interest in those components where limited lifetimes are expected (e.g., exit apertures, rotating or moving optics) due to environmental exposure and require unique materials (e.g., hard coatings for dust resistance, hydrophobic water shedding or chemical resistance) and innovative designs (e.g., flexible substrates) that can adapt, be replaced quickly, or change based on when emergent requirements and increased commercial capacity are noted.

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 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: Demonstrate at small scale (threshold: 10-15cm, objective: > 25cm) ability to create, finish, produce and replicate a single custom highly precise optical component design or integrated subassembly from a proposed set of processes - that results in highly precise end item optic, that can be tested in a standardized high energy laser induced damage test (LIDT). The design should include characteristics that show the resulting optical component can serve in the development of a full-scale beam director for a high energy laser weapons system at scale (small [10cm] or large [50cm]) using a surrogate commercial laser of no less than 1 kilowatt (kW). The final Phase I test shall enable proof in the applicability of additive or subtractive machined optical components, using highly automated processes toward meeting replacements for components and/or subassemblies. Included in the proof shall be demonstration of the ability to incorporate a fully automated manufacturing technique for assembling structures, optics, and/or mirrors that both shorten timelines for availability, or potentially enable innovative laser architectures for an individual component or subsystem. As an objective, one specific optical design that utilizes or extends an existing/anticipated high energy laser beam director (e.g., the planned DOW Joint Beam Control System (JCBS) or other service lightweight beam director) availability or functionality beyond current state of the art is expected.

PHASE II: Demonstrate at larger scales [30 to 50cm (threshold) to 100cm (objective)] of custom optical components or integrated subassemblies developed from the Phase I design concepts that will support a proposed DOW service led high energy laser beam director effort. Include development of all required mechanical and electronic control considerations for a full scale beam director use of the developed component or subsystem, suitable for a prototypical level integration effort within a high energy laser weapons system using a surrogate commercial laser of no less than 10 kW (Threshold) to 50 kW (Objective), showing applicability of additive or subtractive machined components, using only highly automated processes toward meeting replacements for components and/or subassemblies. Complete one specific optical component design that replaces or extends a high energy laser beam director functionality beyond the current state of the art in modular architecture and manufacturable designs by identifying an accurate unit price or cost estimate against documented and identified performance requirements. Identify

potential means where limited lifetimes due to environmental exposure can be monitored and rapidly replaced through the use of unique materials and innovative generational designs that offer changes based on emergent requirements and increased commercial capacity with an objective being to demonstrate a simulated component failure and manufacture a complete replacement optic or component within 1 month.
It is probable that the work under this effort will be classified under Phase II (see the Description section for details).

PHASE III DUAL USE APPLICATIONS: Support transition for Navy use.
The processes and components developed shall transition directly into the DOW development of high energy laser weapons systems, including spares.

Additional commercial products may include sensing and measurements systems that require a rugged, highly accurate optical element for video or still imagery. In particular, multiple service high energy laser beam directors are under development. This also includes potential for near term transition, including but not limited to high energy laser precision optics for LADAR systems; optics that could transition into the Golden Dome 4 America missile defense initiative for a potential directed energy weapon based on high energy lasers; or for a high power optical sensing and tracking capability.

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KEYWORDS: laser; optics; additive manufacturing; directed energy; weapons; beam director

DON26TZ01-NV018 TITLE: Production of Norbornadiene

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

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop efficient and scalable methods for the production of norbornadiene from abundant domestic feedstocks.

DESCRIPTION: Norbornadiene is a critical chemical used in the manufacture of fuels and cross-linked polymers. The conventional process for production of norbornadiene relies on a Diels-Alder coupling reaction between cyclopentadiene and acetylene. Acetylene air mixtures can be explosive, which has increased the cost of norbornadiene and reliance on foreign supply chains. The intent of this STTR topic is to establish a manufacturing process that will enable the safe and efficient domestic production of norbornadiene, which will in turn reduce acquisition costs.
Ultimately, this topic seeks to establish a process for the domestic production of norbornadiene at > 500 metric tons/year with target acquisition costs below $20/kg. The norbornadiene synthesized in this effort should have a purity > 97%. The utilization of advanced manufacturing techniques that generate acetylene on demand or incorporate novel methods for the safe storage of acetylene on-site are encouraged. Other approaches that generate norbornadiene via unique intermediates are also of interest. A preferred approach is to utilize domestic bio-feedstocks, including hemicellulose and furfural, as substrates for the production of norbornadiene.

PHASE I: Identify a chemical process for the synthesis of norbornadiene. Particular attention will be paid to the safe handling of acetylene and other reactants/reagents and solvents used in the manufacturing process. The use of domestic biomass feedstocks as the carbon source for norbornadiene production is preferred. A preliminary technoeconomic analysis will be conducted with a target selling price < $20/kg. Awardee(s) will conduct laboratory scale reactions and demonstrate the ability to generate small quantities of norbornadiene (10-100 mL) at purities comparable to commercial norbornadiene (> 97%). The purity of the product will be confirmed through standard analytical techniques including NMR spectroscopy and gas chromatography.

PHASE II: Demonstrate a prototype scalable approach for the synthesis of norbornadiene and provide 1 kg of material for evaluation by Navy researchers. Demonstrate production of norbornadiene at the 100 kg scale and develop plans for a facility capable of producing > 500 metric tons/year. An updated technoeconomic analysis will be performed utilizing information obtained during the pilot-scale production runs. The assessment will include a comparison of processes utilizing inputs from both conventional petrochemicals and biofeedstocks. At the completion of Phase II, 100 kg of norbornadiene with a purity > 97% will be delivered to the Government.

PHASE III DUAL USE APPLICATIONS: Assist the government in the establishment a CONUS facility capable of producing norbornadiene at the estimated scale of 10-20 metric tons/year, likely doing this in collaboration with a larger chemical supplier. Informed by the standup of this facility, update the plans and technoeconomic analysis for a facility capable of producing > 500 metric tons/year.

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KEYWORDS: Chemical Synthesis; Chemical Engineering; Manufacturing; Norbornadiene; Technoeconomic Analysis; Bio-feedstocks

DON26TZ01-NV019 TITLE: High Voltage and Current Silicon-Carbide (SiC) Metal-Oxide Semiconductor Field-Effect Transistor (MOSFET) for Fast Turn-On Current Applications

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

COMPONENT TECHNOLOGY PRIORITY AREA(S): Directed Energy (DE);Microelectronics;Renewable Energy Generation and Storage

PROJECTED CMMC LEVEL REQUIREMENT: Level 2 (Self)

OBJECTIVE: Develop state-of-the-art silicon carbide (SiC) Metal-Oxide Semiconductor Field-Effect Transistors (MOSFETs) packaged for improved size, weight, and power (SWaP) for applications where a high-blocking voltage of more than 10 kV, a high pulsed current density of greater than +/- 5 kA (10 kA ideal), and tens of nanoseconds turn-on time, with low-jitter, are needed for integration with high power microwave (HPM) systems.

DESCRIPTION: The DOW needs SWaP-favorable solutions for fast turn-on and low-jitter SiC MOSFETs to generate high current densities from high voltage capacitors. Current methods of high-current/voltage switching from SiC MOSFETS rely on an array created from series and parallel combinations of commercial off the shelf (COTS) devices [Ref 1]. However, these device arrays are limited in the voltage and amplitude they can switch, have complicated gate driving circuits, and can become size limited. To improve current state-of-the-art capability, the DOW has a need for the development of MOSFETs that have a blocking voltage greater than 10 kV for a single wafer, such that a low-side gate driver can be used to turn on the MOSFET, and a high pulsed-current capability. The requirements for a 5 kA peak current (10 kA ideal) may require multiple parallel combinations of MOSFET wafers, and if so, packaging is to be minimized and vertically stacked packaged arrays should be utilized. It is understood that at higher blocking voltages and current densities an additional diode may be necessary to accommodate the desired pulse current [Ref 2]. Minimizing gate charge and gate resistance for an array of MOSFET is important to alleviate driver requirements, such that a turn on time of less than 30 nanoseconds (ns) is achievable with less than 30 V of gate voltage and 10's of amps of gate current.

PHASE I: Develop a conceptual design for a MOSFET solution meeting the requirements in the Description. Include methodology and prototype performance through description and modeling that will demonstrate the proposed concept. Perform a tradespace assessment of size and performance for the proposed solutions.
Phase I Key Parameters:

- Voltage blocking from drain to source (V_{DS}) for a single semiconductor wafer of greater than 10 kV
- Low drain to source resistance (R_{DS_on}) of 50 milli-ohms or less up to 150 degrees Celsius
- Pulsed current discharge greater than 1 kA for a period of 500 ns forward (drain to source) and 500 ns reverse (source to drain).
    - Paralleling of devices is acceptable to reach current densities
    - External body diode is acceptable for high reverse currents
    - Pulsed current design is more critical than a continuous current rating
- Turn on time less than 50 ns with a driving gate voltage of equal or less than 30 volts
- Propose methods to provide a low inductance packaging of less than 20 nH per device for drain, source, gate, and kelvin pin. Total package size anticipated to be less than 6 x 6 x 3 inches
    - Thermal dissipation through drain is acceptable
    - Propose methods to minimize partial discharge voltage degradation

  - Propose methods for component layout showing size density
  - Propose methods for improved thermal management through packaging with thermal dissipation to switch up to 1 joule of capacitive energy per discharge at a 5 kHz discharge rate for up to 10 seconds
- Propose methods for operational lifetime evaluation
  - Describe degradation from peak operating conditions
  - Describe methods for electromagnetic interference (EMI) mitigation

PHASE II: Develop and deliver to the government (Quantity 10) optimized MOSFETs for integration with solid-state pulse generator prototypes developed by the government that meet or exceed the key performance requirements listed below. Topic proposals may propose the use of commercial or Federal facilities to satisfy the performance requirements of this topic, provided the performing SBC satisfies the performance thresholds set out in 15 U.S.C. sec. 638 and as implemented in the SBIR/STTR Policy Directive. Deliver a technical data package (TDP) detailing the design and construction of the packaged MOSFET solution as well as a preliminary datasheet on performance. Support integration and testing activities performed by the DOW.

Phase II Key Parameters:
- Voltage blocking from drain to source (V_DS) for a single semiconductor wafer of greater than 10 kV, when evaluated in package in open air (ideal) or liquid dielectric (threshold)
- Pulsed current discharge greater than 5 kA (10 kA ideal) for a period of 500 ns forward (drain to source) and 500 ns reverse (source to drain)
  - The MOSFET will be evaluated in short circuit conditions in a low-impedance, capacitive, and low-inductive (RLC) circuit
  - Paralleling of devices is acceptable to reach current densities
  - External body diode is acceptable and anticipated for high reverse currents
  - Pulsed current design is more critical than a continuous current rating
- Provide a low inductance packaging of less than 10 nH per device for drain, source, gate, and kelvin pin. Total package size anticipated to be less than 3 x 3 x 1 inches
  - Evaluate the package for partial discharge voltage degradation
  - Implement methods for EMI mitigation
- Turn on time less than 30 ns with a driving gate voltage of equal or less than 30 volts
- Low drain to source resistance (R_DS_on) of 10 milli-ohms or less up to 150 degrees Celsius
- Packaging with thermal dissipation to switch up to 2 joules of capacitive energy per discharge at a 50 kHz discharge rate for up to 10 seconds
- Implement methods for operation lifetime evaluation

PHASE III DUAL USE APPLICATIONS: Fast rising edge, high voltage MOSFETs enables the generation of higher power HPM systems. A future looking Phase III award shall deliver a complete refinement of parameters to meet requirements and develop manufacturing methods to reduce production time and cost in a commercialization path. For the delivery of MOSFETs as an enabling technology for solid-state HPM systems in such applications as counter-electronics, ultra-wideband radar, and high-power jammers. Other non-HPM applications include alternative energy (such as solar and wind inverters), power distribution, and automotive and transportation.

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KEYWORDS: Semiconductor; Metal-Oxide Semiconductor Field-Effect Transistor; MOSFET; body diode; high voltage; high current; Directed Energy; DE; High Power Radio Frequency; HPRF; High Power Microwave; HPM; Pulse repetition frequency; PRF; Pulse repetition rate; PRR