

**DEPARTMENT OF THE NAVY (DON)
23.3 Small Business Innovation Research (SBIR)
Proposal Submission Instructions**

IMPORTANT

- **The following instructions apply to topics:**
 - **N233-117 through N233-120**
- Submitting small business concerns are encouraged to thoroughly review the DoD Program BAA and register for the DSIP Listserv to remain apprised of important programmatic changes.
 - The DoD 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 document takes precedence over the DoD Instructions posted for this Broad Agency Announcement (BAA).
- **DON Phase I Technical Volume (Volume 2) page limit is not to exceed 10 pages.**
- Proposing small business concerns that are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF) or any combination of these are eligible to submit proposals in response to DON topics advertised in this BAA. Information on Majority Ownership in Part and certification requirements at time of submission for these proposing small business concerns are detailed in the section titled ADDITIONAL SUBMISSION CONSIDERATIONS.
- 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 provides notice that Basic Ordering Agreements (BOAs) may be used for Phase I awards, and BOAs or Other Transaction Agreements (OTAs) may be used for Phase II awards.
- 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 small business concern.

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.

The Director of the DON SBIR/STTR Programs is Mr. Robert Smith. 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. Refer to the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA for details.
	BAA Open	DoD SBIR/STTR Topic Q&A platform (https://www.dodsbirsttr.mil/submissions) Refer to the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA for details.
Electronic submission to the DoD 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
N233-117 and N233-118	Mr. Timothy Petro and Ms. Gladis Aispuro	Naval Facilities Engineering Center (NAVFAC)	timothy.j.petro4.civ@us.navy.mil and gladis.g.aispuro.civ@us.navy.mil
N233-119	Mr. Shadi Azoum	Naval Information Warfare Systems Command (NAVWAR)	info@navwarsbir.com
N233-120	Ms. Lore-Anne Ponirakis	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 DoD SBIR/STTR Programs.

(NOTE: Proposing small business concerns 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.)

DoD SBIR/STTR Innovation Portal (DSIP). Proposing small business concerns are required to submit proposals via the DoD SBIR/STTR Innovation Portal (DSIP); follow proposal submission instructions in the DoD SBIR/STTR Program BAA on the DSIP at <https://www.dodsbirsttr.mil/submissions>. Proposals submitted by any other means will be disregarded. Proposing small business concerns submitting through DSIP for the first time will be asked to register. It is recommended that small business concerns 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. Please refer to the DoD SBIR/STTR Program BAA for further information.

Proposal Volumes. The following six volumes are required.

- **Proposal Cover Sheet (Volume 1).** As specified in DoD SBIR/STTR Program BAA.
- **Technical Proposal (Volume 2)**
 - Technical Proposal (Volume 2) must meet the following requirements or the proposal will be REJECTED:
 - Not to exceed ten (10) pages, regardless of page content
 - Single column format, single-spaced typed lines
 - Standard 8 ½” x 11” paper
 - Page margins one inch on all sides. A header and footer may be included in the one-inch margin.
 - No font size smaller than 10-point
 - Include, within the ten-page limit of Volume 2, an Option that furthers the effort in preparation for Phase II and will bridge the funding gap between the end of Phase I and the start of Phase II. Tasks for both the Phase I Base and the Phase I Option must be clearly identified. Phase I Options are exercised upon selection for Phase II.
 - Work proposed for the Phase I Base must be exactly six (6) months.
 - Work proposed for the Phase I Option must be exactly six (6) months.
 - Additional information:
 - It is highly recommended that proposing small business concerns use the Phase I proposal template, specific to DON topics, at https://navysbir.com/links_forms.htm to meet Phase I Technical Volume (Volume 2) requirements.
 - A font size smaller than 10-point is allowable for headers, footers, imbedded tables, figures, images, or graphics that include text. However, proposing small business concerns 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 on the Proposal Cover Sheet (Volume 1) and in Volume 3.
 - For Phase I, a minimum of two-thirds of the work is performed by the proposing small business concern. The two-thirds percentage of work requirement must be met in the Base costs as well as in the Option costs. DON will not accept deviations from the minimum percentage of work requirements for Phase I. The percentage of work is measured by both

direct and indirect costs. To calculate the minimum percentage of work for the proposing small business concern the sum of all direct and indirect costs attributable to the proposing small business concern represent the numerator and the total cost of the proposal (i.e., Total Cost before Profit Rate is applied) is the denominator. The subcontractor percentage is calculated by taking the sum of all costs attributable to the subcontractor (Total Subcontractor Costs (TSC)) as the numerator and the total cost of the proposal (i.e., Total Cost before Profit Rate is applied) as the denominator.

- Proposing Small Business Concern Costs (included in numerator for calculation of the small business concern):
 - 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 small business concern.

- Subcontractor Costs (numerator for subcontractor calculation):
 - Total Subcontractor Costs (TSC)
- Total Cost (i.e., Total Cost before Profit Rate is applied, denominator for either calculation)

— **Cost Sharing: Cost sharing is not accepted on DON Phase I proposals.**

- 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).** DoD collects and uses Volume 4 and DSIP requires Volume 4 for proposal submission. Please refer to the Phase I Proposal section of the DoD 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 small business concerns must review and submit the following items, as applicable:

- **Telecommunications Equipment Certification.** Required for all proposing small business concerns. The DoD must comply with Section 889(a)(1)(B) of the FY2019 National Defense Authorization Act (NDAA) and is working to reduce or eliminate contracts, or extending or renewing a contract with an entity that uses any equipment,

system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As such, all proposing small business concerns must include as a part of their submission a written certification in response to the clauses (DFAR clauses 252.204-7016, 252.204-7018, and subpart 204.21). The written certification can be found in Attachment 1 of the DoD SBIR/STTR Program BAA. This certification must be signed by the authorized company representative and is to be uploaded as a separate PDF file in Volume 5. Failure to submit the required certification as a part of the proposal submission process will be cause for rejection of the proposal submission without evaluation. Please refer to the instructions provided in the Phase I Proposal section of the DoD SBIR/STTR Program BAA.

— **Disclosures of Foreign Affiliations or Relationships to Foreign Countries.** Each proposing small business concern is required to complete Attachment 2 of this BAA, “Disclosures of Foreign Affiliations or Relationships to Foreign Countries” and upload the form to Volume 5, Supporting Documents. Please refer to the following sections of the DoD SBIR/STTR Program BAA for details:

- Program Description
- Proposal Fundamentals
- Phase I Proposal
- Attachment 2

— **Certification Regarding Disclosure of Funding Sources.** Each proposing small business concern must comply with Section 223(a) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021. The disclosure and certification must be made by completing Attachment 4, Disclosure of Funding Sources, and uploading to Volume 5, Supporting Documents. Please refer to the following sections of the DoD SBIR/STTR Program BAA for details:

- Phase I Proposal
- Attachment 4

— **Majority Ownership in Part.** Proposing small business concerns which are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF), or any combination of these as set forth in 13 C.F.R. § 121.702, are eligible to submit proposals in response to DON topics advertised within this BAA. Complete certification as detailed under ADDITIONAL SUBMISSION CONSIDERATIONS.

o Additional information:

— Proposing small business concerns 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 small business concern 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
- Allocation of Rights between Prime and Subcontractor
- Disclosure of Information (DFARS 252.204-7000)
- Prior, Current, or Pending Support of Similar Proposals or Awards
- Foreign Citizens

— Do not include documents or information to substantiate the Technical Volume (Volume 2) in Volume 5 (e.g., resumes, test data, technical reports, or publications). Such documents or information will not be considered.

- A font size smaller than 10-point is allowable for documents in Volume 5; however, proposing small business concerns are cautioned that the text may be unreadable.
- **Fraud, Waste and Abuse Training Certification (Volume 6).** DoD requires Volume 6 for submission. Please refer to the Phase I Proposal section of the DoD 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 DoD 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 small business concern has met eligibility requirements and followed the instructions for the Proposal Cover Sheet as specified in the DoD SBIR/STTR Program BAA.
- **Technical Volume (Volume 2).** The DON will evaluate and select Phase I proposals using the evaluation criteria specified in the Phase I Proposal Evaluation Criteria section of the DoD 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 criteria 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 small business concern has met the following requirements or the proposal will be REJECTED:

- Not to exceed ten (10) pages, regardless of page content
 - Single column format, single-spaced typed lines
 - Standard 8 ½” x 11” paper
 - Page margins one inch on all sides. A header and footer may be included in the one-inch margin.
 - No font size smaller than 10-point, except as permitted in the instructions above.
 - Include, within the 10-page limit of Volume 2, an Option that furthers the effort in preparation for Phase II and will bridge the funding gap between the end of Phase I and the start of Phase II. Tasks for both the Phase I Base and the Phase I Option must be clearly identified.
 - Work proposed for the Phase I Base must be exactly six (6) months.
 - Work proposed for the Phase I Option must be exactly six (6) months.
- **Cost Volume (Volume 3).** The Cost Volume (Volume 3) will not be considered in the selection process and will only undergo a compliance review to verify the proposing small business concern 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; a minimum of two-thirds of the work is performed by the proposing small business concern. The two-thirds percentage of work requirement must be met in the Base costs as well as in the Option costs. DON will not accept deviations from the minimum percentage of work requirements for Phase I.
- **Cost Sharing: Cost sharing is not accepted on DON Phase I proposals.**
- **Company Commercialization Report (CCR) (Volume 4).** The CCR (Volume 4) will not be evaluated by the Navy nor will it be considered in the Navy's award decision. However, all proposing small business concerns must refer to the DoD 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 small business concern has included items in accordance with the PHASE I SUBMISSION INSTRUCTIONS section above.
- **Fraud, Waste, and Abuse Training Certificate (Volume 6).** Not evaluated.

ADDITIONAL SUBMISSION CONSIDERATIONS

This section details additional items for proposing small business concerns 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 Defense, in coordination with the Small Business Administration, to establish and implement a due diligence program to assess security risks presented by small business concerns seeking a Federally-funded award. Please review the Program Description section of the DoD SBIR/STTR Program BAA for details on how DoD will assess security risks presented by small business concerns.

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 small business concerns 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. The TABA amount, of up to \$25,000, 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 \$1,800,000 or lower limit specified by the SYSCOM). As with Phase I, the amount proposed for TABA cannot include any profit/fee by the proposing small business concern and must be inclusive of all applicable indirect costs. TABA cannot be used in the calculation of general and administrative expenses (G&A) for the SBIR proposing small business concern. 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. A small business concern 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 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 profit or fee by the SBIR proposing small business concern
- Propose a TABA provider that is the SBIR proposing small business concern
- Propose a TABA provider that is an affiliate of the SBIR proposing small business concern
- Propose a TABA provider that is an investor of the SBIR proposing small business concern
- Propose a TABA provider that is a subcontractor or consultant of the requesting small business concern 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 DoD 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 small business concern requests and is awarded TABA in a Phase II contract, the proposing small business concern will be eliminated from participating in the DON SBIR/STTR Transition Program (STP), the DON Forum for SBIR/STTR Transition (FST), 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. 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 small business concern 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). A small business concern whose proposed work will include fundamental research and requests to eliminate the requirement for prior approval of public disclosure of information must complete the DON Fundamental Research Disclosure and upload as a separate PDF file to the Supporting Documents (Volume 5) in DSIP as part of their proposal submission. The DON Fundamental Research Disclosure is available on https://navysbir.com/links_forms.htm and includes instructions on how to complete and upload the completed Disclosure. Simply identifying fundamental research in the Disclosure does **NOT** constitute acceptance of the exclusion. All exclusions will be reviewed and, if approved by the government Contracting Officer, noted in the contract.

Majority Ownership in Part. Proposing small business concerns that are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF), or any combination of these as set forth in 13 C.F.R. § 121.702, **are eligible** to submit proposals in response to DON topics advertised within this BAA.

For proposing small business concerns that are a member of this ownership class the following must be satisfied for proposals to be accepted and evaluated:

- a. Prior to submitting a proposal, small business concerns must register with the SBA Company Registry Database.
- b. The proposing small business concern within its submission must submit the Majority-Owned VCOC, HF, and PEF Certification. A copy of the SBIR VC Certification can be found on https://navysbir.com/links_forms.htm. Include the SBIR VC Certification in the Supporting Documents (Volume 5).
- c. Should a proposing small business concern become a member of this ownership class after submitting its proposal and prior to any receipt of a funding agreement, the proposing small business concern must immediately notify the Contracting Officer, register in the appropriate SBA database, and submit the required certification which can be found on https://navysbir.com/links_forms.htm.

System for Award Management (SAM). It is strongly encouraged that proposing small business concerns 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 small business concerns should confirm that they are registered to receive contracts (not just grants) and the address in SAM matches the address on the proposal. A small business concern selected for an award **MUST** have an active SAM registration at the time of award or they will be considered ineligible.

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 252.204-7019, in order to be considered for award, a small business concern 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 small business concern 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 small business concern 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 small business concern, and to take other relevant steps necessary prior to making an award.

Contract Types. The DON typically awards a Firm Fixed Price (FFP) contract or a small purchase agreement for Phase I. In addition to the negotiated contract award types listed in the section of the DoD SBIR/STTR Program BAA titled Proposal Fundamentals, for Phase II awards the DON may (under appropriate circumstances) propose the use of an Other Transaction Agreement (OTA) as specified in 10 U.S.C. 2371/10 U.S.C. 2371b and related implementing policies and regulations. The DON may choose to use a Basic Ordering Agreement (BOA) for Phase I and Phase II 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 small business concern per topic. The maximum Phase I proposal/award amount including all options 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 \$1,800,000 (unless non-SBIR/STTR funding is being added). Individual SYSCOMs may award amounts, including Base and all Options, of less than \$1,800,000 based on available funding. The structure of the Phase II proposal/award, including maximum amounts as well as breakdown between Base and Option amounts will be provided to all Phase I awardees either in their Phase I award or a minimum of 30 days prior to the due date for submission of their Initial Phase II proposal.

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

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

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

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

PHASE II GUIDELINES

Evaluation and Selection. All Phase I awardees may submit an **Initial** Phase II proposal for evaluation and selection. The evaluation criteria for Phase II is the same as Phase I (as stated in this BAA). The Phase I Final Report and Initial Phase II Proposal will be used to evaluate the small business concern'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.

NOTE: All SBIR/STTR Phase II awards made on topics from BAAs prior to FY13 will be conducted in accordance with the procedures specified in those BAAs (for all DON topics, this means by invitation only).

Awards. The DON typically awards a Cost Plus Fixed Fee contract for Phase II; but, may consider other types of agreement vehicles. 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 small business concerns (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.

Navy SBIR 23.3 Phase I Topic Index

N233-117	Defluorination of PFAS-impacted Matrices and Detection Methodologies
N233-118	Artificial Intelligence (AI) and Autonomy for Improved Operations and Modernization of Navy Shipyards
N233-119	Solid State Power Amplifier System for Very Low Frequency Communication
N233-120	Transparent and Back-Lit Liquid-Crystal Displays for Lensless Computational Imaging

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

OBJECTIVE: This topic seeks to: (1) demonstrate the integration of new treatment technologies for Per- and Polyfluoroalkyl substances (PFAS) impacted matrices to enable complete on-site disposal/management of PFAS-containing wastewater and solid wastes; (2) demonstrate and validate a rapid field portable solution for PFAS detection in wastewater and solid waste; and (3) develop a standardized analytical approach to properly quantify microplastics in drinking water, wastewater, and solid matrices.

DESCRIPTION: The Department of the Navy (DON) installations vary significantly in their missions, industrial operations, and functions but common to all of them is the generation of wastewater streams. Ensuring proper treatment of these wastewater streams is critical to comply with the installations' permits and secure the availability of potable and non-potable water supplies to sustain missions. Currently, treatment of wastewater streams impacted by contaminants of emerging concern (CEC), such as Per- and Polyfluoroalkyl Substances (PFAS) and potential microplastics, present DON installations with an ongoing challenge.

With present interest in replacing aqueous film forming foam (AFFF) with fluorine-free foam (F3) alternatives, there is a need to dispose of AFFF stockpiles and to treat wastewater streams derived from cleaning fixed (hangars) and mobile (firetrucks) fire suppression systems to less than 70 parts per trillion (ppt.) before discharging into sewers [Refs 1-4]. Often these wastewater streams are treated via conventional methods that involve granular activated carbon (GAC) and ion-exchange (IX) resin—thus producing PFAS-impacted waste that requires off-site disposal. In addition, wastewater treatment plants (WWTP) owned by DON installations may produce PFAS-impacted sewage-sludge and biosolids as a result of processing PFAS-impacted wastewaters from households using products containing PFAS (e.g., cleaning/degreasing agents; water-resistant, stain resistant, and fire-resistant fabrics; non-sticky cookware; personal-care products, etc.). Treated sewage-sludge or biosolids are often applied to crops and fields to supply plant organic nutrients without the use of synthetic fertilizer. If biosolids are PFAS-impacted, they have the potential to become a direct source of PFAS release into the soil and groundwater. In a similar manner, microplastics may end up in soil and groundwater due to the application of treated sewage-sludge or biosolids derived from the processing of domestic wastewater streams containing personal care products (e.g., toiletries and cosmetics) and washing of synthetic textiles [Refs 5-6].

As such, there is a need for PFAS destruction technologies for wastewater and solid waste (e.g., PFAS-impacted wastewater, PFAS-laden GAC, PFAS-laden IX-resin, and PFAS-impacted biosolids) [Refs 6-11]. Prototype technologies must demonstrate the ability to mineralize total PFAS to benign products without producing toxic waste and/or by-products. Particular emphasis must be placed in the mineralization of the six PFAS compounds—perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX Chemicals), perfluorohexane sulfonic acid (PFHxS), and perfluorobutane sulfonic acid (PFBS)—for which the U.S. Environmental Protection Agency (USEPA) is set to establish maximum contaminant levels (MCLs) under the National Primary Drinking Water Regulation (NPDWR). Conversely, it is also critical to have a rapid field portable solution for PFAS detection in wastewater, solid waste and treated PFAS-impacted sources (i.e., wastewater and solid waste). The rapid field portable solution for PFAS detection must be capable of reading PFAS concentration levels for PFOA and PFOS as low as 4 ppt. whereas PFNA, GenX chemicals, PFHxS, and PFBS must attained a combined Hazard Index of 1 (unit less) as proposed by the USEPA [Ref 12]. The latter implies that individual concentrations for these 4 PFAS compounds may be as low as single digit ppt. to double-digit ppt. In the

case of microplastics, for which there is no USEPA health advisory and/or proposed federal regulations but are set to become the next major environmental concern in drinking water, wastewater, and solid waste, there is a need to first develop a standardized analytical approach to properly quantify microplastics in drinking water, wastewater, and solid matrices. Once the standardized analytical approach is reliable and consistent across testing, a strategy must be developed to quantify sources of microplastics entering WWTPs and their effectiveness in removing microplastics. If WWTPs are not capable of addressing the removal of microplastics, an explanation must be provided and potential prototype treatment solutions must be identified.

PHASE I: Determine the feasibility of utilizing an emerging PFAS destruction technology to process PFAS-impacted matrices (i.e., wastewater and solid waste) of relevance to DON stakeholders. Some PFAS-impacted matrices of interest include (i) spent granulated activated carbon (GAC), (ii) spent powdered activated carbon (PAC), (iii) spent ion exchange resins (IXR), and/or (iv) complex PFAS-impacted wastewaters (e.g., fire truck rinse out byproducts). Ensure that matrices must be treated using lab-scale systems. Evaluate treatment success through measuring PFAS destruction levels, assessing the fate of fluorine after treatment, and assessing the fate of co-contaminants and matrix constituents (e.g., the filter material) during treatment.

For the rapid field portable solution for PFAS detection, the solution must be practical and not cumbersome as it will be conducted by personnel with and without engineering or scientific backgrounds. In addition, the rapid field portable solution must provide reliable PFAS concentration readings in the presence of other contaminants that may be present in real-life samples provided by DON stakeholders. PFAS detection and concentration levels by the field portable solution must be double-checked by PFAS analytical methods such as USAEPA Methods 533, 537.1, and/or 1633. Information on the capabilities of the solution as well as its shortcomings must be explained. This will provide information as to what areas still need development and how realistic it is to bring a solution into Phase II.

In the case of the standardized analytical approach to properly quantify microplastics in drinking water, wastewater and solid matrices, define, develop, and identify analytical tools that are both microplastic selective (i.e., specific only for some types of microplastics) and inclusive (i.e., able to detect all types of microplastics with adequate recoveries). Ensure that the microplastics comprise a variety of sizes, colors, and chemical compositions to include fibers, fragments, pellets, flakes, sheets, or foams. Discuss the advantages and disadvantages based on analytical tools in a summary of results and provide the best approach for a path forward to improve analysis of microplastics in the aforementioned matrices. At the end of Phase I, include in the final deliverables information substantiated by results and a Phase II plan that includes a concept for the Phase II field test and demonstration.

PHASE II: Demonstrate the PFAS destruction technology at a DON installation by treating one of the PFAS-impacted matrices identified in Phase I. Based on the results of Phase I, use the demonstration to validate the PFAS destruction performance at a realistic field site, processing a real waste stream. Use demonstration results to assess the feasibility of integrating the proposed technology into longer-term waste management projects.

Demonstrate and validate the rapid field portable solution for PFAS detection at a DON installation that has different sources of PFAS-impacted matrices. Use the equipment in real-time in the field test and demonstration and have it validated with support from DON personnel. Field testing readings must be supported by PFAS analytical testing as indicated in Phase I. Assess ease of use and portability of solution by personnel in the field.

Develop and test a step-by-step protocol of the microplastics standardized analytical approach to standardize collection, extraction, quantification, and identification of microplastics in drinking water, wastewater, and solid matrices to improve reliability, consistency and comparability across testing.

PHASE III DUAL USE APPLICATIONS: Integrate the Phase II-demonstrated technology with full-scale waste disposal and compliance-related PFAS management efforts and coordinate with the Air Force Civil Engineer Center (AFCEC) and the U.S. Army Corps of Engineers (USACE) to transition the technology to tackle broader (not just DON) Department of Defense (DoD)-wide challenges around PFAS-impacted sites. Address non-DoD Governmental and commercial needs including remediation of PFAS-impacted airport and fire training facilities, industrial wastewater treatment, and waste disposal.

Work with USEPA regulators to qualify Phase II rapid field portable PFAS detection and microplastics standardized analytical approach in order to mainstream them. Use rapid field portable PFAS detection and microplastics standardized analysis to quantify sources entering WWTPs and their effectiveness in removing them. If WWTPs are not capable of addressing the removal of PFAS and/or microplastics, provide an explanation and identify potential prototype treatment solutions.

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KEYWORDS: Per- and polyfluoroalkyl substance; PFAS; PFAS destruction; Perfluorooctane sulfonic acid; PFOS; Perfluorooctanoic acid; PFOA; Aqueous film-forming foam; AFFF; Environmental Compliance; Environmental Restoration; AFFF-impacted media; Granular Activated Carbon; GAC; Ion Exchange Resin; Solid-derived Wastes; Rapid Field PFAS Detection; Portable PFAS Detection; PFAS Detection in Real-Time; Microplastics; Microfibers

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N233-118

TITLE: Artificial Intelligence (AI) and Autonomy for Improved Operations and Modernization of Navy Shipyards

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

OBJECTIVE: Modernize Navy Shipyard facilities through three lines of effort: Drydocks, Infrastructure, and Industrial Plant Equipment. Digital technology to include digital twins, AI, and autonomy will bring these century old shipyards up to modern practices. Upgrading and modernizing shipyard operations and processes will expedite, reliably and safely, redeployment of DON assets back in the field as quickly as possible. Technologies for maintaining and sustaining ships, aircraft, and ground vehicles have advanced significantly in the past 50 years. Yet, the DON sustainment community has struggled to pilot, and integrate those same technological advances into public shipyards, fleet readiness centers, and ground vehicle depots. Executing this plan will improve the Navy Shipyards' productivity and increase their maintenance throughput to support the combat readiness of the Navy.

DESCRIPTION: The DON seeks to modernize its four public shipyards by fielding unmanned systems capabilities to improve efficiency and reduce cost without sacrificing safety or reliability. Remotely Operated Vehicles (ROVs), Unmanned Aerial Vehicles (UAVs), Unmanned Underwater Vehicles (UUVs), and materials handling equipment are actively being investigated to reduce exposure to hazardous conditions; reduce or avoid costs related to inspections, repairs, and surveying; and in general improve shipyard work processes. These added capabilities will fundamentally change the shipyard work environment, allowing for faster and more reliable forms of inspection, material delivery, work standardization, security, and condition reporting.

Technologies in the following focus areas are sought. Proposals can address one or multiple areas:

1. Improvement of Materials Handling Workflow Automating cranes and folk lifts; and improving logistics tracking in near real-time. Analytics, AI, and machine learning tools can be deployed to plan scheduling, enable continuous 24/7 operations, improve safety, and track and monitor all logistics to track inventory and identify workflow bottlenecks. These digital solutions serve as a force-multiplier, and not a replacement for the workforce, by maximizing operator talent and empowering faster, smarter decisions to increase safety and operator efficiency.
2. Autonomous 3D Precision Scanning (Command, Control, and Communications): Progress in 3D scanning continues to revolutionize multiple industries. The Navy desires the ability to autonomously 3D scan large platforms (e.g., aircraft carriers, airframes, vehicles) with the greatest precision possible. These scans will further improve digital twins as well as locate various structural issues that may otherwise be difficult to discern. This focus area is intended to advance (1) the digitization rate (including capture of environmental conditions as metadata), (2) precision from stand-off distances, and (3) rate of image rendering/stitching to create an interactive model.
3. Autonomous Non-Destructive Inspection (Autonomy and Microelectronics): Inspections of various structures (e.g., struts or stiffeners), pier facilities, and components (e.g., hatches or assemblies) of DON platforms are very labor intensive. The Navy desires to perform non-destructive inspections (NDI) of various geometries, sizes, and submerged assets through autonomous means. Existing NDI techniques including but not limited to penetrant testing, ultrasonic testing, and magnetic testing are sought to be placed in an autonomous solution.

PHASE I: Develop and demonstrate an initial functional prototype meeting one primary Focus Area of the three Focus Areas listed under the Description. Phase I submissions should provide sufficient

information on how the prototype to be developed and demonstrated during the Phase I will function in a relevant environment in a manner meeting the specified Focus Area. This information may include, but is not limited to, detailed designs, preliminary component or system laboratory testing, or a minimum viable product (MVP). At the end of Phase I, an initial functional prototype will be ready for demonstration and a detailed test plan for prototype testing will be provided to the Government.

PHASE II: Develop and demonstrate a functional prototype. Perform a Prototype Demonstration of Viability that focuses on moving beyond proving basic achievement of meeting DON needs to meeting usability features required for integration and deployment. Work with actual end users and systems integration personnel to ensure that requirements beyond technological performance of the prototype are identified (e.g., Human System Interface, logistics, training, maintenance, installation). Use feedback from DON users, systems integrators, and other potential defense and commercial beneficiaries and stakeholders to modify and adapt the prototype(s) to meet defense operational conditions and technical needs, Ensure that the prototype demonstrates operational and/or commercial viability. Recommend test procedures to demonstrate viability and an appropriate facility for the test.

Perform Pilot Testing in an Operational Environment that includes meeting with DON command stakeholders and operational end users to conduct pilot tests of fully functional prototype(s) in an operational environment or military exercise. Coordinate testing with DON command and operational stakeholders. Provide the results of this testing to inform stakeholders on the capabilities of the developed technology and the probability for its deployment in an operational environment. Use feedback from DON users, systems integrators, and other potential defense and commercial beneficiaries and stakeholders to adapt the prototype(s) to optimize defense operational and technical benefits and to provide optimal dual-use commercial market fit. If required, support the contractor-conducted tests, but the operation of the prototypes in the test must be capable of being performed by the government.

PHASE III DUAL USE APPLICATIONS: Support the transition to Navy use. Given the need for these capabilities at numerous sites, the Navy will coordinate funding to maximize return on investment at needed sites. Depending on financial estimates, a phased procurement may be required to reach full implementation at the necessary sites. Coordination between the Navy and the provider will be required during Phase III to ensure support and proper proficiency of the solution is in place. New guidance or standards may need to be generated to adopt these new technologies into operational processes. Standards and guidance may be adopted from commercial dual use cases. The Navy sees commercial development in autonomous systems in commercial logistics, inspection of facilities and commercial ships that can be leveraged to reduce development and transition costs.

Finally, the Federal Government sees the development of these capabilities as benefiting industrial maintenance activities in partnership with the Navy at commercial shipyards. The ability to keep critical assets in operation is a common need for which the Navy is seeking willing commercial partners . Service and or maintenance contracts may be procurement alternatives to direct acquisition of equipment.

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KEYWORDS: Autonomy; Artificial Intelligence; AI; Inspection; shipyard; robotics; data analytics; construction; digital twin; digitization; 3D scanning

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N233-119

TITLE: Solid State Power Amplifier System for Very Low Frequency Communication

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

OBJECTIVE: Design and demonstrate the ability to provide a 1 megawatt (MW) solid state power amplifier system to integrate into existing very low frequency (VLF) communication equipment.

DESCRIPTION: PMW 770 is looking to develop and install an affordable solid state power amplifier system to replace obsolete vacuum tube amplifiers at VLF transmitter sites with minimal down time and operation impact.

The Navy is interested in verifying a 1 MW solid state power amplifier system that meets the following minimum specifications:

- should work in all weather conditions (e.g., rain, daylight, night, cold, hot, etc.);
- should maintain existing reliability rating;
- should have redundancy and overhead built into the system;
- should have built-in test (BIT) capabilities for fault indications;
- should have automatic and step-by-step (i.e., manual) operation;
- should be able to demonstrate 1 MW across the entire VLF frequency range;
- should be able to demonstrate that it works with arc and phase monitoring equipment;
- should be able to demonstrate that it works with a synchronous tuner and that it can be auto-tuned;
- should be able to integrate into the existing system with minimum downtime;
- should be able to demonstrate that it works with legacy NATO Interoperable Submarine Broadcast System (NISBS) and Low Band Universal Communications System (LBUCS) outputs at their different baud rates; and
- should maintain IEEE electronic standards.

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 DoD 5220.22-M, National Industrial Security Program 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 Naval Information Warfare Systems Command (NAVWAR) 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 IAW DoD 5220.22-M during the advanced phases of this contract.

PHASE I: Conduct a study to determine the technical feasibility and initial design of an affordable 1 MW solid state power amplifier system that could replace the existing vacuum tube amplifier system with minimal downtime at a VLF Broadcast Transmitter Station (BTS). For the identified solution, develop the SBIR Phase II Project Plan to include a detailed schedule (in Gantt format), spend plan, performance objectives and specifications, and transition plan for the identified Program of Record (PoR).

PHASE II: Design, develop, demonstrate, and validate a 1 MW solid state power amplifier system prototype based on Phase I work that could be long term tested at a BTS VLF site. Develop life-cycle support strategies and concepts for the system. Develop a SBIR Phase III commercialization plan. Work in Phase II may become classified. Please see note in Description section.

PHASE III DUAL USE APPLICATIONS: Refine the prototype and if required, perform additional development to produce a Production Representative Article (PRA). Perform test and validation to certify and qualify components for Navy use. Support the Navy in transitioning the technology for Navy use. Investigate the dual use of the developed technologies for other DoD applications as well as commercial applications to include ground penetrating radar and communication.

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KEYWORDS: Very Low Frequency (VLF); solid state power amplifier; Naval Submarine Communications; Fixed Submarine Broadcast System (FSBS); NRTF Lualualei; undersea communications; high power communications

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N233-120

TITLE: Transparent and Back-Lit Liquid-Crystal Displays for Lensless Computational Imaging

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

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

OBJECTIVE: Research, develop, and fabricate micro-scale, high-resolution, high-refresh rate liquid-crystal-on-silicon (LCoS) micro-displays.

DESCRIPTION: The Office of Naval Research (ONR) is currently developing a range of lensless, optical-computing devices for applications in the areas of computer vision and computational photography. To create the next-generation versions of these devices, we are seeking proposals aimed at the design and fabrication of custom liquid-crystal micro-displays. We are interested in micro-scale, high-resolution liquid-crystal displays, with both transparent and back-lit versions under consideration under this SBIR topic. These displays would likely be similar to what is found in commercial virtual-reality headsets and augmented-reality headsets.

The micro-displays we need have several requirements not found in existing commercial offerings. Some additional research is hence needed. The micro-displays must be small (20 millimeter diagonal length or less) and high resolution (2048x1080 pixels or higher). The micro-displays should be grayscale-only and capable of supporting and implementing 8-bit grayscale values with the option to potentially support 16-bit values. A low response time (about 3 milliseconds or lower), and hence high frame rate (240 frames per second or higher), is needed to perform sensing and processing tasks at a level needed for realizing certain autonomy capabilities. The micro-displays should also come in back-lit and non-back-lit, transparent variations. In the latter case, the display should be made as transparent as possible so that light can travel through the liquid-crystal layer and be predominantly attenuated by the point-spread functions that will be shown on them. No strongly-occluding materials can be present behind the liquid-crystal layer for the transparent version of the display. Any electronics should be located at the periphery of the displays and incorporated into the baffling. Both the back-lit and non-back-lit transparent displays should interface with printed-circuit driver boards that will be developed and fabricated by the awardee as part of this SBIR topic.

Design Requirements:

We seek the design and fabrication of two displays. One display is assumed to be transparent and will not have a built-in backlight. The other will have a built-in backlight. Both displays should possess the following traits:

- Size: ≤ 20 millimeter diagonal length
- Resolution: $\geq 1920 \times 1080$ pixels
- Display Color: Either Monochromatic or color (RGB), monochromatic preferred
- Refresh Rate: ≥ 240 frames per second
- Pixel Bit Depth: ≥ 8 Bits for monochromatic, ≥ 24 Bits for color display

- Cell Gap Uniformity: $\leq 5\%$
- Back-lit Display Brightness: ≥ 1000 candela per square meter
- Interface(s): Multi-lane Mobile Industry Processor Interface (MIPI DSI) with High-Definition Multimedia Interface (HDMI) 2.1, or better, to provide inputs to the printed-circuit driver board. A custom Low-Voltage Differential Signaling (LVDS) solution is also acceptable.

The back-lit display should have the additional trait:

- Back-lit Display Brightness: ≥ 1000 candela per sq. meter.

Technical challenges: Ideally, the displays should be as low power as possible. The displays may be used for applications in harsh environments not currently considered by the acquisition program. A path forward for high-temperature operating conditions (greater than 70 degrees Celsius) should be established in the design stage, even if it is not implemented in the prototypes. The displays will not be used in environments where direct contact with water is expected. They will also not be used in environments with strong background radiation present.

Supporting incredibly high frame rates will not be feasible with present HDMI standards. Pre-buffering many image frames may not always be an option. The displays will hence, practically, be limited to the rates and resolution supported by the current HDMI 2.1/2.1a standard, which will be approximately 240 frames per second, during evaluation by the Navy. The designed displays will eventually be integrated with a custom application-specific integrated circuit (ASIC) chip to drive them at the highest frame rate offered by either a multi-lane MIPI connection or an LVDS connection. Potential performers should therefore advertise if their proposed solution can be run at higher frame rates and are limited only by the bandwidth offered by HDMI.

PHASE I: Produce a liquid crystal display design that satisfies the above criteria. Outline testing and evaluation criteria. If the design cannot meet the design objectives an analysis or discussion of the potential should be included in the Phase I report. Modeling, simulation, or comparison to similar developments should be used to justify design decisions.

PHASE II: Fabricate two to three prototype systems for evaluation. These systems should include both the displays and any circuit boards and other components needed to drive them. The prototype demonstration should achieve or show potential for meeting the design requirements. Perform detailed analysis on ruggedness and compatibility with Navy unmanned underwater vehicle handling, storage, and environmental operating conditions. Testing will be conducted by both the performer and by Navy personnel. Cost effectiveness and manufacturability feasibility should be addressed as part of the prototype test and evaluation. The appropriate acquisition program office will be consulted for any additional evaluation metrics needed for Phase III.

PHASE III DUAL USE APPLICATIONS: Build an advanced liquid crystal display prototype that meets appropriate technology readiness level (TRL) metrics set by the acquisition program office. Support the Navy for test and validation of the system for certified Navy use. Explore the potential to transfer the technology for commercial use. Commercial applications might include visual detection and tracking systems, low-power processing for commercial UxV systems, and large-scale supercomputing resources. Develop manufacturing plans to facilitate transition to a program of record.

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