

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

**IMPORTANT**

- **The following instructions apply to topics:**
  - N224-129
  - N224-130
  - N224-131
  
- **The following dates apply to the above listed topics:**
  - **July 12, 2022: Topics issued for pre-release**
  - **August 11, 2022: DON begins accepting proposals via DoD SBIR/STTR Innovation Portal (DSIP)**
  - **August 30, 2022: DSIP Topic Q&A closes to new questions at 12:00 p.m. ET**
  - **September 13, 2022: Deadline for receipt of proposals no later than 12:00 p.m. ET**
  
- **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.**
  
- **Proposers that are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF) or any combination of these 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 proposers 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](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.

**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](http://www.navysbir.com). Additional information on DON's mission can be found on the DON website at [www.navy.mil](http://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	Program Managers list 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 ( <a href="https://www.dodsbirsttr.mil/submissions">https://www.dodsbirsttr.mil/submissions</a> ) 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 <a href="mailto:dodsbirsupport@reisystems.com">dodsbirsupport@reisystems.com</a>
Navy-specific BAA instructions and forms	Always	Navy SBIR/STTR Program Management Office <a href="mailto:usn.pentagon.cnr-arlington-va.mbx.navy-sbir-sttr@us.navy.mil">usn.pentagon.cnr-arlington-va.mbx.navy-sbir-sttr@us.navy.mil</a>

**TABLE 2: DON SYSTEMS COMMANDS (SYSCOM) SBIR PROGRAM MANAGERS**

<u>Topic Numbers</u>	<u>Point of Contact</u>	<u>SYSCOM</u>	<u>Email</u>
N224-129	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
N224-130 and N224-131	Mr. Shadi Azoum	Naval Information Warfare Systems Command (NAVWAR)	w_spsc_ssc_pac_sbir_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: Proposers 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).** Proposers 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. Proposers submitting through DSIP for the first time will be asked to register. It is recommended that firms 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 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:
    - It is highly recommended that proposers use the Phase I proposal template, specific to DON topics, at [https://navysbir.com/links\\_forms.htm](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, proposers 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 firm. The percentage of work is measured by both direct and indirect costs. To calculate the minimum percentage of work for the proposing firm the sum of all direct and indirect costs attributable to the proposing firm 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.
      - Firm Costs (included in numerator for firm calculation):
        - 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 firm.

  - Subcontractor Costs (numerator for subcontractor calculation):
    - Total Subcontractor Costs (TSC)
  - Total Cost (denominator for either calculation)
- 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 proposers must review and submit the following items, as applicable:
  - **Telecommunications Equipment Certification.** Required for all proposers. 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 proposers 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.
  - **Disclosure of Offeror’s Ownership or Control by a Foreign Government.** All proposers must review to determine applicability. In accordance with DFARS provision 252.209-7002, a proposer is required to disclose any interest a foreign government has in the proposer when that interest constitutes control by foreign government. All proposers must review the Foreign Ownership or Control Disclosure information to determine applicability. If applicable, an authorized firm representative must complete the Disclosure of Offeror’s Ownership or Control by a Foreign Government (found in Attachment 2 of the DoD SBIR/STTR Program BAA) and upload as a separate PDF file

in Volume 5. Please refer to instructions provided in the Phase I Proposal section of the DoD SBIR/STTR Program BAA.

- **Majority Ownership in Part.** Proposers which are more than 50% owned by multiple venture capital operating companies (VCO), 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.
- Additional information:
  - Proposers may include the following administrative materials in Supporting Documents (Volume 5); a template is available at [https://navysbir.com/links\\_forms.htm](https://navysbir.com/links_forms.htm) to provide guidance on optional material the proposer 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) (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, proposers 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 proposer has met eligibility requirements and followed the instructions for the Proposal Cover Sheet as specified in 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 proposer 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 proposer 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 firm.
  - **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 proposers 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 proposer 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 proposers to consider during proposal preparation and submission process.

**Discretionary Technical and Business Assistance (TAB A).** The SBIR and STTR Policy Directive section 9(b) allows the DON to provide TAB A (formerly referred to as DTA) to its awardees. The purpose of TAB A 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. Firms may request, in their Phase I Cost Volume (Volume 3) and Phase II Cost Volume, to contract these services themselves through one or more TAB A providers in an amount not to exceed the values specified below. The Phase I TAB A amount is up to \$6,500 and is in addition to the award amount. The Phase II TAB A amount is up to \$25,000 per award. The TAB A 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 proposer 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 proposer. 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 firm 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 proposer
- Propose a TABA provider that is the SBIR proposer
- Propose a TABA provider that is an affiliate of the SBIR proposer
- Propose a TABA provider that is an investor of the SBIR proposer
- Propose a TABA provider that is a subcontractor or consultant of the requesting firm 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 proposer requests and is awarded TABA in a Phase II contract, the proposer 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 DON 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 proposer 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 firm 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](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.** Proposers that are more than 50% owned by multiple venture capital operating companies (VCOC), hedge funds (HF), private equity firms (PEF), or any combination of these as set forth in 13 C.F.R. § 121.702, **are eligible** to submit proposals in response to DON topics advertised within this BAA.

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

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

**System for Award Management (SAM).** It is strongly encouraged that proposers 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, proposers should confirm that they are registered to receive contracts (not just grants) and the address in SAM matches the address on the proposal.

**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 firm 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 proposer 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 firm proposal 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.** Protests of Phase I and II selections and awards must be directed to the cognizant Contracting Officer for the DON Topic Number, or filed with the Government Accountability Office (GAO). Contact information for Contracting Officers may be obtained from the DON SYSCOM Program Managers listed in Table 2. If the protest is to be filed with the GAO, please refer to instructions provided in the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA.

Protests to this BAA and proposal submission must be directed to the DoD SBIR/STTR Program BAA Contracting Officer, or filed with the GAO. Contact information for the DoD SBIR/STTR Program BAA

Contracting Officer can be found in the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA.

**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 proposer, 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 firm 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 \$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. The Phase I Final Report, Initial Phase II Proposal, and Transition Outbrief (as applicable) will be used to evaluate the proposer's potential

to progress to a workable prototype in Phase II and transition 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 firms (e.g., the DON 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 22.4 Topic Index  
Release 1**

N224-129 Geophysics Sensors and AI/ML for Subterranean Shipyard Voids and Piles  
N224-130 GPS Interference Direction of Arrival (DoA) Initiative for User Purposes (GIDI-UP)  
N224-131 Proliferated Low Earth Orbit (pLEO) Positioning, Navigation and Timing (PNT)

OUSD (R&E) MODERNIZATION PRIORITY: Artificial Intelligence (AI)/Machine Learning (ML); Autonomy; Nuclear

TECHNOLOGY AREA(S): Information Systems; Materials / Processes; Sensors

OBJECTIVE: Develop and demonstrate successful seismic geophysical assessment solution to enable non-destructive subterranean assessment of void and pile locations and dimensions (seeking up to 80 feet of penetration) for piers, wharfs, relieving-platforms, and other shipyard-type structures) for initial load restriction or load capacity planning during Port Damage Repair and Port/Harbor/Shipyard assessment scenarios, when electromagnetic contract methods fail due to salt-saturated soils and water.

DESCRIPTION: Facility Inspection, Sustainment, and Resilience via Geophysical Assessment Methods, Via Seismic Geophones:

Currently, those inspecting waterfront facilities (such as piers, wharfs, relieving-platforms, and other shipyard-type structures) for structural and soil voids or support-pile details cannot assess the subterranean structural components or defects which they cannot see. Also, many geophysical assessment methods, which are applicable inland, are impeded in part or whole by typical waterfront facilities site conditions such as soil types, geology, construction materials, construction configurations, onsite electrical interference, etc. Methods thus eliminated include those which rely on magnetics, electromagnetics, electrical methods, gravity, and nuclear [Ref 1]. Geophysical methods not eliminated include seismic methods [Ref 1]. This SBIR topic is therefore limited to this class of technically feasible methods.

The Sensors (Geophones):

The geophysical assessment sensors which receive the seismic energy are geophones (hydrophones in waterborne surveys) or commonly referred to as “phones”, and are typically configured for the geological site conditions of the average inland geophysicist rather than for the needs of those working on the waterfront and littoral regions. Therefore, there is a need and room for innovation within the materials, dimensions, and configuration for prototyping specialized geophone devices; and for evaluating within salt-saturated sediments and other structural configurations typical of waterfront and shipyard facilities. Interpretation of Geophone (Seismograph) Data; Improvements via Artificial Intelligence/Machine Learning (AI/ML):

The equipment that records input geophone voltages in a timed sequence is the seismograph. In general, the subsurface characterization provided by geophysical exploration methods (to the seismograph data) is valuable for waterfront facilities evaluations for the following reasons:

1. They allow nondestructive investigation below the surface of the ground, pavement, pier deck, or other structure.
2. They allow collection of data over large areas in very much shorter times than most destructive methods.
3. They cost less per data point than most invasive methods.
4. They can offer accurate and timely information for design quality and performance.

Although geophysical methods provide the above advantages, it is important to remember that the information obtained in geophysical surveys is often subject to more than one reasonable interpretation. Therefore, there is room for innovation in applying AI/ML to traditional geophysical assessment seismograph data.

#### Combined Need/Opportunity:

The needs expressed herein includes improvements in both the prototyping of specialized geophone devices and the accompanying AI/ML software improvements to the seismograph data. The related technical challenges include limited access to real-world facilities and limited (yet available) real-world subterranean defect data. Therefore, there is an opportunity to simulate the subterranean geophysics of the subject scenarios; however, any proposed simulation should be field verified or otherwise calibrated to relevant real-world data.

#### Capability Requirements:

Proposals shall address or otherwise exhibit the ability to address the 1.) Specialized design and manufacturing of the requisite specialized sensors, and 2.) The AI/ML aspects of improving (interpreting) seismograph data. Proposals shall also address 3.) The teams experience with:

- The typical geophysics and construction of piers, wharfs, relieving-platforms, and other shipyard-type structures;
- The design and prototyping of geophysics sensors; and
- AI/ML relevant to the subject opportunity.

#### Performance Parameters:

This research seeks an overall 30% improvement in a user's ability to correctly determine subterranean void and pile locations and dimensions, up to a depth of 80 feet of soil penetration. The improvements can come from any combination of improving either the sensors or the AI/ML interpretation of seismograph data or any other aspect of the demonstrated prototype. Note: This SBIR topic does not specify nor limit the innovation of the class of waves, nor the sub-class of waves (i.e., body wave class, surface wave class nor the sub-classes of waves within each of the classes).

PHASE I: Determine the technical feasibility of improving and prototyping specialized geophone device(s) for geophysical evaluation within salt-saturated sediments and other structural configurations typical of waterfront and shipyard facilities; for finding: void location(s) and dimensions, subterranean pile location(s) and dimensions, to include driven pile depth; and for proposing the targeted level of improvement in just the geophone sensors.

Apply innovative AI/ML to the traditional geophysical assessment seismograph data. Propose the targeted level of improvement in just the AI/ML interpretation/clarification of the seismograph data. Address if improvements are to come from other aspect(s) of the prototype to be demonstrated. Address if and to what extent the AI/ML training data will rely on simulation versus real-world training data. (Note: During the Phase I period of performance, the Navy can make some representative as-built drawings and inspection data available for all subject facility types. The Navy will not provide seismograph data.) Propose how the prototyped sensors will be adapted for underwater use, with a maximum operating depth of 90 feet of seawater (fsw). Propose how the prototyped sensor wave-source will be adapted for underwater use, with a maximum operating depth of 90 fsw.

Suggest to what extent the above improvements could reduce the required users' level of training, the recency of training, and the overall level of experience in order to correctly employ the prototyped device in either routine field application or expeditionary (communications denied) environments.

Beginning with commercial off-the-shelf (COTS) options is acceptable in Phase I.

Limited proof of concept for custom integration is also acceptable in Phase I, but is not required.

PHASE II: Prototype development of:

1. Specialized Geophysics sensors for use in the salt-saturated soils of waterfront facilities (such as piers, wharfs, relieving-platforms, and other shipyard-type structures), or integration to enable improved data input, when performing data collection via geophones.
2. AI/ML application to automate the clarification and classification of subterranean (seismograph) data for the same site conditions and structures.

While not required at this point, possible steps for the above might include:

- Development, procurement, and/or manufacture specialized sensors, such as geophones
- Gather or simulate relevant AI/ML training data (Government will provide traditional as-built drawings of representative structures, but not seismograph data)
- Determining or establishing situ/constructed pattern recognition (while allowing for constructed variability), either via pattern recognition methods, AI/ML, convenient parametric user interface for identification, or other diverse void or pile identification techniques
- Locate and classify subterranean void and structure detail, down to UNIFORMAT-II component level [Ref 3], i.e., delineate piles (pile depth), pile-caps, beams, deck, voids (size), etc.
- Determining or establishing the construction pattern, while allowing for constructed variability
- Conduct field validation of any formerly simulated or approximated training data used in developing the AI/ML neural network
- Tabulate or map the prototyped outputs, including voids, piles, and possibly other structural details

The Government will provide traditional as-built drawings of representative structures. The Government will also make demonstration facilities available to the Phase II awardee. However, the Phase II awardee will be required to meet all site access requirements; i.e., the Government will not be at fault for the Phase II awardee's failure to complete the typical site access requirements, either in forms/submittals or in the eligibility of its personnel.

The idealized data(s) for structure(s) and defect scenario(s) shall be provided by the awardee, but shall be of typical waterfront and shipyard facilities, and shall include subterranean voids, piles, and other relevant structural details. Single construction type for timber relieving platform is acceptable for Phase II; additionally, conventional concrete pile supported pier is acceptable as a minimum addition.

Validation of the following:

- Location(s) and dimension(s) of subterranean voids in timber-constructed relieving platform structures
- Location(s) and approximate dimension(s) of subterranean piles of timber-constructed relieving platform structures
- Location(s) and approximate dimension(s) of other subterranean structural details of timber-constructed relieving platform structures
- Constructed structural pattern (i.e., bent/row grid, or similar)
- Identification of missing element(s) from pattern or other provision for enhanced user understanding
- Increased user correct interpretation of subterranean details by at least 30% overall, compared to current terrestrial geophones and non-AI/ML aided interface, when the same are applied to waterfront and shipyard-type structures
- Likelihood that the solution will work by users with low-level training in either routine applications or communications-denied expeditionary applications.

Deliver working prototype sensors with integrated elements of the AI/ML application by the end of the full Phase II.



PHASE III DUAL USE APPLICATIONS: The expected transition of the product within the Government will include field demonstration of the Phase II solution for one actual timber-constructed relieving platform shipyard wharf/berth (for void location and classification) and one concrete-constructed convention pier (for driven pile depths); where actual gross defects may or may not exist, and where some aspect of the process may be simulation-based, with either simulated or real-world replicated voids, defects, debris, rubble, and/or other realistic anomalies.

The Phase III solution will conclude as a Government off the shelf (GOTS) product that the Navy Expeditionary Combat Command (NECC), the Underwater Construction Team (UCT), or the Navy Mobile Construction Battalion (NMCB) may employ during PDR exercises.

There is great commercial value in automating the interpretation of seismograph data for waterfront facilities, namely shipyard and port/harbor infrastructure. Therefore, the awardee could transition a non-military tool to industry, possibly in the form of licensing or selling the solution to major vendor(s) of related sensor systems, or computer aided design and modelling tools and software.

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KEYWORDS: Geophysical; Geophysical method; Geophysical assessment; Geophysical investigation; Geophysical surveys; Geophone; Seismograph; Ultraseismic; Subterranean assessment; Subterranean void; Subterranean pile; Nondestructive testing

TPOC-1: Russell Batman  
Email: [john.r.batman.civ@us.navy.mil](mailto:john.r.batman.civ@us.navy.mil)

TPOC-2: Gladis Aispuro  
Email: [gladis.g.aispuro.civ@us.navy.mil](mailto:gladis.g.aispuro.civ@us.navy.mil)

N224-130            TITLE: GPS Interference Direction of Arrival (DoA) Initiative for User Purposes (GIDI-UP)

OUSD (R&E) MODERNIZATION PRIORITY: Networked C3

TECHNOLOGY AREA(S): Electronics; Sensors

OBJECTIVE: Develop Global Positioning System (GPS) interference direction finding sensor for surface and subsurface vessels to provide situational awareness of jamming and/or spoofing signals.

DESCRIPTION: GPS is a highly accurate all-weather source of positioning, velocity, and timing (PVT) and is invaluable in bounding a ship's inertial navigation system's (INS) error. However, GPS utilizes weak radio frequency (RF) signals from distant satellites and are subjected to intentional and unintentional interference. Furthermore, users of GPS desire to ascertain the presence of undesired competing signals that may degrade or deceive platform GPS systems.

Surface platforms have multi-element anti-jamming antenna systems on board for the purposes of nulling/degrading antenna pattern in the direction of interference signals that are above the thermal noise defined by kTB. The GIDI-UP capability seeks to leverage the antenna arrays for the purposes of interferometry to detect and inform the host GPS-based Positioning Navigation and Timing Service (GPNTS) and ships bridge systems of the DoA of unwanted signals such that might be performing jamming and spoofing.

Phased array antenna technology is capable of directing antenna gain patterns for the purposes of electronically steerable arrays which is a well-known process. For GIDI-UP, a capability is required to provide directional accuracy of less than one (1) degree of azimuth and elevation (Threshold)/0.5 degrees (Objective). Capability shall include developing up to six (6) independent records for detected jammers/spoofers. Each DoA record will include bearing and elevation, including percent uncertainty for each separately. Data output will be in the North East Down coordinate frame.

The end solution will integrate into Position, Navigation, and Timing (PNT) suites, such as GPNTS. GPNTS is the Navy's current and modernized PNT system, replacing the Navigation Sensor System Interface (NAVSSI). It is an open-architecture, data-hosting environment for Navy surface platforms and provides real-time PNT data services, while allowing the integration of future APNT sources.

PHASE I: Determine the technical feasibility of using measurements of DoA for interferers. Identify the suitability of antenna arrays (considering the use of existing shipboard arrays configurations) necessary to detect and provide DoA information.

Describe the technical solution based on the investigation and technical trade-offs performed earlier in this Phase. Identify the means to incorporate the technical solution into the PNT suite, such as the GPNTS.

For the identified solution, develop the SBIR Phase II Project Plan to include a detailed schedule (in Gantt format), spend plan, performance objectives, and transition plan for the identified Program of Records (PoRs).

PHASE II: Develop a set of performance specifications for the GIDI-UP sensor with a positioning solution system for GPNTS. Conduct a System Requirements Review (SRR).

Engage with the Program Office during the introduction and collaboration with Naval Information Warfare Center (NIWC) Pacific engineers. Establish a working relationship with PMW/A 170 and NIWC Pacific engineers to perform integration studies to include the identification of any necessary engineering changes to the current GPNTS system. Additionally, establish a working relationship with the engineering team(s) of other potential transition PNT suite target(s).

Develop the prototype GIDI-UP sensor with positioning solution system for demonstration and validation in the GPNTS or equivalent development environment. Conduct a Preliminary Design Review (PDR) and commence development of an Engineering Development Model (EDM) system. Conduct a Critical Design Review (CDR) prior to building the EDM.

Develop the life-cycle support strategies and concepts for the system.

Develop a SBIR Phase III Project Plan to include a detailed schedule (in Gantt format) and spend plan, performance requirements, and revised transition plan for the GPNTS and other potential transition PNT suite target(s).

PHASE III DUAL USE APPLICATIONS: Refine and fully develop the Phase II EDM to produce a Production Representative Article (PRA) of the GIDI-UP sensor.

Perform Formal Qualification Tests (FQT) (e.g., field testing, operational assessments) of the PRA GIDI-UP sensor with the GPNTS system and other potential transition PNT suite target(s).

Provide life-cycle support strategies and concepts for the GIDI-UP sensor with the GPNTS and other potential transition PNT suite contractor(s) by developing a Life-Cycle Sustainment Plan (LCSP).

Investigate the dual use of the developed technologies for commercial applications, including but not limited to, commercial and privately owned vessels. These sensors can provide an additional method of positioning that is independent of GPS and available at all times, worldwide.

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KEYWORDS: Global Positioning System; GPS; Position Navigation and Timing; PNT; Assured PNT; APNT; direction of arrival; DoA

TPOC-1: McLaina Mazzone

Email: mclaina.mazzone.civ@us.navy.mil

TPOC-2: Joseph Schnecker

Email: joseph.f.schnecker.civ@us.navy.mil

N224-131            TITLE: Proliferated Low Earth Orbit (pLEO) Positioning, Navigation and Timing (PNT)

OUSD (R&E) MODERNIZATION PRIORITY: Networked C3

TECHNOLOGY AREA(S): Electronics; Sensors

OBJECTIVE: Develop navigation concepts using commercial Low Earth Orbit (LEO) satellite constellations as signals of opportunity to provide accurate Global Positioning System (GPS)-independent positioning and precise timing with a positioning accuracy of less than 50 meters 3-D (Spherical) Position (95%), less than 6 meters/second velocity error (RMS per axis), and better than 50 nanosecond time transfer (95%) (threshold).

Objective performance requirements are less than 10 meters, less than 3 meters/second, and better than 20 nanosecond time transfer.

DESCRIPTION: Current naval navigation systems are heavily reliant on GPS, which is a highly accurate all-weather source of positioning, velocity, and timing (PVT). However, GPS utilizes weak radio frequency (RF) signals from distant satellites that may be subjected to intentional and unintentional interference. In recent years, the ability to compromise GPS has been demonstrated by adversaries using jamming techniques that interfere with military mission execution. To mitigate these challenges, the Navy is seeking alternate navigation technologies that can meet and/or rival GPS accuracies for improved PVT when GPS is degraded and/or unavailable. Signals of Opportunity (SoOP) have been considered as an alternative navigation source in the absence of Global Navigation Satellite Systems (GNSS), such as GPS.

As Non-Geosynchronous Orbit (NGSO) satellites become more prevalent, the Navy is exploring Low Earth Orbit (LEO) constellations for low-latency, broadband communications, as well as an APNT source through SoOP. As a goal, the effort should also include fast time to first fix (TTFF) capability of less than 1 minute to achieve the above PVT requirements with presumed course initial positioning in the range of 1 kilometer, and initial time uncertainty in the range of 50 microseconds.

SoOP refers to the use of RF signals out of band or different than the GPS traditional signal waveforms that can be leveraged to perform radio navigation. Such SoOP can be either leveraged in their current state/signal structure/baseband messaging, for example for the purposes of communications, or augmented and/or modified specifically to support precise alternate (to GPS) PVT. While SoOP solutions currently exist (some utilizing LEO satellites, such as using Doppler) these solutions do not provide the positioning accuracies and timing feature that this topic is seeking. This SBIR topic is seeking more creative and innovative SoOP solutions.

The end solution will integrate into PNT suites, such as the GPS-based Positioning Navigation and Timing Service (GPNTS). GPNTS is the Navy's current and modernized PNT system, replacing the Navigation Sensor System Interface (NAVSSI). It is an open-architecture, data-hosting environment for Navy surface platforms and provides real-time PNT data services, while allowing to the integration of future APNT sources.

This SBIR topic falls under the NDS Alignment of "Modernize Key Capabilities" and the DDR&E (RT&L) Tech Priority "Networked Command, Control, and Communications (C3)."

PHASE I: Propose specific innovative solutions that use LEO satellite constellations as signals of opportunity to derive and provide accurate positioning and timing. Consider exploring modifications to

signal structures, including specific navigation messages and improved cognitive waveforms, to maintain sufficient ratio of Energy per Bit to the Spectral Noise Density (Eb/No) to maintain precise range/pseudorange measurements to reach for objective performance requirements.

Describe the technical solution based on the investigation and technical trade-offs performed earlier in this Phase. Identify the means to incorporate the technical solution into the PNT suite, such as the GPNTS.

For the identified solution, develop the SBIR Phase II Project Plan to include a detailed schedule (in Gantt format), spend plan, performance objectives, and transition plan for the identified Program of Records (PoRs).

**PHASE II:** Develop a set of performance specifications for the hardware and software solution with positioning solution system for GPNTS. Conduct a System Requirements Review (SRR).

Engage with the Program Office in its introduction and collaboration with Naval Information Warfare Center (NIWC) Pacific engineers. Establish a working relationship with PMW/A 170 and NIWC Pacific engineers to perform integration studies to include the identification of any necessary engineering changes to the current GPNTS system. Additionally, establish a working relationship with the engineering team(s) of other potential transition PNT suite target(s).

Develop the prototype solution for GPNTS for demonstration and validation in the GPNTS or equivalent development environment. Conduct a Preliminary Design Review (PDR) and commence development of an Engineering Development Model (EDM) system. Conduct a Critical Design Review (CDR) prior to building the EDM.

Develop the life-cycle support strategies and concepts for the system.

Develop a SBIR Phase III Project Plan to include a detailed schedule (in Gantt format) and spend plan, performance requirements, and revised transition plan for the GPNTS and other potential transition PNT suite target(s).

**PHASE III DUAL USE APPLICATIONS:** Refine and fully develop the Phase II EDM to produce a Production Representative Article (PRA) of the solution.

Perform Formal Qualification Tests (FQT) (e.g., field testing, operational assessments) of the PRA solution with the GPNTS system and other potential transition PNT suite target(s).

Provide life-cycle support strategies and concepts for the LEO sensor with the GPNTS and other potential transition PNT suite contractor(s) by developing a Life-Cycle Sustainment Plan (LCSP).

Investigate the dual use of the developed technologies for commercial applications, including but not limited to, commercial and privately owned vessels and aircraft. These sensors can provide an additional method of positioning and time that is independent of GPS and available at all times, worldwide.

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**KEYWORDS:** Global Positioning System; GPS; Position Navigation and Timing; PNT; Assured PNT; APNT; GPNTS; Non-Geostationary Orbit; NGSO; Low Earth Orbit; LEO; proliferated LEO;; PLEO; signals of opportunity; SoOP; Velocity; Position Velocity and Timing; PVT

TPOC-1: McLaina Mazzone  
Email: [mclaina.mazzone.civ@us.navy.mil](mailto:mclaina.mazzone.civ@us.navy.mil)

TPOC-2: Joseph Schneckner  
Email: [joseph.f.schneckner.civ@us.navy.mil](mailto:joseph.f.schneckner.civ@us.navy.mil)