DEPARTMENT OF THE NAVY (DON)
22.1 Small Business Innovation Research (SBIR)
Direct to Phase II (DP2) Announcement and Proposal Submission Instructions

IMPORTANT

- **The following instructions apply to Direct to Phase II (DP2) SBIR topics only:**
  - **N221-D01 to N221-D04**
- **The information provided in the DON Proposal Submission Instruction document takes precedence over the DoD Instructions posted for this Broad Agency Announcement (BAA).**
- **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 NOTES.**
- A DP2 Phase I Feasibility proposal template, unique to DP2 topics, is available at https://www.navysbir.com/links_forms.htm; use this template to meet Volume 2 requirements.
- DON provides notice that Basic Ordering Agreements (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. Additional information on DON's mission can be found on the DON website at www.navy.mil.

During government fiscal years (FY) 2012 through 2022, the Department of Defense (DoD), including the Department of the Navy (DON), may issue an SBIR award to a small business firm under Phase II , without regard to whether the firm received a Phase I award for such project. Prior to such an award, the head of the agency, or their designee, must issue a written determination that the firm has demonstrated the scientific and technical merit and feasibility of the technology solution that appears to have commercial potential (for use by the government or in the public sector). The determination must be submitted to the Small Business Administration (SBA) prior to issuing the Phase II award. As such, DON issues this portion of the BAA in accordance with the requirements of the Direct to Phase II (DP2) authority. Only those firms that are capable of meeting the DP2 proposal requirements may participate in this DP2 BAA. No Phase I awards will be issued to the designated DP2 topic.

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 (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	DoD Help Desk via email at dodsbirsupport@reisystems.com
Navy-specific BAA instructions and forms	Always	Navy-sbir-sttr.fct@navy.mil

TABLE 2: DON SYSTEMS COMMAND (SYSCOM) SBIR PROGRAM MANAGERS

Topic Numbers	Point of Contact	SYSCOM	Email
N221-D01 to N221-D04	Mr. Shawn Slade (Acting)	Naval Air Systems Command (NAVAIR)	navair.sbir@navy.mil

Each DON SBIR DP2 topic requires documentation to determine that Phase I feasibility, described in the Phase I section of the topic, has been met.

The DON SBIR DP2 is a two-step process:

STEP ONE: Prepare and Submit a Phase I Feasibility Proposal (instructions and link to template provided below). The purpose of the Phase I Feasibility Proposal is for the firm to provide documentation to substantiate that both Phase I feasibility and the scientific and technical merit described in the topic have been met. The Phase I Feasibility Proposal must: demonstrate that the firm performed Phase I-type research and development (R&D) and provide a concise summary of Phase II objectives, work plan, related research, key personnel, transition/commercialization plan, and estimated costs. Feasibility documentation MUST NOT be solely based on work performed under prior or ongoing federally funded SBIR/STTR work. The government will evaluate Phase I Feasibility Proposals and select firms to submit a Full DP2 Proposal. Demonstrating proof of feasibility is a requirement for a DP2 award. The firm must submit a Phase I Feasibility Proposal to be considered for selection to submit a Full DP2 Proposal.

STEP TWO: If selected, the cognizant SYSCOM Program Office will contact the firm directly to provide instructions on how to submit a Full DP2 Proposal.

DON SBIR reserves the right to make no awards under this DP2 BAA. All awards are subject to availability of funds and successful negotiations. Proposers must read the topic requirements carefully. The Government is not responsible for expenditures by the proposer prior to award of a contract. For 22.1 topics designated as DP2, DON will accept only Phase I Feasibility Proposals (described below).

DP2 PROPOSAL SUBMISSION REQUIREMENTS

The following section details what is required for a DON SBIR DP2 proposal submission 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.

Eligibility. Each proposing firm must:

- Have demonstrated feasibility of Phase I-type R&D work
- Have submitted a Phase I Feasibility Proposal for evaluation
- Meet Offeror Eligibility and Performance Requirements as defined in the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA
- Comply with primary employment requirements of the principal investigator (PI) during the Phase II award including, employment with the firm at the time of award and during the conduct of the proposed project. Primary employment means that more than one-half of the PI's time is spent in the employ of the firm
- Register in the System for Award Management (SAM) as defined in the Proposal Fundamentals section of the DoD SBIR/STTR Program BAA. To register, visit https://beta.sam.gov

Proposal Volumes. The following six volumes are required.

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

- **Technical Volume (Volume 2).**
  - Technical Proposal (Volume 2) must meet the following requirements or it will be REJECTED:
    - Not to exceed 30 pages, regardless of page content; Phase I Proof of Feasibility portion not to exceed 20 pages, Snapshot of Proposed Phase II Effort portion not to exceed 10 pages
    - 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
  - Additional information:
    - It is highly recommended that proposers use the DP2 Phase I Feasibility proposal template at https://navysbir.com/links_forms.htm to meet DP2 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).** The text fields related to costs for the proposed effort must be answered in the Cost Volume of the DoD Submission system (at https://www.dodsbirsttr.mil/submissions/), however, proposers DO NOT need to download and complete the separate cost volume template when submitting the DON SBIR Phase I Feasibility Proposal. Proposers are to include a cost estimate in the Order of Magnitude Cost Estimate Table (example below) within the Technical Volume (Volume 2). Please refer to Table 3 below for guidance on cost and period of performance. Costs for the Base and Option are to be separate and identified on the Proposal Cover Sheet and in the Order of Magnitude Cost Estimate Table in the Technical Volume (Volume 2).

Order of Magnitude Cost Estimate Table			
Line Item – Details	**Estimated Base Amount**	**Estimated Option Amount**	**Total Estimated Amount Base + Option**
Direct Labor (fully burdened) – Prime			
Subcontractors/Consultants			
Material			
Travel & ODC			
G&A			
FCCM			
Fee/Profit			
TABA (NTE $25K, included in total amount)			
Total Estimated Costs			

TABLE 3: COST & PERIOD OF PERFORMANCE

Topic Number	**Base**		**Option One**		**Total (NTE)**
	Cost (NTE)	**POP (NTE)**	**Cost (NTE)**	**POP (NTE)**	
N221-D01 to N221-D04	$800,000	24 mos.	$300,000	12 mos.	$1,100,000

  - 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.

- **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 (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.

  - 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 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.

DP2 EVALUATION AND SELECTION

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

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

- **Proposal Cover Sheet (Volume 1).** Not evaluated. The Cover Sheet (Volume 1) will undergo a compliance review (prior to evaluation) to verify the proposer has met eligibility requirements.

- **Technical Volume (Volume 2).** The DON will evaluate and select Phase I Feasibility 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. "Best value" is defined as approaches containing innovative technology solutions to the Navy's technical challenges for meeting its mission needs as reflected in the SBIR/STTR topics. 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. 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 it will be REJECTED:
  - Not to exceed 30 pages, regardless of page content; Phase I Proof of Feasibility portion not to exceed 20 pages, Snapshot of Proposed Phase II Effort portion not to exceed 10 pages
  - 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.

- **Cost Volume (Volume 3).** Not evaluated. The Cost Volume (Volume 3) will undergo a compliance review (prior to the proposal evaluation) to verify the proposer has complied with not to exceed values for the Base and Option detailed in Table 3 above. Proposals exceeding either the Base or Option not to exceed values will be REJECTED without further consideration.

- **Company Commercialization Report (Volume 4).** Not evaluated.

- **Supporting Documents (Volume 5).** Not evaluated. Supporting Documents (Volume 5) will undergo a compliance review to ensure the proposer has included items in accordance with the DP2 PROPOSAL SUBMISSION REQUIREMENTS 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 (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. Firms may request, in their Cost Volume (Volume 3), to contract these services themselves through one or more TABA providers in an amount not to exceed the values specified below. 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 $1,700,000 or lower limit specified by the SYSCOM). The amount proposed for TABA cannot include any profit/fee by the proposer and must be inclusive of all applicable indirect costs. 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 TABA Report, detailing the results and benefits of the service received, will be required annually by October 30.

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
- 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 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 "Discretionary Technical and Business Assistance" in the section titled Additional Cost Information.

Proposed values for TABA must NOT exceed:

- 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 attend a one-day DON STP meeting during the first or second year of the Phase II contract. This meeting is typically held in the spring/summer in the Washington, D.C. area. STP information can be obtained at: https://navystp.com. Phase II awardees will be contacted separately regarding this program. It is recommended that Phase II cost estimates include travel to Washington, D.C. for this event.

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 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. 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.

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. If the use of human, animal, and recombinant DNA is included under a DP2 proposal, please carefully review the requirements at: https://www.onr.navy.mil/work-with-us/how-to-apply/compliance-protections/Research-Protections/Human-Subject-Research.aspx. This webpage provides guidance and lists approvals that may be required before contract/work can begin.

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 cost analysis, confirm eligibility of proposer, and to take other relevant steps necessary prior to making an award.

Contract Types. 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.

Contract Deliverables. Contract deliverables are typically progress reports and final reports. Required contract deliverables must be uploaded to https://www.navysbirprogram.com/navydeliverables/.

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 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 22.1 Direct to Phase II Topic Index

N221-D01 TITLE: DIRECT TO PHASE II – High-Speed Digital Fiber-Optic Transmitter

OUSD (R&E) MODERNIZATION PRIORITY: General Warfighting Requirements (GWR);Networked C3

TECHNOLOGY AREA(S): Air Platforms;Electronics

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

OBJECTIVE: Develop and package an uncooled digital fiber-optic transmitter that operates at 100 Gbps, binary, non-return-to-zero for air platform fiber-optic link applications.

DESCRIPTION: Current airborne military (mil-aero) core avionics, electro-optic (EO), communications, and electronic warfare systems require ever-increasing bandwidths while simultaneously demanding reductions in space, weight, and power (SWAP). The replacement of shielded twisted pair wire and coaxial cable with earlier generation length-bandwidth product, multimode optical fiber has given increased immunity to electromagnetic interference, bandwidth, throughput, and a reduction in size and weight on aircraft [Ref 22]. The effectiveness of these systems hinges on optical communication components that realize high per-lane throughput, low latency, large link budget, and are compatible with the harsh avionic environment [Refs 1-7].

In the future, data transmission rates of 100 Gbps and higher will be required. Substantial work has been done to realize data rates approaching this goal based on the use of shortwave wavelength division multiplexing (SWDM) and coarse wavelength division multiplexing (CWDM) technologies. To be successful in the avionic application, existing non-return-to-zero (NRZ) signal coding with large link budget and low latency must be maintained. Advances in optical transmitter designs are required that leverage novel laser diode technology, semiconductor process technology, circuit designs, architectures, and packaging and integration techniques.

SWDM transmitters should be compatible with the SWDM4 wavelength grid (844 to 948 nm center wavelength range) [Ref 8]. CWDM transmitters should be compatible the CWDM4 wavelength grid (1271 to 1331 nm center wavelength range) [Ref 9]. Both transmitter types should support non-forward error correction application links as described in 100G CLR4 [Ref 10]. Optical Multimode 4 (OM4) and Optical Multimode 5 (OM5) optical fiber has been optimized for 100 Gbps and higher SWDM links [Refs 11–12]. The length of the transmitter fiber pigtails should be 72 in. (182.88 cm), +/- 2 in. (5.08 cm) long, terminated with ferrule connector/physical contact (FC/PC) connectors [Ref 20]. The fiber pigtails should be strain relieved (1 kg pull test) and protected via 900-micron buffered fiber. The FC/PC connectors must operate at room temperature. FC/PC polished endfaces should be per SAE AS5675A [Ref 21]. A fiber-optic boot or appropriate heat shrink tubing to control pigtail bend radius is required. Evaluation boards should be made of materials that operate from -40 °C to +95 °C.

The proposed avionics SWDM and CWDM transmitters must operate over a -40 °C to +95 °C temperature range, and maintain performance upon exposure to typical naval air platform vibration, humidity, temperature, altitude, thermal shock, mechanical shock, and temperature cycling environments

[Refs 13–19]. The transmitter must support a 15 dB link loss power budget when paired with a receiver without forward error correction sensitivity performance and meeting similar environmental requirements. The SWDM transmitter must be compatible with receivers operating SWDM wavelength band. The CWDM transmitter must be compatible with receivers operating in the CWDM band. The SWDM and CWDM transmitters must be capable of transmitting multi-wavelength signals transmitted over 50 µm core multimode fiber. The transmitters would include four wavelength selected lasers, each operating at 25 Gbps to achieve an aggregate transmitter bandwidth of =100 Gbps. The transmitter optical subassembly optically multiplexes the four transmitter laser output wavelengths onto one 50 micron core multimode optical fiber. The transmitter must allow for 1 X 10–12 bit error rate operation in a 100 m long link. The electrical input of the transmitter must be differential current mode logic.

PHASE I: For a Direct to Phase II topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort. Have developed a concept for a workable prototype or design to address, at a minimum, the basic requirements of the stated objective above. The below actions would be required in order to satisfy the requirements of Phase I:

1. Designed and analyzed an uncooled high-speed digital fiber-optic transmitter circuit and provided an approach for determining transmitter parameters and testing.
2. Designed a high-speed digital fiber-optic transmitter package prototype that is compatible with the transmitter circuit design and coupling to optical fiber.
3. Determined and demonstrated the feasibility of the transmitter design, the package prototype design, and a path to meeting Phase II goals based on analysis and modeling. The analysis and modeling should reference results obtained in previous efforts.

FEASIBILITY DOCUMENTATION: Offerors interested in participating in Direct to Phase II must include in their response to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and Phase I feasibility described in Phase I above has been met (i.e., the small business must have performed Phase I-type research and development related to the topic, but from non-SBIR funding sources) and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology as stated in Phase I above. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI). Read and follow all of the DON SBIR 22.1 Direct to Phase II Broad Agency Announcement (BAA) Instructions. Phase I proposals will NOT be accepted for this topic.

PHASE II: Optimize the transmitter circuit and package designs. Build and test the transmitter circuit and packaged transmitter prototype to meet performance requirements. Characterize the transmitter over temperature, and perform highly accelerated life testing. If necessary, perform root cause analysis and remediate circuit and/or packaged transmitter failures. Verify OM5 fiber performance for CWDM transmitter based links. Create multimode fiber specification for CWDM transmitter based links. Deliver two prototype fiber pigtailed SWDM and two prototype fiber pigtailed CWDM transmitter prototypes and evaluation boards for 100 Gbps digital fiber-optic communication link application.

PHASE III DUAL USE APPLICATIONS: Finalize the prototype. Verify and validate the transmitter performance in an uncooled 100 Gbps fiber-optic transmitter that operates from -40 °C to +95 °C. Transition to applicable naval platforms.

Telecommunication systems, fiber-optic networks, and data centers would benefit from the development of high-speed fiber-optic transmitters.

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KEYWORDS: Digital Fiber-Optic Transceiver; Binary Non-return to zero signaling; 100, 200 Gigabits per Second; Packaging; Highly Accelerated Life Testing; Data rate

N221-D02 TITLE: DIRECT TO PHASE II – Flight Operations Planning Decision Aid Tool for Strike Operations Aboard Aircraft Carriers

OUSD (R&E) MODERNIZATION PRIORITY: Autonomy

TECHNOLOGY AREA(S): Information Systems

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

OBJECTIVE: Develop a decision support tool using intelligent agents to assist Strike Operations (Strike Ops) in scheduling flight operations aboard aircraft carriers.

DESCRIPTION: Flight operations planning on aircraft carriers is central to the success and efficiency of the carrier air wing (CVW) in executing missions. Scheduling is dependent on mission objectives, as well as available resources and strike group readiness. The schedule of all air operations within a day is documented in the Air Plan by the Strike Operations department. The Air Plan consists of events for each CVW squadron, which are broken down into details, such as launch and recovery times, mission type, and aircrafts assigned. A Load Plan is then generated to document the ordnance required to fulfill each event. These plans are distributed throughout the CVW for execution. The process of creating these plans can be challenging and time consuming. Information systems are in place for documenting and managing Air Plans but require expert input from Strike Ops planners. Additionally, there is a wide range of information sources that determine events to include within the Air Plan and it is difficult to gather information on readiness. These plans are likely to change on the fly as well, due to unforeseen changes to missions and resources. There is a technology insertion opportunity to reduce workload, increase planning efficiency, and improve adaptability through the use of a decision support application.

Intelligent agent technology can provide decision aids to reduce the complexity of flight operations planning. Agents would need to be able to generate plans based on mission requirements and strike group readiness. The system would need to collect and perceive all pertinent information required to fill out an Air Plan and a Load Plan. This includes tasks determined from mission requirements, maintenance requirements, carrier qualifications, logistics flights, and training requirements. Tasks would need to be mapped to resources such as squadron capability, ordnance required, and aircraft availability to populate an Air Plan and a Load Plan. For example, the system would need to automatically assign a squadron to a specific mission based on availability, capability, and readiness. The solution should include the ability to provide observability in its decisions while allowing for adjustments and alternative plans. Intelligent agents were proven applicable within many areas in industry, including defense and naval aviation. However, there is currently no intelligent agent technology directed towards the flight operations planning aboard aircraft carriers. This particular application’s dilemma is due to the difficulty of gathering information required to create the Air Plan. Not only do the plans need to take into account the status of available CVW resources, but also the intent of the CVW as well.

The Navy is considering technology solutions to creating an intelligent decision support system. Methods that address the time-consuming nature of information capture, both manual input and sensory input, will

be considered. Solutions that can be implemented to current shipboard flight operations planning processes with minimal impact is preferred.

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 NAVAIR 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: For a Direct to Phase II topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort. Have developed a concept for a workable prototype or design to address, at a minimum, the basic requirements of the stated objective above. The below actions would be required in order to satisfy the requirements of Phase I:

Determined and demonstrated the feasibility of a decision support tool in providing decision aids for a scheduling application. Feasibility must be demonstrated through analysis, modeling or lab demonstration. Results and analysis from previous efforts should be referenced in feasibility documentation.

FEASIBILITY DOCUMENTATION: Offerors interested in participating in Direct to Phase II must include in their response to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and Phase I feasibility described in Phase I above has been met (i.e., the small business must have performed Phase I-type research and development related to the topic, but from non-SBIR funding sources) and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology as stated in Phase I above. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI). Read and follow all of the DON SBIR 22.1 Direct to Phase II Broad Agency Announcement (BAA) Instructions. Phase I proposals will NOT be accepted for this topic.

PHASE II: Develop a decision support software prototype to assist in flight operations planning aboard aircraft carriers. Optimize intelligent agent outputs based on subject matter expert feedback. Demonstrate the technology through simulations and compare its effectiveness to traditional methods of scheduling and planning. Provide documentation on software and hardware architecture.

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

PHASE III DUAL USE APPLICATIONS: Create a full-scale decision support software tool capable of supporting the process of flight operations scheduling aboard aircraft carriers. The system should be capable of providing schedules that increase the performance of flight operations.

Industry applications include production and manufacturing planning, shipping logistics, and medical scheduling.

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KEYWORDS: Intelligent Agents; Decision Support; Scheduling; Aircraft Carriers; Air Plan; Strike Operations

N221-D03 TITLE: DIRECT TO PHASE II – Lowering Integrally Bladed Rotor Sustainment Costs Through Mistuning Characterization of Intentionally Mistuned Blades

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

TECHNOLOGY AREA(S): Air Platforms

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

OBJECTIVE: Develop the measurement equipment and analysis methods required to characterize mistuning in Integrally Bladed Rotors (IBRs) that have intentionally mistuned blades for the purpose of supporting airfoil Foreign Object Damage (FOD) and repair limit expansion.

DESCRIPTION: Foreign Object Damage (FOD) is a top driver of engine removal for nearly every platform in naval aviation. FOD is caused by the ingestion of airfield debris into aircraft engines during operation and thus impacting the blade and vane airfoils [Ref 1]. Newer aircraft engines utilize Integrally Bladed Rotors (IBR/Blisk), which complicates the analysis and repair of FOD. In an IBR, the blades and disk are a single monolithic part rather than removable blades inserted in disk dovetails. The IBR design architecture reduces the mechanical damping contributed by the blade dovetail and introduces the concept of mistuning [Ref 2]. Mistuning changes the dynamic response of the IBR airfoils and can limit the FOD tolerance or blend repair [Ref 3] capability.

The Navy seeks to expand IBR mistuning bench characterization technology to newer engine designs. These new engines utilize two additional design technologies that make vibration testing and analysis more challenging: blades have intentional (A/B) mistuning [Ref 4], and blade vibratory response is excited by asymmetric vane spacing.

This Direct to Phase II topic will develop the hardware needed to measure newer, larger fan IBRs, and also develop other necessary technologies and methods to accommodate intentional mistuning in the presence of asymmetric vane excitation. To demonstrate this capability, the proposed program requirements must include, but not be limited to, the design, build, and demonstration of a prototype IBR airfoil mistuning measurement system. The prototype software must be capable of characterizing dynamic response and driving relevant excitation. These relevant operational modes (excitation) will be used to define the baseline scan plan. The system must also be capable of acquiring the actual 3D geometry of the airfoil leading edge and characterizing the geometry of any blends or damage present. This data, in addition to the predicted and measured mode shape and frequency around the rotor, will be documented in a report generated by the software.

When high-value IBRs are repaired at depot, the repair limits must include additional design margins to accommodate the hypothetical worst-case IBR mistuning (+/- 5% frequency variation). This assessment methodology is governed by the Propulsion Structural Integrity Plan [Ref 5], which defines the requirements to design, sustain, and repair an engine component. With the technology proposed in this topic, the limits can be expanded by quantifying the actual mistuning amplification present in the IBR, thereby increasing repair limits and reducing the cost of scrapping and replacing IBRs.

This measurement will be completed when the IBR is removed from the engine (uninstalled) and is placed statically on a benchtop. The measurement hardware must be designed to ensure that it does not damage the IBR and is capable of supporting its weight (up to 250 lb; (113.4 kg)). The end goal for the technology is to deploy bench measurement systems to relevant Navy and United States Air Force (USAF) engine support depots that can measure new production IBRs and field returned/repaired IBRs to verify that mistuning requirements are maintained.

In order to quantify the actual mistuning present in the IBR, the proposed technology must be able to meet the following technology requirements:

a. measurement of the blade leading edge geometry (identify existing damage or blend repairs);
b. measurement of blade modal frequency response;
c. measurement of blade mode shape response (aid in identification of mode);
d. excitation of all blades in rotor with relevant excitation, including multiple nodal diameters, engine orders, relevant engine rotation speeds, and asymmetric vane spacing;
e. computer system capable of near-real-time processing of collected data and automated report generation of relevant mistuning response parameters;
f. software and analysis methods capable of analyzing benchtop mistuning measurements and predicting the installed (engine operating) dynamic response. The Navy will translate this dynamic response prediction into FOD repair limits;
g. equipment must not damage, mark, or create excessive vibration stress in the IBR (stay below 25% Goodman stress capability), and have provisions for safe handling and lifting of the part.

Although not required, it is highly recommended that the proposer work in coordination with the original equipment manufacturer (OEM) to ensure proper design and to facilitate transition of the final technology.

PHASE I: For a Direct to Phase II topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort. Have developed a concept for a workable prototype or design to address, at a minimum, the basic requirements of the stated objective above. The below actions would be required in order to satisfy the requirements of Phase I:

The offeror must demonstrate the capability to characterize mistuning on traditional IBRs that use “equal” mass blades and synchronous excitation sources. The IBR used in this prior work may be small (prefer 10 in.; (25.4 cm) diameter or greater) and be designed for commercial or military application. The prototype should be able to measure blade frequency and mode shape for all blades on the IBR for at least the first 10 modes and 25 engine orders. The offeror should demonstrate feasibility of scanning the leading edge geometry capable of measuring existing blend repairs of 0.005 in. (0.127 mm) deep and greater. The software should be capable of recording the necessary mistuning parameters; however, automated processing is not required at this phase. While data storage requirements may vary depending on technology approach, IBRs may have up to 100 airfoils per part with up to 25 modes of interest. The system should be capable of storing vibration data and geometry scan data for at least 10 IBRs at a time.

FEASIBILITY DOCUMENTATION: Offerors interested in participating in Direct to Phase II must include in their response to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and Phase I feasibility described in Phase I above has been met (i.e., the small business must have performed Phase I-type research and development related to the topic, but from non-SBIR funding sources) and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology as stated in Phase I above. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the

feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI). Read and follow all of the DON SBIR 22.1 Direct to Phase II Broad Agency Announcement (BAA) Instructions. Phase I proposals will NOT be accepted for this topic.

PHASE II: Develop and demonstrate a prototype measurement system based on the prior work capable of characterizing all relevant modes and excitation frequencies on intentionally mistuned blades. The Navy will provide these relevant parameters. The Navy will provide a relevant advanced IBR that contains intentionally mistuned blades and operates in an environment with asymmetric vane excitation. The program will conclude with delivery of the matured measurement system to the Navy or the USAF for verification testing and by holding a review with the Government of all data and analysis methods developed during this program.

PHASE III DUAL USE APPLICATIONS: Finalize the prototype and supporting software for deployment to the Navy and USAF engine depots. This will include working with the relevant sustainment support equipment and platform program offices to meet computer security and hardware interface requirements. Support design reviews with the Government to determine incorporation strategy. Deliver measurement systems to the depot(s) and support training and maintenance planning for the equipment.

Commercial aircraft engines are also susceptible to FOD and advanced designs also incorporate IBRs with mistuning and asymmetric vanes. The technologies developed under this program will be directly applicable to commercial aviation engines. Due to the larger size of the commercial fleets, the available market should be equal to, or greater than, the initial military application. FOD costs the commercial aviation industry over $2 billion per year and an average of $43 million per year at major U.S. hubs.

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KEYWORDS: FOD; Foreign Object Damage; mistuning; IBR; Integrally Bladed Rotor; Blisk; Bladed-Disk; propulsion; aircraft

N221-D04 TITLE: DIRECT TO PHASE II – Cognitively Inspired Artificial Intelligence for Automated Detection, Classification, and Characterization

OUSD (R&E) MODERNIZATION PRIORITY: 5G;Artificial Intelligence (AI)/Machine Learning (ML);Autonomy

TECHNOLOGY AREA(S): Information Systems

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

OBJECTIVE: Develop a human-level/human-style artificial intelligence (AI) that can perceive and explain signals implicit in magnetics, electro-optical and infrared (EO/IR), and acoustics data to achieve long-range detection, tracking, and classification of maritime surface and subsurface contacts, which is an essential and imperative Naval capability.

DESCRIPTION: Nontraditional adaptive human-level/human-style artificial intelligence (AI) signal-processing algorithms have the potential to increase detection range in high littoral noise environment while extracting precise target signatures that optimize detection, tracking, and classification.

The consistently novel, noisy, and nonlinear aspects of magnetics, EO/IR, and acoustics data, critical for Navy detection, tracking, and classification, present particularly difficult problems for the standard techniques of machine learning (ML) (e.g., deep learning [Ref 1]). To be functional, the artificial neural networks of the latter must be trained on large curated data of “signal” in order to filter out noise. Such pattern recognition has revolutionized many domains [Ref 2], from image classification to game playing. However, such a methodology fails catastrophically in domains where data are frequently changing, and are neither large, curated, nor efficiently transformable into linear-vector form [Ref 3]. This is because engineers in standard ML fail to understand that “making comes before matching” [Ref 4]: a competence to generate general/adaptable pattern schemata prior to data processing is necessary to recognize novel (untrained) patterns in novel and potentially sparse and noisy/nonlinear data. Fundamentally, to be of greatest value to the Navy, these schemata ought to be conjectured explanations for the signals, beyond their mere detection. Such explanatory competence cannot be implemented in standard ML [Ref 5], hence the failure of ML to solve non-linear, signal-to-noise over noise problems.

However, such a competence is characteristic of some “good old fashioned artificial intelligence” architectures and the human intelligence they emulate [Ref 6]. Humans can routinely recognize novel signals in variable noise environments, and the Navy has relied on this human intelligence to process magnetic, EO/IR, and acoustics data for detection and classification of objects and environmental footprints. Indeed the evolutionarily-optimized, pattern-matching of the human mind/brain can expertly and efficiently recognize (i.e., “make-and-match”) patterns in novel/noisy time series as expertly and efficiently as it recognizes grammatical patterns in language [Ref 7]. Of profoundest importance—equipped with language—human intelligence seeks to explain these patterns. It generates causal knowledge. Obviously, however, it would be an intractably Herculean task for humans to process and interpret all the magnetics, EO/IR, and acoustics data necessary to satisfy naval objectives of near-real-time, long-range detection, tracking, and classification of surfaced and submerged objects with 90%

probability of detection (Pd) rates. Hence, the optimal solution would be to implement the competence of human intelligence in the machinery of artificial intelligence. Thus, the Navy requires human-style AI.

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 NAVAIR 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: For a Direct to Phase II topic, the Government expects that the small business would have accomplished the following in a Phase I-type effort. Have developed a concept for a workable prototype or design to address, at a minimum, the basic requirements of the stated objective above. The below actions would be required in order to satisfy the requirements of Phase I:

The development of Strong Artificial Intelligence: human-level/human AI capacitated with the linguistic competence to generate causal explanatory models via critical rationalism. Given a set of big or small data, constructs a Chomskyan grammar construct to model causal relations, thereby transcending descriptions that answer what is being observed, transforming data into evidence for/against conjectured explanations that answer why and how the data, or the phenomena underlying the data, - exist and behave.

The objective is a linguistically competent AI that can generate explanatory causal models. An example would be the classic board game Battleship. The strong cognitive AI is given a partially revealed board state and must, by its epistemic process of critical rationalism (i.e., conjecture-and criticism), discover the true state of the board. What the solution ultimately seeks is an explanation for the configuration of the partially revealed gameboard: “Why does the board appear this way?” The reason why is the complete configuration (i.e., the position of the hidden ships). It is an exercise in explanatory causal-model-construction. The Cognitive AI succeeds and surpasses humans in constructing “the ultimate question”: one question whose answer reveals the true state of the board. This is formally analogous to a complete explanation for some complex phenomena in the real world. Importantly, this problem cannot be solved by reinforcement learning, as Google DeepMind did for “Go” and “Chess”. It requires a cognitive strong intelligence: language and explanation. AI researchers have tested numerous techniques to solve this problem, from tree search to Bayesian models, but all fail to attain human-level competence, the common denominator being limitations imposed by hard-coded rules with single objectives that are insufficiently adaptive and creative.

FEASIBILITY DOCUMENTATION: Offerors interested in participating in Direct to Phase II must include in their response to this topic Phase I feasibility documentation that substantiates the scientific and technical merit and Phase I feasibility described in Phase I above has been met (i.e., the small business must have performed Phase I-type research and development related to the topic, but from non-SBIR funding sources) and describe the potential commercialization applications. The documentation provided must validate that the proposer has completed development of technology as stated in Phase I above. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. Work submitted within the feasibility documentation must have been substantially performed by the offeror and/or the principal investigator (PI). Read and follow all of the DON SBIR 22.1 Direct to Phase II Broad Agency Announcement (BAA) Instructions. Phase I proposals will NOT be accepted for this topic.

PHASE II: Develop a prototype of a human-level/human-style AI that can perceive and explain "artificial" (i.e., invented) magnetics, EO/IR, and acoustics data in an idealized Navy war game simulation. Further development of the AI prototype and its demonstration on "natural" (i.e., real-world) data in a realistic Navy war game simulation. Perform sea trials data collection of individual vessels in terms of feature identification performance, operational agility, and accuracy. Perform limited sea trial test data analysis of surface and subsurface objects.

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

PHASE III DUAL USE APPLICATIONS: Continue to refine magnetics, EO/IR, and acoustics data. Finalize sea trials data collection of individual vessels in terms of feature identification performance, operational agility, and accuracy. Complete final testing and perform necessary integration and transition for use in antisubmarine and countermine warfare, counter surveillance and monitoring operations with appropriate current platforms and agencies, and future combat systems under development.

Commercially this product could have applicability in search and rescue operations; and could be used to enable remote environmental monitoring of geophysical survey, facilities, and vital infrastructure assets.

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KEYWORDS: Artificial Intelligence; AI; Nonlinear; signal processing; Cognitive; Nontraditional