

**Defense Advanced Research Projects Agency (DARPA)
DoD 23.D Small Business Technology Transfer (STTR) Annual BAA
Proposal Submission Instructions Release 2**

INTRODUCTION

To achieve DARPA's mission to create technological surprise, the agency makes strategic, early investments in science and technology that will have long-term positive impacts on our national security. The pace of discovery in both science and technology is accelerating worldwide, resulting in new fields of study and the identification of scientific areas ripe for small business utilization through the SBIR and STTR programs. Small businesses are critical for developing technology to support national security. Proposers are encouraged to consider whether the R/R&D being proposed to DoD Components also has private sector potential, either for the proposed application or as a base for other applications. The topics below focus on technical domains important to DARPA's mission pursuing innovative research concepts that fall within one of its technology offices. More information about DARPA's technical domains and research topics of interest may be found at: <http://www.darpa.mil/about-us/offices>.

Proposers responding to a topic in this BAA must follow all general instructions provided in the Department of Defense (DoD) STTR Program BAA. DARPA requirements in addition to or deviating from the DoD Program BAA are provided in the instructions below.

Proposers are encouraged to thoroughly review the DoD Program BAA and register for the DSIP Listserv to remain apprised of important programmatic and contractual changes.

- The DoD Program BAA is located at: <https://www.defensesbirsttr.mil/SBIR-STTR/Opportunities/#announcements>. Be sure to select the tab for the appropriate BAA cycle.
- Register for the DSIP Listserv at: <https://www.dodsbirsttr.mil/submissions/login>.

Specific questions pertaining to the administration of the DARPA Program and these proposal preparation instructions should be directed to: DARPA Small Business Programs Office at SBIR_BAA@darpa.mil. DSIP Topic Q&A will NOT be available for these DARPA topics. Technical questions related to improving the understanding of a topic's requirements must be submitted to SBIR_BAA@darpa.mil by the deadline listed below.

The following dates apply to this DARPA Topic release:

- August 17, 2023:** Topics issued for pre-release
- August 31, 2023:** Topics open; DARPA begins accepting proposals via DSIP
- September 28, 2023:** Deadline for technical question submission
- October 03, 2023:** Deadline for receipt of proposals no later than **12:00 pm ET**

PHASE I PROPOSAL GUIDELINES

The Defense SBIR/STTR Innovation Portal (DSIP) is the official portal for DoD SBIR/STTR proposal submission. Proposers are required to submit proposals via DSIP; proposals submitted by any other means will be disregarded. Detailed instructions regarding registration and proposal submission via DSIP are provided in Appendix A.

Current Release Award Structure by Topic

Topic Number	Phase I		
	Technical Volume	Award Amount	Period of Performance (PoP)
HR0011ST2023D-02	25 pages	\$275,000	10 months
HR0011ST2023D-03	25 pages	\$275,000	10 months

Technical Volume (Volume 2)

The technical volume is not to exceed 20 pages and must follow the formatting requirements provided in the DoD STTR 2023.D Program BAA. Phase I commercialization strategy shall not exceed 5 pages. This should be the last section of the Technical Volume and will not count against the 20-page limit.

Content of the Technical Volume

Proposers should refer to the DARPA Phase I Proposal Instructions, provided on the DARPA Small Business site (<https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>).

Cost Volume (Volume 3)

Please see the chart above for award amounts listed by topic. Proposers are required to use the Phase I – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided on the DARPA Small Business site (<https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>). Subcontractors may also submit unsanitized costs using this template directly to DARPA at SBIR-BAA@darpa.mil.

Please review the updated Percentage of Work (POW) calculation details included in the DoD Program BAA. DARPA cannot accept deviations from the POW requirements for STTR proposals.

Company Commercialization Report (CCR) (Volume 4)

Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD STTR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by DARPA during proposal evaluations.

Supporting Documents (Volume 5)

In addition to the documents required by DoD, small businesses may also submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5. See Appendix A for required certifications that must be included in Volume 5. For additional information, see the SBIR 23.4 Annual Program Broad Agency Announcement (BAA) at <https://www.defensesbirstr.mil/SBIR-STTR/Opportunities/>.

PHASE II PROPOSAL GUIDELINES

Phase II proposals may only be submitted by Phase I awardees. Should DARPA have funding available and decide to proceed with a Phase II, proposers awarded a Phase I contract will be eligible to submit a proposal for Phase II and will be contacted by the DARPA Small Business Programs Office at the appropriate time during their Phase I period of performance. Phase II proposals will be evaluated in accordance with the applicable DoD or DARPA SBIR/STTR BAA. Phase II selection(s) are at the sole

discretion of the government and are subject to funding availability and Phase I performance. Phase II Instructions are available at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.

Topic Number	Phase II				
	Tech Volume	Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
HR0011ST2023D-02	45 pages	\$1,300,000	24 months	\$500,000	12 months
HR0011ST2023D-03	45 pages	\$1,200,000	24 months	\$600,000	12 months

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TAB A)

DARPA does not offer TAB A funding.

EVALUATION AND SELECTION

All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD STTR 2023.D BAA. DARPA will conduct an evaluation of each conforming proposal. Proposals that do not comply with the requirements detailed in this BAA and the research objective(s) of the corresponding topic are considered non-conforming and therefore are not evaluated nor considered for award.

Using the evaluation criteria, the Government will evaluate each proposal in its entirety, documenting the strengths and weaknesses relative to each evaluation criterion, and, based on these identified strengths and weaknesses, determine the proposal's overall selectability. Proposals will not be evaluated against each other during the evaluation process, but rather evaluated on their own individual merit to determine how well the proposal meets the criteria stated in this BAA and the corresponding topic.

Awards will be made to proposers whose proposals are determined to be the most advantageous to the Government, consistent with instructions and evaluation criteria specified in the DoD STTR 2023.D BAA and availability of funding. Given the limited funding available for each topic released, not all proposals considered selectable will be necessarily selected for funding.

For the purposes of this proposal evaluation process, a selectable proposal is defined as follows:

Selectable: A selectable proposal is a proposal that has been evaluated by the Government against the evaluation criteria listed in the BAA and topic, and the strengths of the overall proposal outweighs its weaknesses. Additionally, there are no accumulated weaknesses that would require extensive negotiations and/or a resubmitted proposal.

For the purposes of this proposal evaluation process, a non-selectable proposal is defined as follows:

Non-Selectable: A proposal is considered non-selectable when the proposal has been evaluated by the Government against the evaluation criteria listed in the BAA and topic, and the strengths of the overall proposal do not outweigh its weaknesses.

Proposing firms will be notified of selection or non-selection status for a Phase I award within 90 days of the closing date of the BAA. It is the policy of DARPA to treat all proposals as source selection information and to disclose their contents only for the purpose of evaluation. Restrictive notices notwithstanding, during the evaluation process, submissions may be handled by support contractors for

administrative purposes and/or to assist with technical evaluation. All DARPA support contractors are expressly prohibited from performing DARPA-sponsored technical research and are bound by appropriate nondisclosure agreements. Input on technical aspects of the proposals may be solicited by DARPA from other Government and/or non-Government consultants/experts who are strictly bound by the appropriate non-disclosure requirements. No submissions will be returned. Upon completion of the evaluation and selection process, an electronic copy of each proposal received will be retained at DARPA.

Proposal titles, abstracts, anticipated benefits, and keywords of proposals that are selected for contract award will undergo a DARPA Policy and Security Review. Proposal titles, abstracts, anticipated benefits, and keywords are subject to revision and/or redaction by DARPA. Final approved versions of proposal titles, abstracts, anticipated benefits, and keywords may appear on the DoD SBIR/STTR awards website and/or the SBA's SBIR/STTR award website (<https://www.sbir.gov/sbirsearch/award/all>).

Refer to the DoD STTR 2023.D Program BAA for procedures to protest the Announcement. As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests regarding the selection decision should be submitted to:

DARPA
Contracts Management Office (CMO)
675 N. Randolph Street
Arlington, VA 22203
E-mail: scott.ulrey@darpa.mil and sbir@darpa.mil

AWARD AND CONTRACT INFORMATION

1. General Award Information

Multiple awards are anticipated. DARPA may award FAR-based government contracts (Firm- Fixed Price or Cost-Plus Reimbursement) or Other Transactions for Prototypes agreement (under the authority of 10 U.S.C. § 4022) subject to approval of the Contracting Officer. The amount of resources made available under each topic issued under this BAA will depend on the quality of the proposals received and the availability of funds.

The Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this announcement and to make awards with or without communications with proposers. Additionally, the Government reserves the right to award all, some, one, or none of the options on the contract(s)/agreement(s) of the performers based on available funding and technical performance. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that proposer. The Government reserves the right to fund proposals in phases with options for continued work, as applicable.

The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. The Government reserves the right to remove a proposal from award consideration should the parties fail to reach agreement on award terms, conditions, and price within a reasonable time, and/or the proposer fails to provide requested additional information within three business days.

In all cases, the Government Contracting Officer reserves the right to select award instrument type, regardless of instrument type proposed, and to negotiate all instrument terms and conditions with selectees. DARPA will apply publication or other restrictions, as necessary, if it determines that the research resulting from the proposed effort will present a high likelihood of disclosing performance

characteristics of military systems or manufacturing technologies that are unique and critical to defense. Any award resulting from such a determination will include a requirement for DARPA permission before publishing any information or results on the program. For more information on publication restrictions, see the DoD STTR 2023.D Program BAA.

Because of the desire to streamline the award negotiation and program execution process, proposals identified for negotiation will result in negotiating a type of instrument for award that is in the best interest of the Government. In the case of an OT for Prototype agreement under DARPA's authority to award OTs for prototype projects, 10 U.S.C. § 4022, use of an OT provides significant opportunities for flexible execution to assist in meeting DARPA's aggressive SBIR/STTR program goals.

All proposers that wish to consider an OT award should carefully read the following:

The flexibility of the OT award instrument is beneficial to the program because the Performer will be able to apply its best practices as required to carry out the research project that may be outside of the Federal Acquisition Regulation (FAR) process-driven requirements. Streamlined practices will be used, such as milestone-driven performance, intended to reduce time and effort on award administration tasks and permit performers to focus on the research effort and rapid prototyping. Because of this ability, OTs provide the Agreements Officer the flexibility to create an award instrument that contains terms and conditions that promote commercial transition, reduce some administratively burdensome acquisition regulations, and meet SBIR/STTR program goals.

Proposers must only propose an OT agreement with fixed payable milestones. Fixed payable milestones are fixed payments based on successful completion of the milestone accomplishments agreed to in the milestone plan. Refer to the Other Transactions for Prototypes Fact Sheet and Other Transaction for Prototype Agreement, available at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>. Specific milestones will be based upon the research objectives detailed in the SBO.

Please see <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program> for more information on OTs.

2. Transition and Commercialization Support Program (TCSP)

DARPA will provide services to Phase II or DP2 awardees upon contract execution through the Transition and Commercialization Support Program (TCSP) at no cost to awardees. The TCSP goal is to maximize the potential for SBIR/STTR companies to move their technology beyond Phase II and into other research and development programs for further maturity or into solutions or products for DoD acquisition programs, other Federal programs, and/or the commercial market. Please visit <https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued> for more information on DARPA TCSP.

3. Embedded Entrepreneurship Initiative

Awardees of SBIR funding pursuant to this BAA may be eligible to participate in the DARPA Embedded Entrepreneurship Initiative (EEI) during the Period of Performance. Invitation to participate in EEI is at the sole discretion of the Government based on evaluation of technical and commercial factors and subject to program balance and the availability of funding. EEI is a limited scope program offered by DARPA, at DARPA's discretion, to a small subset of awardees. The goal of DARPA's EEI is to increase the likelihood that DARPA-funded technologies take root in the U.S. and provide new capabilities for national defense. EEI supports DARPA's mission "to make pivotal investments in breakthrough technologies and capabilities for national security" by accelerating the transition of innovations out of the lab and into new capabilities for the Department of Defense (DoD). EEI investment supports development of a robust and deliberate Go-to-Market strategy for selling technology product to the government and

commercial markets and positions DARPA awardees to attract U.S. investment. The following is for informational and planning purposes only and does not constitute solicitation of proposals to the EEI.

There are three elements to DARPA's EEI: (1) A Senior Commercialization Advisor (SCA) from DARPA who works with the Program Manager (PM) to examine the business case for the awardee's technology and uses commercial methodologies to identify steps toward achieving a successful transition of technology to the government and commercial markets; (2) Connections to potential industry and investor partners via EEI's Investor Working Groups; and (3) Additional funding on an awardee's contract for the awardee to hire an embedded entrepreneur to achieve specific milestones in a Go-to-Market strategy for transitioning the technology to products that serve both defense and commercial markets. This embedded entrepreneur's qualifications should include business experience within the target industries of interest, experience in commercializing early stage technology, and the ability to communicate and interact with technical and non-technical stakeholders. Funding for EEI is typically no more than \$250,000 per awardee over the duration of the award. An awardee may apportion EEI funding to hire more than one embedded entrepreneur, if achieving the milestones requires different expertise that can be obtained without exceeding the awardee's total EEI funding. The EEI effort is intended to be conducted concurrent with the research program without extending the period of performance.

EEI Application Process:

After receiving an award under the solicitation, awardees interested in being considered for EEI should notify their DARPA Program Manager (PM) during the period of performance. Timing of such notification should ideally allow sufficient time for DARPA and the awardee to review the awardee's initial transition plan, identify milestones to achieve under EEI, modify the award, and conduct the work required to achieve such milestones within the original award period of performance. These steps may take 9-18 months to complete, depending on the technology. If the DARPA PM determines that EEI could be of benefit to transition the technology to product(s) the Government needs, the PM will refer the performer to DARPA Commercial Strategy.

DARPA Commercial Strategy will then contact the performer, assess fitness for EEI, and in consultation with the DARPA technical office, determine whether to invite the performer to participate in the EEI. Factors that are considered in determining fitness for EEI include DoD/Government need for the technology; competitive approaches to enable a similar capability or product; risks and impact of the Government's being unable to access the technology from a sustainable source; Government and commercial markets for the technology; cost and affordability; manufacturability and scalability; supply chain requirements and barriers; regulatory requirements and timelines; Intellectual Property and Government Use Rights, and available funding.

Invitation to participate in EEI is at the sole discretion of DARPA and subject to program balance and the availability of funding. EEI participants' awards may be subsequently modified bilaterally to amend the Statement of Work to add negotiated EEI tasks, provide funding, and specify a milestone schedule which will include measurable steps necessary to build, refine, and execute a Go-to-Market technology transition plan aimed at delivering new capabilities for national defense. Milestone examples are available at: <https://www.darpa.mil/work-with-us/contract-management>.

Awardees under this solicitation are eligible to be considered for participation in EEI, but selection for award under this solicitation does not imply or guarantee participation in EEI.

For more information please refer to the EEI website <https://eei.darpa.mil/>.

4. DARPA Toolbox Initiative

DARPA Toolbox is an Agency-wide effort to provide open licensing opportunities with

commercial technology vendors to the researchers behind DARPA programs. DARPA Toolbox provides easy, low-cost, scalable access to state-of-the-art tools and intellectual property (IP) under predictable legal terms and streamlined acquisition procedures. The goal is to reduce performer reliance on low-quality, low-cost tools and IP that increase execution risks and complicate post-DARPA transitions.

Through this initiative, DARPA performers are granted access to select vendor tools and technologies throughout the life of their contractual relationship with the Agency. The Toolbox suppliers bring to the table proven technologies commonly used in state-of-the-art commercial microelectronics or system design methodologies.

DARPA Toolbox program information and a full list of participating suppliers can be found at <https://www.darpa.mil/work-with-us/darpa-toolbox-initiative>. If there are tool or technologies of interest, contact the Supplier POC listed for the product, referencing the DARPA Toolbox Initiative. The Supplier POC will provide advice on products and pricing information. Include any non-production pricing quotes in your proposal. Products and pricing are between you and the suppliers – *do not* contact DARPA directly.

ADDITIONAL INFORMATION

DARPA intends to use electronic mail for all correspondence regarding these topics. Questions related to the technical aspect of the research objectives and awards specifically related to a topic should be emailed to SBIR_BAA@darpa.mil. Please reference the topic number in the subject line. All questions must be in English and must include the name, email address, and the telephone number of a point of contact.

DARPA will attempt to answer questions in a timely manner; however, questions submitted within seven (7) calendar days of the proposal due date listed herein may not be answered. DARPA will post a consolidated Frequently Asked Questions (FAQ) document. To access the posting please visit: <http://www.darpa.mil/work-with-us/opportunities>. Under the topic number summary, there will be a link to the FAQ. The FAQ will be updated on an ongoing basis until one week prior to the proposal due date.

Technical support for the Defense SBIR/STTR Innovation Portal (DSIP) is available Monday through Friday, 9:00 a.m. – 5:00 p.m. ET. Requests for technical support must be emailed to DoDSBIRSupport@reisystems.com with a copy to SBIR_BAA@darpa.mil.

DARPA STTR 23.D Topic Index
Release 2

HR0011ST2023D-02
HR0011ST2023D-03

Bistatic Engagement Algorithms and Methodologies (BEAM)
Cyber Operations Preparedness and Education (COPE)

HR0011ST2023D-02 TITLE: Bistatic Engagement Algorithms and Methodologies (BEAM)

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Directed Energy (DE)

OBJECTIVE: This topic will explore the technical challenges critical to significantly reducing the size, weight, and power (SWaP) of directed energy beam control systems through the use of an on-gimbal, bistatic beam director for Laser Weapon Systems (LWS) to replace today's Common Path-Common Mode (CPCM) monostatic configurations which rely on large optical benches for image and laser management.

DESCRIPTION: CPCM configurations offer the advantage of improved jitter performance and high-fidelity knowledge of the laser aimpoint with respect to the tracking line-of-sight, but are high size, weight, and power (SWaP). Alternatively, a bistatic architecture with modern track camera frame rates and image processing techniques should now be able to achieve comparable accuracy, providing a beam control solution for on-gimbal, phased-array laser sources while significantly reducing the SWaP of the beam control system.

Performers will develop methodologies and tracking algorithms required to perform LWS engagements using a bistatic architecture, where the tracking and imaging path is separate from the outgoing laser path. Performers also will develop jitter mitigation techniques, aimpoint maintenance via electronic beam steering methods, and atmospheric compensation strategies. All traditional functions of a beam control and tracking system are required. These functions include target acquisition, closed loop track, aimpoint selection and maintenance, and atmospheric compensation.

Limitations to an all on-gimbal architecture will be identified by the performer, to include performance limitations as a function of camera aperture size, total system size, and laser power.

Expected deliverables include the following:

- Descriptions of possible physical implementations of on-gimbal beam control systems
- Performance predictions for the performer's chosen physical architecture
- Including peak and average irradiance for a variety of slant ranges and elevation angles
- Identification of viable algorithms for jitter mitigation, aimpoint maintenance, and atmospheric compensation
- Analysis of the ability to scale the performer's approach, with respect to effective range and target type, for three laser powers: 12 kW, 50 kW, 150 kW
- Laboratory demonstration of the performer's on-gimbal LWS design utilizing a performer-chosen low-power phased array

Expected key metrics:

- SWaP comparison between on-gimbal and CPCM LWS of similar laser power and aperture size
- Minimum achievable jitter and aimpoint error
- Atmospheric compensation capability; Strehl, or power-in-the-bucket at the target, as a function of turbulence strength and slant range

PHASE I: During Phase I, the performers will conceptualize a low-power, low-SWaP phased-array Laser Weapon System (LWS) where all hardware and functionalities are located on-gimbal, with the exception of subsystems for power generation/storage and thermal management. The LWS must contain all capabilities of a traditional LWS: acquisition, tracking, pointing (ATP), laser generation, adaptive optics (AO), and system/mission controls. It is assumed that adaptive optics and fine angle beam steering will be performed via the piston phase control capability of the phased array.

To perform the ATP and AO functions without using CPCM, contractors will need to identify viable algorithms and methodologies to establish laser aimpoint relative to tracker line-of-sight, perform aimpoint control, measure instantaneous turbulence distortion, and apply correct wavefront conjugations.

Performers will then design a low-power, on-gimbal, LWS meeting the above requirements. A low-power optical phased array of the performers' choice, to include fiber-based laser technology, may be used in the LWS design. For this demonstration, the laser source (seed, amplifiers, phase modulators) may be off-gimbal, but the laser array head, or emitting apertures, must be on-gimbal. System size (number of sub-apertures, number of track cameras, etc.) is to be defined by the performer.

Required Phase I deliverables include the following:

- Month 3: A Systems Requirements Review (SRR) for the low-power, on-gimbal LWS, to include a presentation at PI meeting of the requirements.
- Month 5: Report summarizing modelling and simulation software capabilities. Presentation at PI meeting on capabilities.
- Month 9: A Preliminary Design for the low-power, on-gimbal LWS, to include a list of any long lead purchases required, to include a presentation at PI meeting of the design.
- Month 10: Phase I final report summarizing Phase I work, to include identification of viable algorithms for beam control, aimpoint maintenance, wavefront measurement/correction, and phase control. Presentation at final PI meeting of accomplishments.

PHASE II: During Phase II, the performers will build the low-power, on-gimbal LWS designed in Phase I, and demonstrate the system under controlled scenarios in a laboratory setting. Contractors will be required to predict the performance of the as-built system, then compare these results to the laboratory tests. Contractors will also be responsible for defining the laboratory test objectives and success criteria; however, the testing must demonstrate all functionalities described above in the Description.

Performers will also conduct modeling and simulation of three on-gimbal LWS variants utilizing a government reference laser source with output powers of 12 kW, 50 kW and 150 kW. Volumes (length x width x height), and masses of the three laser sources, as well as piston phase modulation rates will be based on state-of-the-art laser sources and provided as Government Furnished Information (GFI). System optimization of each variant will be based on achievable Strehl ratios as a function of slant range and engagement angle. Other parameters of interest to the government are achievable slew rates, residual jitter estimates, and system weight and volume reductions when compared to traditional CPCM systems.

Phase II deliverables include the following:

- Month 4: A Critical Design for the low-power, on-gimbal LWS, to include a presentation at PI meeting of the design.
- Month 12: Report containing trade study results for the three laser powers listed above. Presentation at PI meeting of results.
- Month 22: Report containing detailed test and performance results based on laboratory tests. Presentation at PI meeting of results.
- Month 24: Design documents for the low-power, on-gimbal LWS, to include a list of all hardware purchased under contract, as well as a detailed explanation of the algorithms and methods used for ATP and AO, and source code for ATP and AO functions. Phase II Final Report to include a summary of tasks completed during Phase 2, a list of identified changes required to scale the LWS design to higher powers and channel counts, and any recommended system improvements. Presentation at final PI meeting of accomplishments.

PHASE III DUAL USE APPLICATIONS: One potential application of BEAM technology is to marry the laser arrays under development in the DARPA Modular Efficient Laser Technology program (<https://www.darpa.mil/program/modular-efficient-laser-technology>) with the beam control architectures of BEAM. A high-power, on-gimbal, system could be used on a large variety of ground vehicles for C-UAS and potentially even for counter-mortar missions. Such a low-SWaP system could be used by Special Forces for operational preparation of the battlespace. Finally, airborne applications on smaller UAS might become available depending on the performance results of Phase II.

REFERENCES:

1. Kenneth W. Billman, Bruce A. Horwitz, Paul L. Shattuck, "Airborne laser system common path/common mode design approach," Proc. SPIE 3706, Airborne Laser Advanced Technology II, (3 August 1999); doi: 10.1117/12.356958
2. Vorontsov, M., Filmonov, G., Ovchinnikov, V., Polnau, E., Lachinova, S., Wyrach, T., Mangano, J., "Comparative efficiency analysis of fiber-array and conventional beam director systems in volume turbulence," Applied Optics, Vol. 55, No. 15; <http://dx.doi.org/10.1364/AO.55.004170>
3. Ahmed Hassebo, Balbina Salas, Yasser Y. Hassebo, "Monostatic and bistatic lidar systems: simulation to improve SNR and attainable range in daytime operations," Proc. SPIE 10094, Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVII, 1009421 (17 February 2017); doi: 10.1117/12.2253567

KEYWORDS: Beam control systems, Directed energy, Bistatic beam director, Phased-array laser system, On-gimbal laser system, Adaptive Optics (AO), Atmospheric compensation, Acquisition Tracking and Pointing (ATP)

HR0011ST2023D-03

TITLE: Cyber Operations Preparedness and Education (COPE)

OUSD (R&E) Critical Technology Area(s): Advanced Computing and Software

OBJECTIVE: The objective of the COPE STTR topic is to push forward the state-of-the-art in rapid and effective cybersecurity training to address the current skills gap in the cybersecurity workforce [1, 2].

DESCRIPTION: The US cybersecurity workforce currently suffers a deficit of over 400,000 skilled personnel [3]. Not only is there a shortfall of cybersecurity professionals, there's a lack in the preparedness of hired professionals to perform critical cybersecurity tasks. Studies have found that only half of hired recent graduates in cybersecurity are adequately prepared to carry out their duties [4, 5]. That is, the skills gap is even worse than often stated, as even filled positions might represent missing talent.

One reason for this skills gap is the inadequacy of current training/education techniques. Training techniques need to be both scalable, to address the sheer size of the skills gap, and effectively in-depth, because adequately understanding the security of every additional layer in a system requires a workable understanding of the security of the underlying layers. Unfortunately, most current training approaches in cybersecurity fail to achieve both adequate scalability and efficacy to properly prepare learners in the foundational concepts of critical cyber operational skills.

This lack of practical training/education puts mission-critical offensive and defensive cyberspace operations at risk and drives cybersecurity talent shortages.

The objective of COPE is to push forward the state-of-the-art in rapid and effective cybersecurity training to address the current skills gap in the cybersecurity workforce.

PHASE I: Phase 1 of COPE will explore feasibility by:

1. Conducting a study on cybersecurity job vacancies and required skillsets across the Department of Defense (DoD), intelligence community (IC), US government (USG), and industry; the study will identify specific security concepts needed by each;
2. Developing a curriculum and scalable training/education framework with technical capabilities to teach critical cybersecurity concepts such as network security operations, threat hunting, ransomware prevention and recovery, etc.;
3. Identifying potential DoD, IC, USG, and industry benefactors of the advanced security training and working with them on pilot iterations of the training; and
4. Demonstrating the pilot training capability and evaluating its efficacy.

Phase 1 deliverables and milestones for COPE should include:

- Months 2, 4, 6, and 8: report detailing technical progress made to date, tasks accomplished, current risks/mitigations, plan for the remainder of Phase 1 (e.g., tasks to be accomplished, planned activities/trips/meeting), trip/meeting summaries, and a summary of any potential issues or problem areas (technical or financial) that require the attention of the DARPA PM. Reports may be in the form of Microsoft Word or PowerPoint.
- Month 10:
 - Final COPE study report on cybersecurity job vacancies and required skillsets;
 - Final COPE curriculum and education framework/platform that can host training material relevant to real-world problems encountered by cybersecurity engineers;
 - Training material to develop relevant real-world skills; and,
 - Final COPE delivery/demonstration of training capability and efficacy evaluation.

PHASE II: Phase II of COPE will focus on expanding the training platform by:

- Increasing the amount and variety of material supported by the training platform by working with potential training benefactors to identify gaps and additional requirements; and
- Increasing the scalability of training delivery.

The goal of Phase 2 is to transition the COPE framework/platform into a significant DoD/IC/USG and industry footprint.

Successful proposals will present a clear plan for conceptualizing, developing, and delivering a training platform that:

1. Scales to the scope needed to address the cybersecurity skills gap;
2. Effectively conveys a wide variety of security concepts to newcomers to cybersecurity and to cybersecurity engineers seeking to improve their qualifications;
3. Achieves results in a rapid enough fashion to fit into personnel training time; and
4. Is applicable to and solves specific training problems in DoD/IC/USG and industry settings.

Phase 2 deliverables and milestones for COPE should include:

- Quarterly (with the exception of Month 24 and Month 36, if the option is exercised): reports detailing technical progress made to date, tasks accomplished, current risks/mitigations, plan for the remainder of Phase 2 (e.g., tasks to be accomplished, planned activities/trips/meeting), trip/meeting summaries, and a summary of any potential issues or problem areas (technical or financial) that require the attention of the DARPA PM. Reports may be in the form of Microsoft Word or PowerPoint.
- Month 24:
 - Final COPE curriculum and education framework/platform;
 - Final training material documentation; and,
 - Final COPE delivery/demonstration of training capability scaled to at least 13 trainings per year across DoD/IC/USG and industry settings.
- Month 36 (Phase II Option period):
 - Final Phase II Option period technical report including details of COPE training framework/platform prototype efficacy against other state-of-the-art platforms/curriculums, including quantitative metrics for assessment;
 - Final COPE curriculum and education framework/platform;
 - Final training material documentation;
 - Final COPE delivery/demonstration of training capability scaled to at least 26 trainings per year across DoD/IC/USG and industry settings.

PHASE III DUAL USE APPLICATIONS: COPE has potential applications across the DoD/IC/USG and industry. For DoD/IC/USG, successful COPE approaches will provide a repeatable, reliable, effective, and scalable cybersecurity training capability. COPE has the same applicability for industry/the commercial sector.

Phase III refers to work that derives from, extends, or completes an effort made under prior STTR funding agreements, but is funded by sources other than the STTR program. The Phase III work will be oriented towards transition and commercialization of the developed COPE framework. For Phase III, the proposer is required to obtain funding from either the private sector, a non-STTR Government source, or both, to develop the prototype into a viable product or non-R&D service for sale in government or private sector markets.

COPE solutions will support national efforts to improve cybersecurity workforce abilities and help secure DoD/IC/USG and commercial networks by enabling a workforce qualified to handle mission-critical offensive and defensive cyberspace operations.

REFERENCES:

- [1] Mitchell, B. (2021, April 22). DOD grapples with the future of its cyber workforce. FEDSCOOP. <https://fedscoop.com/dod-cybersecurity-workforce-struggles-dennis-crall-john-sherman/>
- [2] Crumpler, William, and James A. Lewis. (January 2019). The Cybersecurity Workforce Gap. Retrieved from the Center for Strategic and International Studies website: https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/190129_Crumpler_Cybersecurity_FINAL.pdf
- [3] Fitzgerald, Jay. (2022, October 24). Cybersecurity Labor Shortage Grows Worse in U.S. And Worldwide: Report. The Channel Co. CRN. <https://www.crn.com/news/security/report-cybersecurity-labor-shortage-grows-worse-in-u-s-and-worldwide>
- [4] St. Clair, Nelbert, and John Girard. "Are cybersecurity professionals satisfied with recent cybersecurity graduates?" In Journal of The Colloquium for Information Systems Security Education, vol. 7, no. 1, pp. 7-7. 2020. <https://cisse.info/journal/index.php/cisse/article/download/103/103>
- [5] ISACA. (2021, May 4). New ISACA Study Finds Cybersecurity Workforce Minimally Impacted by Pandemic, but Still Grappling with Persistent Hiring Challenges. ISACA. <https://www.isaca.org/why-isaca/about-us/newsroom/press-releases/2021/new-isaca-study-finds-cybersecurity-workforce-minimally-impacted-by-pandemic-but-still-grappling>

KEYWORDS: Cybersecurity, Training, Education, Offensive Cyberspace Operations, Defensive Cyberspace Operations, Network Security Operations, Threat Hunting, Ransomware Prevention and Recovery

Appendix A: DARPA PHASE I PROPOSAL INSTRUCTIONS

I. Introduction

A complete proposal submission consists of:

Volume 1: Proposal Cover Sheet

Volume 2: Technical Volume

Volume 3: Cost Volume

Volume 4: Company Commercialization Report

Volume 5: Supporting Documents

a. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment (Attachment 1)

MANDATORY

b. Disclosures of Foreign Affiliations or Relationships to Foreign Countries (Attachment 2)

MANDATORY

c. Verification of Eligibility of Small Business Joint Ventures (Attachment 3), if applicable

d. Disclosure of Funding Sources (Attachment 4) **MANDATORY**

e. Other supporting documentation

A completed proposal submission in DSIP does NOT indicate that the mandatory supporting documents have been uploaded. It is the responsibility of the proposing small business concern to ensure that the mandatory documents listed above have been uploaded and included with the proposal submission.

Volume 6: Fraud, Waste and Abuse Training

The Defense SBIR/STTR Innovation Portal (DSIP) provides a structure for building the proposal volumes and submitting a consolidated proposal package. If this is your first time submitting an SBIR or STTR proposal using DSIP, please review detailed training guides at <https://www.dodsbirsttr.mil/submissions/learning-support/training-materials>. It is the responsibility of the proposing firm to ensure that a complete proposal package is certified and submitted by the close date listed in the TOPIC to which they are responding.

To assist in proposal development, templates for Volume 2: Technical Volume and Volume 3: Cost Volume have been provided as attachments on the DARPA Small Business website, under SBIR/STTR Forms and Templates at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>. Use of the DARPA Cost Proposal template is mandatory.

II. Proprietary Information

Proposers that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall follow instructions in the DoD STTR 2023.D BAA regarding marking propriety proposal information.

III. Phase I Proposal Instructions

a. Proposal Cover Sheet (Volume 1)

The Cover Sheet must include a brief technical abstract of no more than 3000 characters that describes the proposed R&D project with a discussion of anticipated benefits and potential commercial applications. **Do not include proprietary or classified information in the**

Proposal Cover Sheet. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits may be publicly released.

b. Format of Technical Volume (Volume 2)

1. Type of file: The Technical Volume must be a single Portable Document Format (PDF) file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. **Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document.**
2. Length: The Phase I technical volume should consist of a 20-page technical proposal and a 5-page commercialization plan. The Government will not consider pages in excess of the page count limitations.
3. Layout: Number all pages of your proposal consecutively. Font size should not be smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins. The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by DSIP when the Cover Sheet was created. The header may be included in the one-inch margin. Please refer to the document titled Phase I Template – Volume 2: Technical Volume at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program> for additional details.

c. Content of the Technical Volume (Volume 2)

The Technical Volume should cover the following items in the order given below:

1. **Identification and Significance of the Problem or Opportunity.** Define the specific technical problem or opportunity addressed and its importance.
2. **Phase I Technical Objectives.** Enumerate the specific objectives of the Phase I work, including the questions the research and development effort will try to answer to determine the feasibility of the proposed approach.
3. **Phase I Statement of Work (including Subcontractors' Efforts)**
 - a) Provide an explicit, detailed description of the Phase I approach. The Statement of Work should indicate what tasks are planned, how and where the work will be conducted, a schedule of major events, and the final product(s) to be delivered. The Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the Technical Volume section.
 - b) The topic may have been identified by the Program Manager as research or activities involving Human/Animal Subjects and/or Recombinant DNA. In the event that Phase I performance includes performance of these kinds of research or activities, please identify the applicable protocols and how those protocols will be followed during Phase I. Please note that funds cannot be released or used on any portion of the project involving human/animal subjects or recombinant DNA research or activities until all of

the proper approvals have been obtained (see DoD STTR 2023.D BAA).

4. **Related Work.** Describe significant activities directly related to the proposed effort, including any conducted by the PI, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The technical volume must persuade reviewers of the proposer's awareness of the state-of-the-art in the specific topic. Describe previous work not directly related to the proposed effort but similar. Provide the following: (1) short description, (2) client for which work was performed (including individual to be contacted and phone number), and (3) date of completion.

5. **Relationship with Future Research or Research and Development**
 - a) State the anticipated results of the proposed approach if the project is successful.
 - b) Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort.
 - c) Identify the applicable clearances, certifications and approvals required to conduct Phase II testing and outline the plan for ensuring timely completion of said authorizations in support of Phase II research or research and development effort.

6. **Key Personnel.** Identify key personnel who will be involved in the Phase I effort including information on directly related education and experience. A concise technical resume of the PI, including a list of relevant publications (if any), must be included (Please do not include Privacy Act Information). All resumes will count toward the page limit for Volume 2, as specified in the topic.

7. **Foreign Citizens.** Identify any foreign citizens or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. Refer to DoD SBIR 2023.4/STTR 2023.D BAA for more information.

Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)).

8. **Facilities/Equipment.** Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Justify equipment purchases in this section and include detailed pricing information in the Cost Volume. State whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name), and local Governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.

9. **Subcontractors/Consultants.** Subcontractor means any supplier, distributor, vendor, firm, academic institution, research center, or other person or entity that furnishes supplies or

services pursuant to a subcontract, at any tier. Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be identified and described according to the Cost Breakdown Structure at <https://www.dodsbirsttr.mil/submissions/learning-support/firm-templates>. Please refer to DoD SBIR 2022.4/STTR 2023.D BAA for detailed eligibility requirements as it pertains to the use of subcontractors/consultants.

10. **Prior, Current, or Pending Support of Similar Proposals or Awards.** If a proposal submitted in response to a corresponding topic is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, or another DoD Component or DARPA, you must reveal this on the Proposal Cover Sheet and provide the following information:
- a) Name and address of the Federal Agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.
 - b) Date of proposal submission or date of award.
 - c) Title of proposal.
 - d) Name and title of the PI for each proposal submitted or award received.
 - e) Title, number, and date of BAA(s) or solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.
 - f) If award was received, state contract number.
 - g) Specify the applicable topics for each proposal submitted or award received.

Note: If this does not apply, state in the proposal "No prior, current, or pending support for proposed work."

11. **Transition and Commercialization Strategy.** DARPA is equally interested in dual use commercialization of SBIR/STTR project results to the U.S. military, the private sector market, or both, and expects explicit discussion of key activities to achieve this result in the transition and commercialization strategy part of the proposal. Phase I is the time to plan for and begin transition and commercialization activities. The small business must convey an understanding of the market, competitive landscape, potential stakeholders and end-users, and preliminary transition path or paths to be established during the Phase I project. The Phase I transition and commercialization strategy shall not exceed 5 pages. It should be the last section of the technical volume and include the following elements:

- a) **A summary of transition and commercialization activities conducted during prior SBIR/STTR efforts if applicable, and the Technology Readiness Level (TRL) achieved.**
- b) **Problem or Need Statement.** Briefly describe the problem, need, or requirement, and its significance relevant to a Department of Defense application and/or a private sector application that the SBIR/STTR project results would address. Is there a broader societal need you are trying to address? Please describe.
- c) **Description of Product(s) and/or System Application(s).** Identify the commercial product(s) and/or DoD system(s), or system(s) under development, or potential new system(s). Identify the potential DoD end- users, Federal customers, and/or private sector customers who would likely use the

- technology.
- d) **Business Model(s)/Procurement Mechanism(s).** Discuss your current business model hypothesis for bringing the technology to market. Describe plans to license, partner, or self-produce your product. How do you plan to generate revenue? Describe the resources you expect will be needed to implement your business models. Discuss your plan and expected timeline to secure these resources. Understanding DARPA's goal of creating and sustaining a U.S. military advantage, describe how you intend to develop your product and supply chains to enable this differentiation.
 - e) **Target Market.** Describe the market and addressable market for the innovation. Describe the customer sets you propose to target, their size, their growth rate, and their key reasons they would consider procuring the technology. Discuss the business economics and market drivers in the target industry. Describe competing technologies existent today on the market as well as those being developed in the lab. How has the market opportunity been validated? Describe the competition. How do you expect the competitive landscape may change by the time your product/service enters the market?
 - f) **Funding Requirements.** Describe your company's funding history. How much external financing have you raised? Describe your plans for future funding sources (internal, loan, angel, venture capital, etc.).
 - g) **Transition and Commercialization Risks.** Describe the major technology, market and team risks associated with achieving successful transition and commercialization of the DARPA funded technology. DARPA is not afraid to take risks but we want to ensure that our awardees clearly understand the risks in front of them. What are the key risks in bringing your innovation to market? What are actions you plan to undertake to mitigate these risks?
 - h) **Expertise/Qualifications of Team/Company Readiness.** Describe the expertise and qualifications of your management, marketing/business development and technical team that will support the transition of the technology from the prototype to the commercial market and into government operational environments. Has this team previously taken similar products/services to market? If the present team does not have this needed expertise, how do you intend to obtain it? What is the financial history and health of your company (e.g., availability of cash, profitability, revenue growth, etc.)?
 - i) **Anticipated Transition and Commercialization Results.** Include a schedule showing the anticipated quantitative transition and commercialization results from the Phase II project at one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.). After Phase II award, the company is required to report actual sales and investment data in its Company Commercialization Report at least annually.

Advocacy Letters (OPTIONAL)* Feedback received from potential Commercial and/or DoD customers and other end-users regarding their interest in the technology to support their capability gaps. Advocacy letters that are faxed or e-mailed separately will NOT be accepted.

Letters of Intent/Commitment (OPTIONAL)* Relationships established, feedback received, support and commitment for the technology with one or more of the following: Commercial customer, DoD PM/PEO, a Defense Prime, or vendor/supplier to the Primes and/or other vendors/suppliers identified as having a potential role in the integration of the technology into

fielded systems/products or those under development. Letters of Intent/Commitment that are faxed or e-mailed separately will NOT be accepted.

*Advocacy Letters and Letters of Intent/Commitment are optional, and should ONLY be submitted to substantiate any transition or commercialization claims made in the commercialization strategy. Please DO NOT submit these letters just for the sake of including them in your proposal. These letters DO NOT count against any page limit.

In accordance with section 3-209 of DOD 5500.7-R, Joint Ethics Regulation, letters from government personnel will NOT be considered during the evaluation process.

d. Format of Cost Volume (Volume 3)

Proposers are required to use the Phase I – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.

e. Content of the Cost Volume (Volume 3)

Some items in the Cost Breakdown Guidance below may not apply to the proposed project. If such is the case, there is no need to provide information on each and every item.

ALL proposed costs should be accompanied by documentation to substantiate how the cost was derived. For example, if you proposed travel cost to attend a project-related meeting or conference, and used a travel website to compare flight costs, include a screen shot of the comparison. Similarly, if you proposed to purchase materials or equipment, and used the internet to search for the best source, include your market research for those items. You do not necessarily have to propose the cheapest item or supplier, but you should explain your decision to choose one item or supplier over another. It's important to provide enough information to allow contracting personnel to understand how the proposer plans to use the requested funds.

If selected for award, failure to include the documentation with your proposal will delay contract negotiation, and the proposer will be asked to submit the necessary documentation to the Contracting Officer to substantiate costs (e.g., cost estimates for equipment, materials, and consultants or subcontractors). It is important to respond as quickly as possible to the Contracting Officer's request for documentation.

Cost Breakdown Guidance:

- List all key personnel by name as well as by number of hours dedicated to the project as direct labor.
- Special tooling and test equipment and material cost may be included. The inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation and/or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with DARPA; unless it is determined that transfer of title to the contractor would be more cost effective than

recovery of the equipment by the DARPA.

- Cost for travel funds must be justified and related to the needs of the project.
- Cost sharing is permitted for proposals under this announcement; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a proposal.
- All subcontractor costs and consultant costs must be detailed at the same level as prime contractor costs in regard to labor, travel, equipment, etc. Provide detailed substantiation of subcontractor costs in your cost proposal. Enter this information in the Explanatory Material section of the on-line cost proposal form. The Supporting Documents Volume (Volume 5) may be used if additional space is needed.

For more information about cost proposals and accounting standards associated with contract awards, see the DCAA publication titled “Audit Process Overview – Information for Contractors” available at <http://www.dcaa.mil>.

f. Company Commercialization Report (Volume 4)

The Company Commercialization Report (CCR) allows companies to report funding outcomes resulting from prior SBIR and STTR awards. The Company Commercialization Report (CCR) is required for Phase I and Direct to Phase II proposals. Please refer to the DoD STTR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by DARPA during proposal evaluations.

g. Supporting Documents (Volume 5)

In addition to required DoD documentation and certifications, small businesses may also submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3) in Volume 5.

f. Fraud Waste and Abuse (Volume 6)

The Fraud, Waste and Abuse (FWA) training is required for Phase I and Direct to Phase II proposals. FWA training provides information on what represents FWA in the SBIR/STTR program, the most common mistakes that lead to FWA, as well as the penalties and ways to prevent FWA in your firm. This training material must be thoroughly reviewed once per year. Plan ahead and leave ample time to complete this training based on the proposal submission deadline. Knowingly and willfully making any false, fictitious, or fraudulent statements or representations may be a felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to \$10,000, up to five years in prison, or both. Understanding the indicators and types of fraud, waste, and abuse that can occur is critical for the SBIR/STTR awardees’ role in preventing the loss of research dollars.