

**Defense Advanced Research Projects Agency (DARPA)
DoD 23.4 Small Business Innovation Research (SBIR) Annual BAA
Proposal Submission Instructions Release 7**

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) SBIR 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:

- May 23, 2023:** Topic issued for pre-release
- June 07, 2023:** Topic opens; DARPA begins accepting proposals via DSIP
- July 03, 2023:** Deadline for technical question submission
- July 11, 2023:** Deadline for receipt of proposals no later than **12:00 pm ET**

DIRECT TO PHASE II PROPOSAL GUIDELINES

Proposers should refer to the DARPA Direct to Phase II SBIR XL Proposal Instructions, provided in Appendix A.

Current Release Award Structure by Topic

Topics	Period of Performance	Amount
HR0011SB20234XL-03 Subtopic 1*	Base: 6-months	\$ 1,500,000
	Option 1: 6-months	\$ 1,000,000

	Option 2: 6 months	\$	500,000
HR0011SB20234XL-03 Subtopic 2*	Base: 6-months	\$	1,500,000
	Option 1: 6-months	\$	1,000,000
	Option 2: 6 months	\$	500,000

*For sub-topic 1 DARPA will accept DP2 proposals with a total maximum cost/price of \$4,000,000. This maximum cost/price includes a 6-month base period not to exceed \$1,500,000, a 6-month Option of \$1,000,000, and a second 6-month Option minimum of \$500,000. The base period and the minimum funding for the Options (if exercised) are funded entirely by DARPA. Additionally, if the second Option is exercised, DARPA is encouraging the performer to arrange additional program funding with a commercial or government (non-DARPA) partner of up to \$500,000. Any proposed non-DARPA funding agreement must be written, signed, and received by DARPA 60 calendar days before the last day of the period of performance of the base period to permit DARPA sufficient time to access as part of the determination to award the Option effort. DARPA will match up to \$500,000 of non-DARPA funds under a written, signed, and timely submitted agreement. Securing a non-DARPA funding agreement does not obligate DARPA to exercise the Option effort, nor will the lack of a written funding agreement prevent the performer from receiving an Option. DARPA will make option award decisions based on performance and funding availability.

For sub-topic 2 DARPA will accept DP2 proposals with a total maximum cost/price of \$4,000,000. This maximum cost/price includes a 6-month base period not to exceed \$1,500,000, a 6-month Option of \$1,000,000, and a second 6-month Option minimum of \$500,000. The base period and the minimum funding for the Option (if exercised) are funded entirely by DARPA. Additionally, if the second Option is exercised, DARPA is encouraging the performer to arrange additional program funding with a commercial or government (non-DARPA) partner of up to \$500,000. Any proposed non-DARPA funding agreement must be written, signed, and received by DARPA 60 calendar days before the last day of the period of performance of the base period to permit DARPA sufficient time to access as part of the determination to award the Option effort. DARPA will match up to \$500,000 of non-DARPA funds under a written, signed, and timely submitted agreement. Securing a non-DARPA funding agreement does not obligate DARPA to exercise the Option effort, nor will the lack of a written funding agreement prevent the performer from receiving an Option. DARPA will make option award decisions based on performance and funding availability.

Note that the information in the chart above includes matching funds for Option 2; firms may obtain matching funding at any time during performance of the effort.

Note: Please see Appendix A, section III (d) for complete instructions on the White Paper/Slide Deck technical volume format.

Content of the Technical Volume

Proposers should refer to the DARPA DP2 Proposal Instructions, provided in Appendix A and 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 Direct to Phase II – 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 will occasionally accept deviations from the POW requirements with a letter of explanation or approval from the Funding Agreement officer.

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 SBIR 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. Firms should fill out and upload the DARPA SBIR XL Milestones Template found on the DARPA Small Business website under SBIR/STTR BAA FORMS & TEMPLATES at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.

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 SBIR 2023.4 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 DARPA 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 SBIR 2023.4 BAA and availability of funding. Given the limited funding available for each topic released, not all proposals considered selectable will be 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 DoD SBIR 2023.4 BAA and DARPA 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 DoD SBIR 2023.4 BAA and DARPA 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 DoD SBIR 2023.4 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 SBIR 2023.4 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 for each topic issued under this BAA will depend on the quality of the proposals received and the availability of funds.

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 DARPA 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://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>, under SBIR/STTR BAA Forms. 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 under SBIR/STTR BAA Forms and Templates on <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.

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 SBIR 2023.4 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 topic.

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.

APPENDIX A: DARPA DIRECT TO PHASE II (DP2) PROPOSAL INSTRUCTIONS

I. Introduction

A complete proposal submission consists of:

Volume 1: Proposal Cover Sheet

Volume 2: Technical Volume (feasibility documentation and technical proposal)

Volume 3: Cost Volume

Volume 4: Company Commercialization Report

Volume 5: Supporting Documents

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 Volume 3: Cost Volume have been provided as attachments to the announcement posted at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>. Use of this template is mandatory.

NOTE: All proposers are required to submit Volume 4: Company Commercialization Report (CCR).

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 section 4.5 regarding marking propriety proposal information.

III. DP2 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. Content of the Technical Volume (Volume 2) – White Paper & Slide Deck

White Paper (NTE 20 pages). Provide the following information:

Goals and Impact: Clearly describe what is being proposed and what difference it will make (qualitatively and quantitatively), including a brief discussion on how this directly relates to the topic.

1. Phase I Feasibility: This topic is accepting Direct to Phase II proposals ONLY. To be eligible, proposers must demonstrate that the feasibility requirements outlined in the topic have been met, and achieved outside of the SBIR program.

2. **Technical Plan:** Outline and address all technical areas and challenges inherent in the approach and possible solutions for overcoming potential problems. Provide specific objectives, metrics, and milestones at intermediate stages to demonstrate a plan for accomplishment of the project objectives. Propose additional appropriate qualitative and quantitative metrics specific to the approach, as needed. Intermediary milestones should occur at no greater than 1-month increments.
3. **Management and Capabilities:** Designate key personnel who will be involved in the Phase II effort. Provide a brief summary of expertise of the team, including subcontractors and key personnel. Describe the organizational experience in this technology area, previous work not directly related to the proposed effort but similar, existing intellectual property required to complete the project, and any specialized facilities to be used as part of the project. List Government-furnished materials or data assumed to be available. Describe any specialized facilities to be used as part of the project, the extent of access to these facilities, and any biological containment, biosafety, and certification requirements.
4. **Transition and Commercialization Plan (limit to 5 pages):**
 - a. Describe the commercial product or DoD system to be developed.
 - b. Discuss the potential end users – DoD, Federal, and/or private sector customers. Discuss your business model for this technology (i.e., how do you anticipate generating revenue with this technology?). Who are you selling to directly or indirectly, a supplier, an integrator, or an end user?
 - c. Describe your company’s funding history. Discuss how much additional funding above this proposed effort (include additional required technology development, staffing requirements, infrastructure requirements, IP strategy costs, etc.) that will be required to bring this technology to market and how you anticipate going about getting that funding (e.g., Govt S&T contracts, investment).
 - d. Describe the timeline to maturity for sales or transition to an end user. Describe your IP strategy.
 - e. Describe the technology, market, team and business risks associated with this proposed effort and your plan to mitigate these risks.

Slide Deck (NTE 15 slides). Provide the following information (convert the completed deck to a pdf and attach it to the white paper):

1. What are you trying to do and how does this directly relate to the topic?
2. **Technology and commercial product:** Specifically, what are you proposing to produce – software, system, application? Be specific on what your proposed technology development is targeting as an end state.
3. How is the technology approached today? Who is doing the research, development and delivering products/services? What are the current limitations in the technology and commercial marketplaces?
4. **Technical and commercial value proposition:** How have you substantiated the feasibility of your approach? What is innovative in your approach and how does it compare to the state-of-the-art? Why do you think it will be successful both from a technical and commercial perspective? If you are successful what difference will it make? Discuss your proposed business model – how do you expect to generate revenue from your technology?

5. Technical and commercial risks: What are the key technical and commercial challenges and how do you plan to address/overcome these?
6. Technical and commercial market analysis: Who will care and what will the impact be if you are successful? What/who are the markets/industries/integrators/stakeholders that would/should care?
7. Cost, schedule and milestones: Provide a summary of your cost volume. Provide a summary of your schedule and milestones. How much will your proposed effort cost in total? How long will it take? What are your technical milestones for achieving the proposed efforts? What are your transition and commercialization plan milestones? Discuss how much funding will be required to bring your proposed technology to market and execute on your proposed transition and commercialization plan. Include any funding raised to date and expected plans for raising any additional required funding (government contracting revenue, product sales, internal R&D investment, loan, angel or Venture Capital investment, etc.). Describe timeline to maturity for operational use or commercial sales.
8. Management: Overview of team, facilities and qualifications.
9. Technical summary quad chart: Use template provided at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.
10. Commercialization summary quad chart: Use the DARPA Transition and Commercialization Strategy Plan (TCSP) template, located at <https://www.darpa.mil/work-with-us/for-small-businesses/commercialization-continued>.

NOTE: All letters of recommendation and CVs can be loaded in Volume 5: Supporting Documents.

c. Format of Cost Volume (Volume 3)

Proposers are required to use the Direct to Phase II – Volume 3: Cost Proposal Template (Excel Spreadsheet) provided as an attachment to this announcement. The Cost Volume (and supporting documentation) DOES NOT count toward the page limit of the Technical Volume.

d. 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:

1. 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.
2. Cost for travel funds must be justified and related to the needs of the project.
3. 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.
4. 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, see the DCAA publication titled “Audit Process Overview – Information for Contractors” available at: <http://www.dcaa.mil>.

e. 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.

f. 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. Firms should fill out and upload the DARPA SBIR XL Milestones Template found on the DARPA Small Business website under SBIR/STTR BAA FORMS & TEMPLATES at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>.

g. 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.

DARPA SBIR 23.4 Topic Index
Release 7

HR0011SB20234XL-03

Bright ELectron and Light Sources (BELLS) - SBIR XL

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

OBJECTIVE: The goal of BELLS is to demonstrate and commercialize practical sources of intense, tunable electrons and monochromatic hard x-rays. These sources would support transformative capabilities for applications such as non-destructive inspection, medical diagnostics, and treatments.

DESCRIPTION: BELLS will develop compact sources of monoenergetic electrons and photons suitable for demonstrating a range of transformative medical and non-destructive inspection applications with the overall goal of defining a minimum viable product (MVP) for commercialization. BELLS contains two subtopics that will be executed in parallel. Subtopic 1 focuses on maturing existing laboratory scale systems to demonstrate application feasibility and further productization. Subtopic 2 seeks to mature specific component technologies to be integrated into Subtopic 1 laboratory-scale systems that provide brightness enhancements enabling additional applications and productization opportunities.

Subtopic 1: Demonstration and Productization. High-quality electron and photon sources are of broad interest for a range of security, industrial, and medical applications. Recent advances in photoinjectors[1], linear accelerators[2], high power lasers[3], and a range of ancillary technologies have resulted in several prototype systems that provide novel, compact testbeds for investigating these applications. However, further maturation and demonstration of these technologies is needed to realize systems with commercialization potential. The purpose of this subtopic is to mature testbed system(s) demonstrating one or more applications and to define minimum viable commercial product(s).

High-quality electrons produced from photoinjectors and linear accelerators offer utility by themselves as well as the ability to produce bright monoenergetic x-rays through laser-Compton interactions[4]. Controlling the accelerator power allows the energy of electrons and x-rays to be tuned. For x-rays, it is possible to achieve synchrotron-like performance while achieving higher energies (100s of keV to MeV energies) in highly compact form factors.

Very high-energy electron beams (100s of MeV) and bright light sources enable a range of applications including, but not limited to:

- Medical imaging, including phase contrast
- Medical radiotherapy, including FLASH and theranostics
- Nondestructive test and evaluation, including high resolution tomography and semiconductor metrology.

The effort will not just explore the technical applications of these sources, but also the business cases, economic impacts, and regulatory requirements for such technologies to be broadly employed. These studies will support jump-starting medical and industrial activity in this sector, leading to commercially viable system designs.

Subtopic 2: Brightness Enhancements. Application performance can often be improved with increased source brightness, i.e. intensity and purity. This subtopic seeks to enhance the testbed(s)/prototype(s) of Subtopic 1 by advancing and integrating new component technology. Examples of such technology could include improvements in laser systems, electron systems, spot size reduction strategies, Fabry-Perot cavities, pulse stacking, and pulse recirculation.

PHASE I: BELLS is a direct to Phase II SBIR XL program only; there is no Phase I. Proposers must provide experimental evidence of their approach concept commensurate to a Phase I effort that achieves significant performance. Specifically, proposers must provide evidence of existing performance in the three technology areas described below:

- Photoinjector
 - o C-band or higher frequency
 - o Support microamp or greater average currents
 - o Support micropulse structures at RF frequencies at macro system repetition rates of 100 Hz or greater
 - o > 10 pC of charge produced per incident laser pulse
 - o Support electron energy of 5 MeV or greater
 - o Normalized emittance of 1 μm or better
- Electron accelerator
 - o C-band or higher frequency
 - o Acceleration gradients 50 MV/m or greater
 - o Support electron energy of 50 MeV or greater
 - o Support 10 micron or smaller laser-Compton interaction spot sizes
- Interaction laser
 - o Support 10 micron or smaller laser-Compton interaction spot sizes
 - o Sufficient energy to support laser-Compton applications generating > 30 keV photons

PHASE II: Subtopic 1: Demonstrations and Productization

Proposers must apply to Subtopic 1 to be eligible to apply to Subtopic 2. Subtopic 2 will run concurrently with Subtopic 1.

The purpose of this subtopic is to mature existing laboratory scale systems into platforms demonstrating one or more applications, and defining a minimum viable commercial product for supporting those applications.

Proposers must clearly and quantitatively describe the existing laboratory system that can support laser-Compton x-ray generation. This includes key subsystems such as photoinjector, linear electron accelerator, interaction laser, and precision subsystem synchronization.

Proposers must also choose at least one application (preferably more) and describe in detail how the existing laboratory scale system can be used to develop and mature a testbed enabling productization. This must include both a technical description and an economic analysis supporting commercial viability of the approach. This analysis must also include participation by one or more relevant stakeholders able to employ this product for the described application(s).

In addition, the system must support the performance metrics in the table below for photon production.

	Parameter	Threshold	Objective
Intensity	Intensity (photons/s)	> 10^9	> 10^{10}
	Repetition Rate (Hz)	> 100	> 1000
Energy	Minimum (keV)	> 100	> 300
Purity	Bandwidth (dE/E)	< 10%	< 0.1%

Here, “threshold” indicates the minimum acceptable performance levels while “objective” levels are highly desired.

The base period will focus on completing a BELLS testbed capable of producing relevant levels of electrons and laser-Compton photons for the chosen application(s). Performers will conduct outreach to customers, stakeholders, industrial partners, and regulators to engage in testbed use.

Option period 1 will focus on testbed demonstration and characterization activities, and develop system requirements for a minimum viable product. System characterization supporting the laser-Compton performance metrics above is expected. Option period 2 continues testbed activities while further developing the minimum viable product through a critical design review. Active participation of customers, stakeholders, industrial partners, and regulators (as appropriate) is required throughout both option periods.

Base period (6 months) milestones:

- Month 1: Kickoff slide deck summarizing technical approach to meet overall goals, risks, and risk mitigations, and quantified milestone schedule
- Month 3: Testbed build interim report
- Month 6: Testbed build final report

Option period 1 (6 months) milestones:

- Month 1: Testbed demonstration kickoff materials, with stakeholder participation
- Month 3: Testbed characterization report
- Month 6: Testbed demonstration interim report, MVP system requirements review report

Option period 2 (6 months) milestones:

- Month 1: Testbed stakeholder engagement and transition report
- Month 3: MVP preliminary design review report
- Month 6: Testbed demonstration final report, MVP critical design review report

Monthly written technical progress reports will supplement the above milestones (see template under SBIR/STTR BAA DOCUMENTS at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>).

Subtopic 2: Brightness Enhancements

Proposers can propose to Subtopic 2 within their Subtopic 1 proposal.

This subtopic seeks to enhance the testbed(s) of subtopic 1 by advancing and integrating component technology – specifically, laser-Compton performance to improve brightness, supporting commercially-relevant applications.

Proposers must clearly describe the new component technology and anticipated testbed performance increases. Increases in performance must enable an additional application or improve the commercial prospects of the minimum viable product.

Development timelines must align to integration into the testbed by the end of the option period 1. The Base period will focus on developing component technology to enhance brightness. During the option period 1, components will be refined and integrated into the testbed. During the option period 2, the enhanced testbed will be tested to verify performance, assess improvements in testbed capabilities, and enable further minimum viable product definition.

Base period (6 months) milestones:

- Month 1: Kickoff slide deck summarizing technical approach to meet overall goals, risks, and risk mitigations, and quantified milestone schedule
- Month 3: Testbed enhancement preliminary design review report
- Month 6: Testbed enhancement critical design review report

Option period 1 (6 months) milestones:

- Month 1: Testbed enhancement integration readiness report
- Month 3: Testbed enhancement interim report
- Month 6: Testbed enhancement final report

Option period 2 (6 months) milestones:

- Month 1: Enhanced testbed stakeholder engagement and transition report
- Month 3: Enhanced testbed characterization report
- Month 6: Final system performance report

Monthly written technical progress reports will supplement the above milestones (see template under SBIR/STTR BAA DOCUMENTS at <https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program>).

PHASE III DUAL USE APPLICATIONS: The successful development of such electron and x-ray sources supports a range of medical and non-destructive inspection applications. These include microbeam radiation diagnostic procedures, FLASH e-beam/x-ray radiotherapy, and innovations in theranostics. These sources would also be of high interest to the semiconductor industry for nanometrology and in-line inspection at semiconductor foundries, to include fraud detection.

Successful proposals for this SBIR offering must make significant arguments supporting the commercial viability of their approach. Hence, proposals must provide initial evidence that their laboratory scale systems have sufficient technical maturity and performance characteristics that would support economically viable applications with development into a minimally viable product. Proposals for Subtopic 2 must make arguments that the proposed enhancement(s) could significantly advance the economics of productization of their system concepts. Transition and commercialization (T-C) milestones have been added as part of the option periods to aid in assuring commercial viability

REFERENCES:

1. Performance of a second generation X-band rf photoinjector, Marsh et al., Phys. Rev. Accel. Beams 21, 073401, 2018
2. Design and demonstration of a distributed-coupling linear accelerator structure, Tantawi et al., Phys. Rev. Accel. Beams 23, 092001, 2020
3. 1 kHz repetition rate 1.1 J picosecond laser, Wang et al., Laser Congress AM2A.4, 2021
4. Photon flux and spectrum of γ -rays Compton sources, V. Petrillo et al., Nucl. Instrum. Methods Phys. Res A, 693, 109-116, 2012

KEYWORDS: Monochromatic hard x-rays, tunable electrons.

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