AMENDMENT 1
The purpose of Amendment 1 to DARPA Release 8 is to update Direct to Phase II language for topic HR0011SB20224-17, Mobile Infrastructure Compliance in Expeditionary Environments (MICEE), paragraph two, bullet two (highlighted text)

Defense Advanced Research Projects Agency (DARPA)
DoD 22.4 Small Business Innovation Research (SBIR) Annual BAA
Proposal Submission Instructions Release 8

INTRODUCTION

DARPA's mission is to make strategic, early investments in science and technology that will have long-term positive impact on our national security. As part of this mission, DARPA makes high-risk, high-reward investments in science and technology that have the potential to disrupt current understanding and/or approaches. 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.

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 03, 2022: Topics issued for pre-release
August 18, 2022: Topics open; DARPA begins accepting proposals via DSIP
September 13, 2022: Deadline for technical question submission
September 20, 2022: 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)
HR0011SB20224-15	25 pages	$250,000	6 months

Technical Volume (Volume 2)
The technical volume is not to exceed 20 pages and must follow the formatting requirements provided in the DoD SBIR 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 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 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).

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.

DIRECT TO PHASE II PROPOSAL GUIDELINES
Proposers should refer to the DARPA Direct to Phase II Proposal Instructions, provided on the DSIP Submission site.

Current Release Award Structure by Topic

Topic Number	Direct to Phase II				
	Tech Volume	Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
HR0011SB20224-12	65 pages	$1,400,000	18 months	$400,000	6 months
HR0011SB20224-13	65 pages	$1,400,000	18 months	$400,000	6 months

HR0011SB20224-14	65 pages	$1,200,000	24 months	$600,000	12 months
HR0011SB20224-15	65 pages	$1,500,000	18 months	N/A	N/A
HR0011SB20224-16	65 pages	$1,500,000	24 months	N/A	N/A
HR0011SB20224-17	65 pages	$1,000,000	24 months	N/A	N/A

Technical Volume (Volume 2)

If a proposer can provide adequate documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the topic has been met and describes the potential commercial applications, the Direct to Phase II (DP2) authority allows the Department of Defense (DoD) to make an award to a small business concern under Phase II of the SBIR program without regard to whether the small business concern was provided an award under Phase I of an SBIR program. This topic is accepting DP2 proposal submissions.

DP2 Feasibility Documentation shall not exceed 20 pages. DP2 Technical Proposal shall not exceed 40 pages. Phase II commercialization strategy shall not exceed 5 pages. This should be the last section of the Technical Volume and will not count against the 40-page limit.

Content of the Technical Volume

Proposers should refer to the DARPA DP2 Proposal Instructions, provided in Appendix B 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).

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.

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 to do so 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 BAA. Phase II selection(s) are at the sole discretion of the government and are subject to funding availability and Phase I performance.

Current Release Award Structure by Topic

Topic Number	Phase II

	Tech Volume	Award Amount	Period of Performance (PoP)	Option Amount	Option PoP
HR0011S210002-15	45 pages	$1,500,000	18 months	N/A	N/A

Technical Proposal shall not exceed 40 pages. Phase II commercialization strategy shall not exceed 5 pages. It should be the last section of the Technical Volume and will not count against the 40-page limit.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)
DARPA does not offer TABA funding.

EVALUATION AND SELECTION
All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD SBIR 2022.4 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 2022.4 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 2022.4 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 2022.4 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 2022.4 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 2022.4 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. § 2371b) 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.

Small businesses that are owned in majority part by multiple venture capital operating companies (VCOCs), hedge funds, or private equity funds are eligible to submit applications or receive awards.

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 2022.4 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. § 2371b, 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.

DARPA 22.4 Topic Index
Release 8

HR0011SB20224-12   TITLE: High Voltage Standing Wave Ratio Mechanical Impedance Tuners for
                               G-Band Noise Characterization

HR0011SB20224-13   TITLE: I/O for Heterogeneous SoCs

HR0011SB20224-14   TITLE: Persistent IR Sensor Node (P-IR)

HR0011SB20224-15   TITLE: Side Channels for Heterogenous Integrated Circuits

HR0011SB20224-16   TITLE: Encountering Vulnerabilities through Analysis of Disclosures and
                               Exploits (EVADE)

HR0011SB20224-17   TITLE: Mobile Infrastructure Compliance in Expeditionary Environments
                               (MICEE)

HR0011SB20224-12   TITLE: High Voltage Standing Wave Ratio Mechanical Impedance Tuners for
                      G-Band Noise Characterization

OUSD (R&E) MODERNIZATION PRIORITY: Microelectronics

TECHNOLOGY AREA(S): Electronics

OBJECTIVE: This topic seeks to develop high voltage standing wave ratio (VSWR) mechanical impedance tuners which operate across a 110 – 300 GHz frequency range to enable on-wafer G-band noise parameter characterization.

DESCRIPTION: Today's warfighter operates in an extremely crowded electromagnetic environment and demands innovations at the microelectronics level to meet mission requirements. These innovations include necessary modifications to the underlying transistors and integrated circuits to increase the frequency of operation. Several attractive and novel defense applications would be enabled by designing at higher frequencies. Furthermore, commercial satellite communications and telecommunications sectors would benefit from frequency scaling as they continue to demand higher data rates and wider bandwidths to meet the increasing user demand. The ELectronics for G-band ARrays (ELGAR) program [1] seeks to support the innovation of next generation III-V based transceivers integrated with silicon-like back end of the line interconnects for upper millimeter-wave bands to enable defense and commercial applications in the 100 – 300 GHz frequency range. Success of the ELGAR program requires precision on-wafer noise parameter characterization of unmatched transistors to develop noise models and enable low noise amplifier (LNA) monolithic microwave integrated circuit (MMIC) designs. Furthermore, precision measurements of the on-wafer LNA MMICs are required for design validation and integration into transceiver architectures.

A critical component for noise parameter measurements are high VSWR, low insertion loss mechanical impedance tuners that cover the 110 – 300 GHz frequency range [2] – [4]. Tuners with high VSWR operating across this large bandwidth do not exist today. Therefore, an innovative solution for high VSWR G-band mechanical impedance tuner(s) is required. The tuner(s) must provide a minimum 20:1 VSWR across a minimum 110 – 300 GHz frequency range. Furthermore, the tuner(s) must demonstrate a maximum insertion loss of 0.75 dB across the same minimum frequency range. The high VSWR requirement of the tuner(s) across the frequency range is derived from expected high insertion loss of mm-wave probes used for on-wafer measurements. The low insertion loss of the tuner(s) across the frequency range will enable integration into other test system configurations, e.g., on-wafer load-pull. The tuner(s) must be amenable to external software control via standard commands for programmable instruments (SCPI). Although there is no maximum size requirement, a clear emphasis must be placed on minimizing the form factor of the tuner(s). This will be critical for adoption into commercial on-wafer measurement systems. The final deliverable(s) will be provided to a government laboratory for evaluation and verification of SBIR performance goals.

The Phase II option of this SBIR will address integration of the final tuner deliverable(s) into an existing on-wafer system at a government laboratory. The deliverables of the Phase II option will include the necessary hardware components and software drivers for demonstrating on-wafer noise parameter measurements around 220 GHz. Finally, on-site support will be required to ensure proper operation at the government laboratory.

PHASE I: This Direct -to-Phase II (DP2) SBIR requires documentation on existing mechanical impedance tuners and a proposed plan for scaling up to 300 GHz in order to demonstrate feasibility of achieving high VSWR G-band mechanical impedance tuners. The documentation must include measured

data of existing mechanical tuners demonstrating impedance control up to a minimum of 110 GHz with a typical 20:1 VSWR and a maximum 0.75 dB insertion loss.

Proposers interested in submitting a Direct to Phase II (DP2) proposal must provide a DP2 Feasibility Documentation to substantiate that the scientific and technical merit and feasibility described above has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Phase II (Base)
This DP2 SBIR will have an 18-month duration in which the high VSWR G-band mechanical impedance tuner(s) will be designed, developed, tested, and verified for performance goals. The requirements of the impedance tuner(s) are:
1. Minimum 110 – 300 GHz frequency of impedance control
2. Minimum 20:1 VSWR across 2.d.1
3. Maximum 0.75 dB insertion loss across 2.d.1
4. SCPI commands for control from external computer

The final Phase II base deliverable(s) will be shipped to a government laboratory to be specified in the contract for evaluation.

Phase II (option)
This DP2 SBIR will have a 6-month option in which the high VSWR G-band mechanical impedance tuner(s) innovated in section 2.d will be integrated into an existing on-wafer measurement system. A Phase II option final report will detail the successful demonstration of a noise parameter measurement of an attenuator near 220 GHz. Integration of the novel G-band mechanical impedance tuner into the existing measurement system must include:
1. Acquisition of necessary commercial off the shelf (COTS) components, including waveguide components, waveguide probes, a noise source, RF switches, and a noise receiver module for noise parameter demonstration near 220 GHz.
2. Development of software drivers to control hardware components within the on-wafer noise parameter measurement system.
3. Delivery of prototype on-wafer noise parameter measurement system to a government laboratory.
4. Support for implementation at a government measurement laboratory.
The prototype on-wafer noise parameter measurement system deliverable(s) will be shipped to a government laboratory to be specified in the contract for evaluation.

Schedule/Milestones/Deliverables
Phase II (base) fixed milestones include:
- Month 1: Detailed report on high VSWR G-band mechanical impedance tuner(s) design including documentation on multiple design paths towards meeting DF2 SBIR goals and explicit details of the tuner(s) design.
- Month 3: Report on progress towards final design of mechanical impedance tuner(s).
- Month 6: Report on progress towards final design of mechanical impedance tuner(s).
- Month 9: Report on progress towards final design of mechanical impedance tuner(s).
- Month 12: Initial prototype of high VSWR G-band mechanical impedance tuner. A detailed report on preliminary measured data of the tuner prototype including documentation on the path towards the final DF2 SBIR deliverable(s) which meet final specifications.
- Month 15: Detailed report on significant progress towards final design of the mechanical impedance tuner(s) including preliminary measured data on a critical component of the final deliverable.

- Month 18: Final impedance tuner deliverable(s). Detailed data report on the final measurements of the deliverable(s). Documentation on the SCPI commands created for the tuner(s).

Phase II (option) fixed milestones include:
- Month 1: Detailed report on a) necessary COTS components for integration of G-band mechanical impedance tuners into an on-wafer noise parameter measurement system and b) plans for software control of external hardware components and overall software operation for noise parameter measurements.
- Month 3: Report on progress towards final on-wafer noise parameter system integration.
- Month 6: Delivery of final on-wafer noise parameter measurement system. Detailed report on operation of the noise measurement system including measured data of an attenuator for validation of the system.

PHASE III DUAL USE APPLICATIONS: As described in section II.b, several attractive and novel defense applications as well as commercial satellite communications and telecommunications sectors would benefit from operation at higher frequencies. Develop of RF electronics that support these applications requires high frequency test benches for characterization/optimization of RF components. The 110 – 300 GHz, high VSWR, low insertion loss mechanical impedance tuners developed under this SBIR would become a commercial product used in test benches for development of these DoD and commercial systems.

REFERENCES:
1. DARPA Broad Agency Announcement, ELectronics for G-band ARrays (ELGAR), Microsystems Technology Office, HR001121S0042, September 30, 2021
2. T. Vaha-Heikkila, M. Lahdes, M. Kantanen, and J. Tuovinen, "On-wafer noise-parameter measurements at W-band," IEEE Trans. Microwave Theory Techn., vol. 51, no. 6, pp. 1621–1628, Jun. 2003, doi: 10.1109/TMTT.2003.812554.
3. F. Danneville et al., "Noise parameters of SiGe HBTs in mmW range: towards a full in situ measurement extraction," 2017 International Conference on Noise and Fluctuations (ICNF), Vilnius, Lithuania, Jun. 2017, pp. 1–4. doi: 10.1109/ICNF.2017.7985944.
4. M. Margalef-Rovira et al. "Wideband mm-Wave Integrated Passive Tuners for Accurate Characterization of BiCMOS Technologies." 2022 International Microwave Symposium (IMS). June 2022.

KEYWORDS: Microelectronics, Tuner, Impedance, G-band, Noise Parameter, Measurements

HR0011SB20224-13   TITLE: I/O for Heterogeneous SoCs

OUSD (R&E) MODERNIZATION PRIORITY: Artificial Intelligence (AI)/ Machine Learning (ML),Autonomy,Cybersecurity,Microelectronics,Networked Command, Control, and Communications (C3),Space

TECHNOLOGY AREA(S): Information Systems,Sensors

OBJECTIVE: Exploit ontology-based application analysis techniques to integrate and configure Input/Output (I/O) capabilities into heterogeneous Systems-on-Chips (SoCs) and to increase programming productivity by automating dataflow into throughout, and out of the SoC.

DESCRIPTION: Field-Programmable Gate Arrays (FPGAs) and Application-Specific Integrated Circuits (ASICs) can now be used to implement entire SoCs using heterogeneous components such as CPUs, GPUs, accelerators, memories, and specialized IP blocks. SoCs are used across the board in autonomous vehicles, cell phones, software-defined radios, biological monitoring, and a wealth of defense edge applications. Most of these applications share a need to manage large volumes of real-time data from sensors, networked devices, and co-processors and to distribute products and results to displays, storage, and remote destinations. The challenge is to develop the ability to reconfigure or adapt device I/O capabilities flexibly to a range of applications within the target domain to avoid the need to redesign the SoC, and to ease the programming burden associated with routing and managing the dataflow between and across the heterogeneous processing components within the SoC.

DARPA's Domain-Specific System on a Chip (DSSoC) program, for example, improves many aspects of heterogeneous SoC design by analyzing the domain application code, identifying the hardware accelerators best suited for the domain, automating the SoC layout, and managing the compute resources at run-time. However, DSSoC does not address the I/O. This SBIR will address the missing I/O piece and use the information that can be acquired from deep analysis of the application requirements and application code to identify and ideally configure/reconfigure the SoC I/O capabilities needed, and to automate the dataflow into, throughout and out of the SoC.

Given the availability of an approach that incorporates ontology-based deep analysis of the application domain code which informs the design and layout of the target SoC and also supports run-time decision making via a run-time task scheduler, the technical approach may include:
   • Analysis of the application code to understand I/O requirements:
       o Dataflow into and out of the SoC
       o Dataflow between the SoC heterogeneous processing components (CPUs, GPUs, and other accelerators)
   • Development of a configuration-driven approach to I/O:
       o Demonstrate configurable management of I/O intellectual property (IP), such as double data rate (DDR) support, external interfaces and protocols, high-speed sensor data, etc.
       o Implement reconfigurable I/O so that SoC can be repurposed for applications with different I/O requirements
       o Development of dynamic automated run-time management of data buffers Support features such as temporary storage, first-in first-out (FIFO) buffers, and double-buffering
       o Automatically route data at run time based on application analysis

A deep analysis of application domain code can be used to map application compute-intensive functions and kernels to hardware processing elements in a System-on-Chip device (ASIC or FPGA). Development of enhanced, automated, reconfigurable I/O capabilities would open up strong transition opportunities and

address feedback from potential transition partners.as well as build on the software/hardware co-design concepts exemplified by the DSSoC program.

PHASE I: This topic is soliciting Direct to Phase II (DP2) proposals only. Ontology-based application analysis can be used to identify the compute-intensive portions (loops, kernels, primitives, functions) of a set of applications, and can feed this information to software tools, such as code generators, accelerator designs, and run-time libraries. To establish Phase I feasibility, the proposer must provide documentation based on using an ontology-based analysis approach to inform the hardware I/O requirements of the SoC, to steer the reconfiguration of existing SoC I/O capabilities, and to automate the run-time management of dataflow into, across, and out of the SoC heterogeneous processing components. The ontology-based analysis documentation should include technical papers, reports, and related documentation to substantiate proposer's claim to experience/expertise in the use of ontology-based analysis of application domain code.

PHASE II: The goal of this SBIR is the development of a configuration-driven approach to SoC I/O and the associated design automation tools. Performers are expected to 1) perform analysis of the application code to understand I/O requirements including dataflow into and out of the SoC and dataflow between the SoC heterogeneous processing components (CPUs, GPUs, and other accelerators); 2) demonstrate configurable management of I/O Intellectual Property (IP), such as DDR support, external interfaces and protocols, high-speed sensor data, etc.; 3) implement reconfigurable I/O so that SoC can be repurposed for applications with different I/O requirements; and 4) enhance run-time scheduling to manage data buffers dynamically including adding support features such as temporary storage, FIFOs, and double-buffering and to support automatic routing of data at run-time based on application analysis. Expected Phase II (base) key metrics include:
- 50X Productivity improvement compared to hand-coding
- 5 GB/s sustained external I/O bandwidth supported
- I/O types supported (8-bit, 16-bit, protocols, buses, channels)

Schedule/Milestones/Deliverables
- Month 1: KO, Technical Approach Report that details approach for analysis of the application code to understand I/O requirements and approach for development of configurable I/O and demonstration plans.
- Month 3: PI meeting, including detailed hardware and software architecture, preliminary SoC with configurable I/O design review (PDR), PowerPoint presentations of accomplishments and plans.
- Month 6: PI meeting, including critical design review (CDR) and performance analysis using emulation, PowerPoint presentations of accomplishments and plans.
- Month 9: PI meeting, including final design review/tape out of SoC design with configurable I/O, final performance analysis using emulation, PowerPoint presentations of accomplishments and plans.
- Month 12: PI meeting, including software infrastructure demonstration, PowerPoint presentations of accomplishments and plans.
- Month 15: PI meeting, including initial test data for SoC with configurable I/O; PowerPoint presentations of accomplishments and plans; run-time demonstration of automated dataflow management; identification of potential transition partner(s) and other interested DoD organizations.
- Month 18: Final report, including quantitative metrics on SoC I/O capabilities including at least 5GB/sec sustained aggregate SoC I/O, 50X improved productivity in dataflow programming compared with hand-coding, support for 8-bit, 12-bit, and 16-bit sensor data samples, and at least three (3) standard external bus protocols such as Ethernet and AXI bus. Proposal for Phase II option including target SoC device associated test data and demonstration application (based on transition party requirements). The report shall also document any scientific advances that have

been achieved under the program. (A brief statement of claims supplemented by publication material will meet this requirement.) Final PI meeting presentation material.

Phase II Option
Based on progress and status during the Phase II (base), Phase II option activities should include a real-world demonstration in collaboration with a transition partner, based on the fabrication of a highly capable SoC with advanced I/O capabilities.
Schedule/Milestones/Deliverables
- Month 1: KO, Technical Approach Report, that details approach for Demonstration application based on transition party requirements
- Month 3: PI meeting with PowerPoint presentations of accomplishments and plans.
- Month 6: Final review/report including demonstration device (SoC with advanced I/O capabilities) running transition partner application or facsimile thereof and associated test data. Final PI meeting presentation material.

PHASE III DUAL USE APPLICATIONS: FPGAs and ASICSs are used extensively in embedded applications across both commercial and DoD/military fields. A commercial example of SoC use is in automobiles for such applications as RADAR and LIDAR processing to support autonomous driving. Military applications include software-defined radio (SDR) communications processing. Ontology-based I/O management for SoCs has the potential to make the development of such embedded and edge applications quicker, easier, and less expensive with shorter time-to-deploy and more flexibility to adapt to changing circumstances.

REFERENCES:
1. K. Asanovic, et al. The landscape of parallel computing research: A view from Berkeley. Technical Report UCB/EECS-2006-183, EECS Department, University of California, Berkeley, 2006.
2. E. L. Kaltofen, "The 'Seven Dwarfs' of Symbolic Computation," Department of Mathematics, North Carolina State University, http://kaltofen.math.ncsu.edu/bibliography/10/Ka10_7dwarfs.pdf.
3. Xiaojun Yang et al. MemoryIO: An Extended I/O Technology in Embedded Systems, IEEE 2008 International Conference on Networking, Architecture, and Storage.

KEYWORDS: I/O, ontology, SoC, heterogeneous, ASIC, Reconfigurable

HR0011SB20224-14   TITLE: Persistent IR Sensor Node (P-IR)

OUSD (R&E) MODERNIZATION PRIORITY: Autonomy,Microelectronics,Networked Command, Control, and Communications (C3)

TECHNOLOGY AREA(S): Information Systems,Sensors

OBJECTIVE: Develop a standalone wireless sensor node for infrared radiation (IR) detection of personnel at operationally relevant ranges (>3 m) with extremely small form factor (i.e., <2 cm3) and unprecedented persistence (>5 yr).

DESCRIPTION: Common constraints for IR sensors are the persistence and size of conventional detectors. State-of-the-art sensors drain battery power continuously regardless of the presence of the target signal, which leads to short sensor lifetime and frequent battery replacement. Conventional infrared sensors are also bulky. For instance, conventional pyroelectric IR sensor-based motion detectors require a bulky Fresnel lens for their normal operation.

This SBIR intends to develop persistently aware, miniaturized, wireless IR signature detectors with unprecedented longevity for personnel detection given insight into low-power sensor technologies developed in DARPA's Near Zero Power RF and Sensor Operations (N-ZERO) program [1-4].

PHASE I: This topic is accepting Direct to Phase II (DP2) proposals only. Phase I will produce a breadboard design that combines at least one IR switch sensor with a wireless module, load-switch, and battery unit. The following performance should be demonstrated, at minimum, in a laboratory environment:

Metric	Unit	Phase I goal
Personnel Detection Range	M	>1
Probability of detection	--	>80%
False alarm rate	Per month	<1
Size	cm^3	<200
Lifetime*	years	>2

*projected based on battery capacity, persistently aware power consumption, and assumed communications and detection schedule.

Proposers interested in submitting a Direct to Phase II (DP2) proposal must provide documentation to substantiate that the scientific and technical merit and feasibility described above has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Phase II will create a prototype IR detector node based on sensor threshold scaling. This will allow for longer detection range at LWIR and intimate integration with state-of-the-art discrete components based on the Phase I design. The key metrics for Phase II are shown in the table below. There will also be a Phase II Option to build the final deliverable prototypes and perform field testing for long-term reliability and stability against environmental conditions such as vibration and temperature.

Personnel Detection Range	M	>3
Probability of detection	--	>95%
False alarm rate	Per month	<1
Size	cm^3	<2
Lifetime	Years	>5

Schedule/Milestones/Deliverables
Phase II fixed milestones for this program should include:
- Month 3: Preliminary Design Review Briefing Report – covering the Phase II system design and concept-of-operation, custom component development, discrete component selection and procurement, system integration, and schedule of development and testing.
- Month 12: Critical Design Review Briefing Report – review quantitative analysis (experimental, simulated and/or modeled) and component demonstrations to project system performance and development schedule.
- Month 18: Interim report describing system development and performance update.
- Month 24: Delivery and testing of first prototype to program metrics and a Phase II final report documenting prototype sensor and architecture, methods, and results. Final report will outline development schedule to develop, test and deliver final deliverable prototypes (5). Final report will also include a business plan for identified government transition
- partner(s) and dual-use applications.

Phase II option milestones should include:
- Month 30: Interim report of prototype performance against environmental conditions documenting key technical gaps towards productization.
- Month 36: Final Phase II Option report, including quantitative metrics on decision making benefits, costs, risks, and schedule for implementation of the full prototype capability. Delivery of the prototype to a government chosen testing facility.

PHASE III DUAL USE APPLICATIONS: Infrared radiation detectors are a critical component for DoD imaging systems used in areas such as military vehicles, military night vision, military communication, environmental monitoring, and target acquisition. In addition, they are crucial for commercial markets including surveillance, digital cameras, automotive and scientific research.

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1. Qian, Z., Kang, S., Rajaram, V. et al. "Zero-power infrared digitizers based on plasmonically enhanced micromechanical photoswitches," Nature Nanotech 12, 969–973 (2017).
2. Kang, S., Rajaram, V., Risso, A., Calisgan, S. D., Qian, Z., and Rinaldi, M., "Thermomechanical Modeling and Optimization of Zero-Power Micromechanical Photoswitch," Journal of Microelectromechanical Systems 31 (2), 241-248 (2022).
3. Hui, Y., Kang, S., Qian, Z., and Rinaldi, M., "Uncooled Infrared Detector Based on an Aluminum Nitride Piezoelectric Fishnet Metasurface," Journal of Microelectromechanical Systems 30 (1), 165-172 (2021).
4. Exner, A. T., Pavlichenko, I., Lotsch, B. V., Scarpa, G. and Lugli, P., "Low-cost thermo-optic imaging sensors: a detection principle based on tunable one-dimensional photonic crystals," ACS Applied Materials & Interfaces 5, 1575–1582 (2013)

KEYWORDS: MEMS, Infrared Switch, Infrared Detector, Zero-Power

HR0011SB20224-15   TITLE: Side Channels for Heterogenous Integrated Circuits

OUSD (R&E) MODERNIZATION PRIORITY: Microelectronics

TECHNOLOGY AREA(S): Electronics

OBJECTIVE: Determine if functions in individual chips on a heterogenous integrated circuit can be detected through side channels.

DESCRIPTION: A heterogenous integrated circuit (HIC) consists of multiple different integrated circuits (ICs), such as central processing units (CPUs), graphic processing units (GPUs), field programmable gate arrays (FPGAs), and on-chip accelerators (neural network accelerators) on a single, larger integrated package. To date, side channels have looked for vulnerabilities and emissions in single purpose ICs only (e.g. CPUs and GPUs). New state-of-the-art packaging techniques already have integrated multiple different types of ICs onto a single package. Identifying the contributions of the individual ICs to the overall composite signal of the side channel is an important first step to defining potential mitigations. This SBIR topic seeks to explore multiple different potential approaches to differentiate individual ICs and their functions from the composite side channel signal measured on the HIC.

In order to quantify the different approaches and their feasibility, the expected performance metrics for Phase I and Phase II are described in Table 1. Proposers should be able to provide comparison to the current state of the art (with references) and clearly describe how their approach is intended meet or exceed the metrics.

Phase	Probability of Detection	Probability of False Alarm	# of integrated circuits
End of Phase 1	80%	0.01%	2
End of Phase 2	90%	0.01%	4

PHASE I: The goal of Phase I is to identify signal components that contribute to the composite side channel from a HIC containing two or more heterogenous ICs. The proposer should be able to articulate what composite side channel(s) are being used and why those side channel(s) were selected. The selected side channels shall be extensible, that is, they should be able to model and predict behaviors on other types of ICs. When identifying the components, the performer shall have a probability of detection of at least 80% and a probability of false alarm of less than 0.01% by the end of Phase I.

Schedule/Milestones/Deliverables
- Month 1: Report and presentation on initial algorithms
- Month 2: Report on experimental set up
- Month 3: Report on acquisition of different integrated circuits and initial conditions
- Month 4: Interim report describing current experimental results
- Month 5: Interim report describing current experimental results and potential extensibility
- Month 6: Final Phase I Report summarizing approach; results; comparison with alternative state-of-the-art methodology; quantification of probability of detection; quantification of probability of false alarm; and quantification of extensibility

Proposers interested in submitting a Direct to Phase II (DP2) proposal must provide documentation to substantiate that the scientific and technical merit and feasibility described above has been met and describes the potential military and/or commercial applications. Documentation should include all

relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.

PHASE II: Phase II efforts should refine the extensibility of the algorithms developed in Phase I for additional ICs. Potential additional side channels should be analyzed if the methodology from Phase I is not sufficiently extensible. At the end of Phase II, at least four or more unique ICs (not copies of the same integrated circuit) in a single HIC should be separable from the overall composite side channel.

Schedule/Milestones/Deliverables
- Month 2: Report on lessons learned, updated algorithms, and potential additional ICs to be evaluated
- Month 4: PI meeting, including demonstration of progress to date, PowerPoint presentations of accomplishments and plans
- Month 6: Interim report quantifying the effects of real-world noise and other potential contributions that could cause issues with separation of the signals
- Month 9: Interim report describing the theory behind the specific side channel(s) used and interim demonstration of capabilities
- Month 12: Interim report on progress to date
- Month 15: Interim report on progress to date and final demonstration plans
- Month 16/17: Final demonstration of developed tools and capabilities
- Month 18: Final Phase II Report summarizing approach, results, comparison with alternative state-of-the-art methodology, quantification of probability of detection, quantification of probability of false alarm, theory of side channel contributions, and quantification of extensibility (ability to model and predict behaviors on other ICs)

PHASE III DUAL USE APPLICATIONS: Heterogenous integrated circuits are starting to become a larger and larger part of both commercial and DoD/military systems. Identifying how side channels are convoluted when measuring multiple ICs supports the eventual exploration of mitigation paths to these. Mitigating side channels in HICs enables increased signal quality within the package and reduction of potential information leakage of a heterogenous integrated circuit.

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2. T. Kasper, D. Oswald, and C. Paar. "Side-channel analysis of cryptographic RFIDs with analog demodulation." International workshop on radio frequency identification: Security and privacy issues. Springer, Berlin, Heidelberg, 2011.
3. P. Kocher, J. Jaffe, and B. Jun. "Differential power analysis." Annual international cryptology conference. Springer, Berlin, Heidelberg, 1999.
4. J. Ferrigno, and M. Hlaváč. "When AES blinks: introducing optical side channel." IET Information Security, vol. 2, issue 3, pp. 94-98, 2008

KEYWORDS: Microelectronics, Side Channels, Hardware Security, Heterogenous Integrated Circuits, System on Chip, Cyber Security

HR0011SB20224-16   TITLE: Encountering Vulnerabilities through Analysis of Disclosures and
                     Exploits (EVADE)

OUSD (R&E) MODERNIZATION PRIORITY: Cybersecurity

TECHNOLOGY AREA(S): Information Systems

OBJECTIVE: For the Internet of Things (IoT) and other embedded devices, exhaustive enumeration of the systems impacted by a given vulnerability is incumbent upon the device manufacturer. However, code reuse is a common practice in modern software development, and this practice has frequently resulted in the same or similar code existing across not only devices, but manufacturers. This presents a disadvantage for network defenders, as vulnerability disclosures for embedded devices commonly fail to fully articulate their impact.

In order to mitigate this issue, DARPA is seeking proposals which address the challenge of automatically determining the exhaustive set of embedded devices impacted by publicly disclosed vulnerabilities, especially those beyond ones enumerated in public disclosures. Specifically, DARPA is seeking dynamic-analysis-based approaches to identify the underreporting of Common Platform Enumerations (CPEs) associated with Common Vulnerabilities and Exposures (CVEs) for IoT and embedded devices. Successful proposals will address the challenges of conducting the analysis at scale in the IoT/embedded device ecosystem.

DESCRIPTION: Performers will develop novel approaches to automated security assessments, detecting and assessing vulnerabilities extrapolated from a single published vulnerability or exploit. Their solution should scale across device types and instruction set architectures by determining semantically equivalent programs, subroutines, and vulnerable code across multiple devices and architectural frameworks.

The program seeks breakthrough approaches to various technical challenges, including but not limited to:
- developing efficient algorithms and techniques to support cross-architecture detection of code re-use for programs of arbitrary complexity;
- creating high-fidelity models of IoT and embedded systems;
- address knowledge gaps in IoT and embedded systems software supply chain/software bill of materials (SBOM); and,
- development of scalable analyses which enable the re-identification of semantically-equivalent vulnerable code, even when such code exceeds the bounds of individual subroutines or executables across devices.

PHASE I: This is a Direct to Phase II (DP2) solicitation; Phase I proposals will not be accepted or reviewed. Phase I feasibility will be demonstrated through evidence of: a completed feasibility study or a basic prototype system; definition and characterization of properties desirable for both Department of Defense (DoD) and civilian use; and comparisons with alternative state-of-the-art methodologies (competing approaches). Proposers interested in submitting a DP2 proposal must provide documentation to substantiate that the scientific and technical merit and feasibility described above have been met and describe the potential military or commercial applications. DP2 documentation should include:
- technical reports describing results and conclusions of existing work, particularly regarding the commercial opportunity or DoD insertion opportunity, and risks/mitigations, assessments;
- presentation materials and/or white papers;
- technical papers;
- test and measurement data;
- prototype designs/models;

- performance projections, goals, or results in different use cases; and
- documentation of related topics such as how the proposed EVADE solution can close the analytic gap.

This collection of material will verify mastery of the required content for DP2 consideration. DP2 proposers must also demonstrate knowledge, skills, and ability in computer science, mathematics, program analysis, and software engineering. For detailed information on DP2 requirements and eligibility, please refer to the DoD BAA and the DARPA Instructions for this topic.

Proposers interested in submitting a Direct to Phase II (DP2) proposal must provide documentation to substantiate that the scientific and technical merit and feasibility described above has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. For detailed information on DP2 requirements and eligibility, please refer the DoD 22.2 BAA.

PHASE II: The goal of EVADE is to develop a software analysis tool which takes inputs in the form of known-vulnerable device firmware, along with a representation of knowledge about a CVE (e.g., a public proof of concept exercising the vulnerability described by the CVE) in order to automatically extrapolate the list of vulnerable systems through identification of shared and semantically equivalent code.

DP2 proposals should:
- describe a proposed design/architecture to achieve these goals;
- present a plan for maturation of the architecture to a prototype system to demonstrate enumeration of multiple platforms impacted by a CVE, to include at least the set of platforms detailed in the CPE associated with the CVE; and
- detail a test plan, complete with proposed metrics and scope, for verification and validation of the system performance with respect to both accuracy and scale.

Phase II will culminate in a system demonstration incorporating automated dynamic analysis for the recognition of semantically equivalent code across at least eight (8) devices and across two (2) of the instruction set architectures commonly in used in IoT/embedded devices today (e.g., ARM, MIPS, PowerPC). Additionally, performers will demonstrate the capacity to scale analysis capability to support the magnitude of the existing CVE database and associated interactive security artifacts (e.g. crash PoC inputs, n-day exploits). The below schedule of milestones and deliverables is provided to establish expectations and desired results/end products for the Phase II effort.

Schedule/Milestones/Deliverables Proposers will execute the Research and Development (R&D) plan as described in the proposal.
- Month 1: Phase I Kickoff briefing (with annotated slides) to the DARPA Program Manager (PM) (in person or virtual, as needed) including: any updates to the proposed plan and technical approach, risks/mitigations, schedule (inclusive of dependencies) with planned capability milestones and deliverables, proposed metrics, and plan for prototype demonstration/validation.
- Months 4, 7, 10: Quarterly technical progress reports detailing technical progress made, tasks accomplished, major risks/mitigations, a technical plan for the remainder of Phase II (while this will normally report progress against the plan detailed in the proposal or presented at the Kickoff briefing, it is understood that scientific discoveries, competition, and regulatory changes may all have impacts on the planned work and DARPA must be made aware of any revisions that result), planned activities, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.

- Month 12: Interim technical progress briefing (live system demo with annotated slides) to the DARPA PM (in-person or virtual as needed) detailing progress made (include quantitative assessment of capability developed to date), tasks accomplished, major risks/mitigations, planned activities, and technical plan for the second half of Phase II, the demonstration/verification plan for the end of Phase II, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.
- Month 15, 18, 21: Quarterly technical progress reports detailing technical progress made, tasks accomplished, major risks/mitigations, a technical plan for the remainder of Phase II (with necessary updates as in the parenthetical remark for Months 4, 7, and 10), planned activities, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.
- Month 24/Final Phase II Deliverables: Final architecture demonstration with documented details, demonstrating enumeration of IoT/embedded systems impacted by a given CVE (in excess of the CPE detailed in the CVE); documented application programming interfaces; any other necessary documentation (including, at a minimum, user manuals and a detailed system design document; and the end of phase commercialization plan).

PHASE III DUAL USE APPLICATIONS: The Phase III work will be oriented towards transition and commercialization of the developed EVADE technologies. The proposer is encouraged to obtain funding from either the private sector, a non-SBIR Government source, or both, to develop the prototype software into a viable product or non-R&D service for sale in military or private sector markets. Phase III refers to work that derives from, extends, or completes an effort made under prior SBIR funding agreements, but is funded by sources other than the SBIR Program.

Primary EVADE support will be to national efforts to develop approaches to improve the cybersecurity of systems and networks making use of IoT/embedded devices. Outcomes have the potential to significantly benefit the DoD and numerous commercial entities by improving knowledge of the software supply chain/SBOM for critical networks and systems. Specifically, in the DoD space, EVADE technologies will improve the cybersecurity posture of Blue and Grey terrain environments; in the commercial space, EVADE technologies will have security applications with the defense industrial base (DIB) entities seeking to improve the vulnerability management capabilities.

REFERENCES:
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KEYWORDS: Program Analysis, Embedded Systems, Internet of Things, Cybersecurity, Supply Chain

HR0011SB20224-17   TITLE: Mobile Infrastructure Compliance in Expeditionary Environments
                    (MICEE)

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

TECHNOLOGY AREA(S): Electronics,Information Systems

OBJECTIVE: Secure communications using foreign 5G infrastructure is becoming a necessity for US
forces deployed abroad. However, its use raises many security concerns, even in friendly or neutral
environments, not least due to the impact of outsourced manufacturing. To reduce the cost and time-to-
market, many companies adapted their manufacturing models and design flow, and started using
Intellectual Property (IP) of third-party companies and outsourced the fabrication of their hardware to
offshore foundries. When combined with use of non-US 5G telecoms, the lack of assurance on supply
chain and system management creates a very high risk of a malicious cyber adversary impacting
operations at a time and manner of their choosing.

Mobile Infrastructure Compliance in Expeditionary Environments (MICEE) performers will explore
novel approaches and develop prototypes to passively/non-intrusively monitor and detect malicious
activities in non-owned 5G/mobile infrastructure devices. MICEE is interested in different
hardware/software monitoring or verification methods that can radically improve security outcomes in
critical infrastructure for Blue and Grey terrain environments. MICEE is intended to provide easy-to-field
monitoring solutions. The hardware/software/component verification or monitoring may be performed
periodically, one-time or continuously based on the criticality of the monitored system.

DESCRIPTION: Performers are expected to develop systems that will alert military system users about
adversarial or anomalous activities detected on non-owned 5G network infrastructure elements.
Additionally, MICEE prototypes should help validate both the hardware and the software of integrated
systems during acceptance testing.
The program seeks breakthrough approaches to various technical challenges, including but not limited to:
- developing effective tools and algorithms to support one-time, periodic, and continuous
  monitoring schemes;
- creating models to differentiate modified and unaltered systems;
- software/hardware validation of critical infrastructure before and after deployment;
- developing prototypes and non-intrusive, low-overhead monitoring schemes for easy and secure
  deployment of monitoring systems;
- minimizing the connection/communication between the monitoring and monitored devices;
- detecting hardware/software trojans with no reverse-engineering techniques; and,
- developing monitoring methods for the devices that are operating at high frequency and have an
  air-gapped nature.

PHASE I: This is a Direct to Phase II (DP2) solicitation, Phase I proposals will not be accepted or
reviewed. Phase I feasibility will be demonstrated through evidence of: a completed feasibility study or a
basic prototype system; definition and characterization of properties desirable for both Department of
Defense (DoD) and civilian use; and comparisons with alternative state-of-the-art methodologies
(competing approaches). Proposers interested in submitting a DP2 proposal must provide documentation
to substantiate that the scientific and technical merit and feasibility described above have been met and
describe the potential commercial applications. DP2 documentation should include:
- technical reports describing results and conclusions of existing work, particularly regarding the
  commercial opportunity or DoD insertion opportunity, and risks/mitigations, assessments;
- presentation materials and/or white papers;

- technical papers;
- test and measurement data;
- prototype designs/models;
- performance projections, goals, or results in different use cases; and,
- documentation of related topics such as how the proposed MICEE solution can close the analytic gap.

This collection of material will verify mastery of the required content for DP2 consideration. DP2 proposers must also demonstrate knowledge, skills, and ability in networking, computer science, mathematics, and software engineering. For detailed information on DP2 requirements and eligibility, please refer to the DoD BAA and the DARPA Instructions for this topic.

Proposers interested in submitting a Direct to Phase II (DP2) proposal must provide documentation to substantiate that the scientific and technical merit and feasibility described above has been met and describes the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results. For detailed information on DP2 requirements and eligibility, please refer the DoD 22.2 BAA.

PHASE II: The goals of MICEE are to develop a zero-overhead technology for diagnosing implementation and configuration errors, malicious activities, and monitoring and maintaining system robustness of mobile/5G critical infrastructure.

DP2 proposals should:
- describe a proposed design/architecture to achieve these goals;
- present a plan for maturation of the architecture to a prototype system to demonstrate ==passive/non-intrusive monitoring and detection of malicious activities in non-owned 5G mobile infrastructure devices; and==
- detail a test plan, complete with proposed metrics and scope, for verification and validation of the system performance.

Phase II will culminate in a system demonstration using one or more compelling use cases consistent with commercial opportunities and/or insertion into a DARPA program (e.g., Open Programmable Secure 5G). The below schedule of milestones and deliverables is provided to establish expectations and desired results/end products for the Phase II effort.

Schedule/Milestones/Deliverables. Proposers will execute the Research and Development (R&D) plan as described in the proposal.
- Month 1: Phase I Kickoff briefing (with annotated slides) to the DARPA Program Manager (PM) (in person or virtual, as needed) including: any updates to the proposed plan and technical approach, risks/mitigations, schedule (inclusive of dependencies) with planned capability milestones and deliverables, proposed metrics, and plan for prototype demonstration/validation.
- Months 4, 7, 10: Quarterly technical progress reports detailing technical progress made, tasks accomplished, major risks/mitigations, a technical plan for the remainder of Phase II (while this will normally report progress against the plan detailed in the proposal or presented at the Kickoff briefing, it is understood that scientific discoveries, competition, and regulatory changes may all have impacts on the planned work and DARPA must be made aware of any revisions that result), planned activities, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.
- Month 12: Interim technical progress briefing (with annotated slides) to the DARPA PM (in-person or virtual as needed) detailing progress made (include quantitative assessment of capability developed to date), tasks accomplished, major risks/mitigations, planned activities, and technical plan for the second half of Phase II, the demonstration/verification plan for the end of

Phase II, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.
- Month 15, 18, 21: Quarterly technical progress reports detailing technical progress made, tasks accomplished, major risks/mitigations, a technical plan for the remainder of Phase II (with necessary updates as in the parenthetical remark for Months 4, 7, and 10), planned activities, trip summaries, and any potential issues or problem areas that require the attention of the DARPA PM.
- Month 24/Final Phase II Deliverables: Final architecture with documented details, demonstrating diagnosing a malicious activity and unauthorized modification on software/hardware; documented application programming interfaces; any other necessary documentation (including, at a minimum, user manuals and a detailed system design document; and the end of phase commercialization plan).

PHASE III DUAL USE APPLICATIONS: The Phase III work will be oriented towards transition and commercialization of the developed MICEE technologies. The proposer is required to obtain funding from either the private sector, a non-SBIR Government source, or both, to develop the prototype software into a viable product or non-R&D service for sale in military or private sector markets. Phase III refers to work that derives from, extends, or completes an effort made under prior SBIR funding agreements, but is funded by sources other than the SBIR Program.

Primary MICEE support will be to national efforts to develop approaches to monitor and detect malicious activities in 5G/mobile infrastructure devices. Outcomes have the potential to significantly benefit the DoD and numerous commercial entities by improving security outcomes in critical infrastructure. Specifically, in the DoD space, MICEE technologies will improve security outcomes in critical infrastructure for Blue and Grey terrain environments; in the commercial space, MICEE technologies have security applications to telecom companies and companies that develop 5G/mobile infrastructure software and hardware.

REFERENCES:
1. DARPA Broad Agency Announcement, Open Programmable Secure 5G (OPS-5G), HR001120S0026, January 30, 2020. Available at https://sam.gov/opp/6ee795ad86a044d1a64f441ef713a476/view

KEYWORDS: Algorithms, Networking, 5G, Cybersecurity, Sensing

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
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 to the announcement posted at https://www.darpa.mil/work-with-us/for-small-businesses/participate-sbir-sttr-program. Use of these templates 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 SBIR 2022.4/STTR 2022.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 length of the technical volume will be specified by the corresponding topic. 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 attachment 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 SBIR 2022.4/STTR 2022.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). <u>All resumes will count toward the page limit for Volume 2, as specified in the topic</u>.

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 2022.4/STTR 2022.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 2022.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.

h. **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.

APPENDIX B: 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 for Volume 2: Technical Volume and Volume 3: Cost Volume have been provided as attachments to the announcement posted at https://www.dodsbirsttr.mil/submissions/login Use of these templates 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. Format of Technical Volume (Volume 2)

   1. The Technical Volume must include two parts, PART ONE: Feasibility Documentation and PART TWO: Technical Proposal.

   2. 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.

3. Length: The length of each part of the technical volume (Feasibility Documentation and Technical Proposal) will be specified by the corresponding TOPIC. The Government will not consider pages in excess of the page count limitations.

4. 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.

c.   Content of the Technical Volume (Volume 2)

PART ONE: Feasibility Documentation
   1.   Provide documentation to substantiate that the scientific and technical merit and feasibility described in the Phase I section of the TOPIC has been met and describe the potential commercial applications. Documentation should include all relevant information including, but not limited to: technical reports, test data, prototype designs/models, and performance goals/results.
   2.   Maximum page length for feasibility documentation will be specified by the TOPIC. If you have references, include a reference list or works cited list as the last page of the feasibility documentation. This will count towards the page limit.
   3.   Work submitted within the feasibility documentation must have been substantially performed by the proposer and/or the PI.
   4.   If technology in the feasibility documentation is subject to Intellectual Property (IP), the proposer must either own the IP, or must have obtained license rights to such technology prior to proposal submission, to enable it and its subcontractors to legally carry out the proposed work. Documentation of IP ownership or license rights shall be included in the Technical Volume of the proposal.
   5.   Include a one-page summary on Commercialization Potential addressing the following:
      i.   Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?
      ii.   ii.   Describe the potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.
DO NOT INCLUDE marketing material. Marketing material will NOT be evaluated.

PART TWO: Technical Proposal
   1.   Significance of the Problem. Define the specific technical problem or opportunity addressed and its importance.
   2.   Phase II Technical Objectives. Enumerate the specific objectives of the Phase II work, and describe the technical approach and methods to be used in meeting these objectives.
   3.   Phase II Statement of Work. The statement of work should provide an explicit, detailed description of the Phase II approach, indicate what is planned, how and where the work will be carried out, a schedule of major events and the final product to be delivered. 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 total proposal.
      a.   Human/Animal Use: Proposers proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal in order to avoid potential delay of contract award.
      b.   Phase II Option Statement of Work (if applicable, specified in the corresponding TOPIC). The statement of work should provide an explicit, detailed description of the activities planned during the Phase II Option, if exercised. Include how and where the work will be

carried out, a schedule of major events and the final product to be delivered. The methods planned to achieve each objective or task should be discussed explicitly and in detail.

4. Related Work. Describe significant activities directly related to the proposed effort, including any conducted by the PI, the proposer, consultants or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The proposal 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.
    i. State the anticipated results of the proposed approach if the project is successful.
    ii. Discuss the significance of the Phase II effort in providing a foundation for Phase III research and development or commercialization effort.

6. Key Personnel. Identify key personnel who will be involved in the Phase II effort including information on directly related education and experience. A concise resume of the PI, including a list of relevant publications (if any), must be included. All resumes count toward the page limitation. Identify any foreign nationals you expect to be involved on this project.

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 section 3.2 of this 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 II effort. Items of equipment to be purchased (as detailed in the cost proposal) shall be justified under this section. Also 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. 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 Guidance. Please refer to section 3 of this 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 this topic is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, or another or the same DoD Component, 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 projects that result in products sold to the U.S. military, the private sector market, or both. DARPA expects explicit discussion of key activities to achieve this result in the transition and commercialization strategy part of the proposal. The Technical Volume of each Direct to Phase II proposal must include a transition and commercialization strategy section. The Phase II transition and commercialization strategy shall not exceed 5 pages, and will NOT count against the proposal page limit.

Information contained in the commercialization strategy section will be used to determine suitability for participation in EEI. Selection for participation in EEI will be made independently following selection for SBIR/STTR award. Please refer to section 2.6 of this BAA for more information on the DARPA EEI and additional proposal requirements.

The transition and commercialization strategy should include the following elements:

a. A summary of transition and commercialization activities conducted during Phase I, and the Technology Readiness Level (TRL) achieved. Discuss the market, competitive landscape, potential stakeholders and end-users, and how the preliminary transition and commercialization path or paths may evolve during the Phase II project. Describe key proposed technical milestones during Phase II that will advance the technology towards product such as: prototype development, laboratory and systems testing, integration, testing in operational environment, and demonstrations.
b. Problem or Need Statement. Briefly describe what you know of 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 the 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 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 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.

 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:
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.

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.

h. 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.