



U.S. Department of Homeland Security (DHS)

Small Business Innovation Research (SBIR)

Program

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The Science and Technology Directorate

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1.0 PROGRAM DESCRIPTION

1.1 Summary

The Department of Homeland Security (DHS) Small Business Innovation Research (SBIR) Program, housed within the Science and Technology (S&T) Directorate invites small business concerns (SBCs) to submit innovative proposals under this Solicitation. The DHS SBIR Program Office encourages all small business concerns, including small disadvantaged, women-owned, veteran-owned, service-disabled veteran-owned, and socially and economically disadvantaged small business concerns, with the capability to conduct research and development for homeland security-related topic areas described in **Appendix A**, and to commercialize the results of that R/R&D, are encouraged to participate to submit proposals in response to topics described in this Solicitation.

IMPORTANT:

- Please read the solicitation carefully. Failure to comply with the requirements herein will likely result negatively in the proposal evaluation or elimination from consideration for award.
- This Solicitation contains topics for the S&T Directorate's SBIR Program. Only proposals submitted in response to topics contained in this Solicitation will be accepted and considered for awards. **Section 7.0** outlines the nine (9) S&T topics. Unsolicited proposals will not be accepted.
- While the Phase II proposal process is covered in this Solicitation, at this time **this Solicitation requests and accepts Phase I proposals only**. See **Section 1.3**.
- SBCs that are majority-owned by multiple venture capital operating companies, hedge funds or private equity firms are not eligible to submit proposals in response to this Solicitation. See **Section 1.5**.
- Per the Small Business Administration (SBA) SBIR Policy Directive, dated May 2, 2019, (hereafter referred to as "the Policy Directive") to be eligible for a Phase I award, Offerors must meet or exceed the following benchmark:
 - Phase I to Phase II Transition rate, See **Section 3.7**, DHS Phase II Transition Rate Benchmark

1.2 DHS SBIR Program, Purpose and Objectives

The statutory purpose of the SBIR Program is to strengthen the role of innovative small business concerns in Federally-funded R/R&D. Program objectives are to: (1) stimulate technological innovation; (2) strengthen the role of small business concerns in meeting Federal R/R&D needs; (3) foster and encourage participation by socially and economically disadvantaged small businesses (SDBs) and by women-owned small businesses (WOSBs); and (4) increase private sector commercialization of innovations developed through Federal R/R&D, thereby increasing competition, productivity, and economic growth. The federal SBIR Program is mandated by the Small Business Research and Development Act of 1982 (Public Law 97-219), the Small Business Research and Development Act of 1992 (Public Law 102-564), and the SBIR/STTR Reauthorization and Improvement Act of 2016 (Public Law 114-328).

The DHS SBIR Program follows the policies and practices of the Policy Directive. This Solicitation incorporates and uses the flexibility of the Policy Directive to encourage innovative proposals in response to the research topics listed in **Appendix A**.

13 Three Phase Program

The SBIR Program is a three phase program. The objective of Phase I is to determine the scientific, technical, and commercial merit and feasibility of the proposed effort, and the quality of performance of the SBC, with a relatively small agency investment prior to providing further Federal support in Phase II. Phase I proposals should concentrate on that R/R&D which will significantly contribute to proving the scientific and technical feasibility, and commercialization potential of the proposed effort. The successful completion of which is a prerequisite for further DHS support in Phase II. Offerors are encouraged to consider whether the R/R&D being proposed also has private sector potential, either for the proposed application or as a base for other applications.

The objective of Phase II is to continue the R/R&D effort from the completed Phase I. Phase II efforts further develop work from Phase I that meets particular program needs and exhibits potential for commercial application. Phase II is the principal R&D effort and is expected to produce a well-defined deliverable prototype. Phase II awards may be made to SBCs on the basis of the results of their Phase I projects, and the scientific merit, technical merit, and commercialization potential of the Phase II proposal.

In accordance with the SBIR/STTR Reauthorization Act of 2016 (Public Law 114- 328), all small businesses awarded a Phase I contract originating from this Solicitation are eligible to submit a Phase II proposal. A Contracting Officer will notify Phase I awardees of the Phase II proposal submission requirements and the deadline for Phase II submissions.

SBIR 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. Phase III work is typically oriented towards commercialization of SBIR research or technology. Under Phase III, the SBIR awardee is expected to seek contracts and obtain funding from the private sector and/or the Federal government (non-SBIR federal government sources) to develop the prototype or supply goods or services related to the work performed under the SBIR contract(s) into a viable product or non-R&D service for sale in DHS and/or private sector markets.

A Phase III award, by its nature, is an SBIR award, has SBIR status, and must be accorded SBIR data rights. Phase III proposals can only be submitted by, and made to, a Phase I and/or Phase II awardee or successor in interest. The competition for SBIR Phase I and Phase II awards satisfies any competition requirement of the Armed Services Procurement Act, the Federal Property and Administrative Services Act, and the Competition in Contracting Act. Therefore, an agency that wishes to fund an SBIR Phase III project is not required to conduct another competition in order to satisfy those statutory provisions.

14 Key Dates and Events

The following chart shows the important events and corresponding dates of the 20.1 DHS SBIR Solicitation:

KEY	
EVENT	DATE*
Pre-solicitation issued:	November 13, 2019
Direct contact with Topic POC	November 13, 2019 – December 17, 2019
Solicitation released:	December 18, 2019
Phase I proposals submission:	December 19, 2019 – January 22, 2020

Last day to submit questions:	January 3, 2020 12:00 NOON. ET
Q&A Posted on FBO.gov	January 10, 2020
Deadline for receipt of proposals:	January 22, 2020, 12:00 NOON. ET
Phase I POP	~May 2020 - Nov 2020
Phase II Proposals Due	~November 2020
Phase II Begins	~March 2021
The dates in the table above are approximate dates and are subject to change without notice.	

15 Eligibility

SBCs that are majority-owned by multiple venture capital operating companies, hedge funds or private equity firms are not eligible to submit proposals in response to this Solicitation nor are they eligible to receive a DHS SBIR award.

To receive SBIR funds, each awardee of a Phase I or Phase II award must qualify as a SBCs at the time of award and at any other time set forth in SBA's regulations at 13 CFR 121.701 through 121.705.

Small businesses concerns must register with the SBA Company Registration Database. See **Section 2.1**.

For both Phase I and Phase II, the primary employment of the principal investigator must be with the SBC at the time of the award and during contract performance. Primary employment means that more than one-half of the principal investigator's time is spent in the employ of the SBC. This precludes full-time employment with another organization.

For both Phase I and Phase II, all research or research and development must be performed by the SBC and its subcontractors in the United States. See **Section 5.8** for performance work requirements.

16 SBIR Office Contacts

For general questions about the S&T Directorate's SBIR Program, please contact STSBIR.PROGRAM@hq.dhs.gov.

17 Definitions

Definitions provided in the Policy Directive and the Federal Acquisition Regulation (FAR) apply for the purposes of this Solicitation. Terms that are unique to the SBIR Program, this specific SBIR solicitation, or may be unfamiliar to SBCs, are defined in **Appendix B**.

18 Fraud, Waste and Abuse

DHS and the SBIR Program Office are taking proactive measures to reduce the vulnerability of the SBIR Program to fraud, waste, and abuse. To report SBIR fraud, please contact the DHS Office of the Inspector General (OIG):

- Anonymous Hotline: 1-800-323-8603
- OIG Online Allegation Form: <http://www.oig.dhs.gov/hotline/hotline.php>

- Fax: (202) 254-4297
- Mail: DHS Office of Inspector General/MAIL STOP
0305
Attention: Office of Investigations-Hotline
245 Murray Drive SW,
Washington, DC 20528

To reach someone within S&T's SBIR Program Office about fraud, waste and abuse, please contact DHS S&T SBIR Program PM, STSBIR.PROGRAM@hq.dhs.gov

2.0 REGISTRATION, CERTIFICATIONS, DATA COLLECTION

2.1 Mandatory Registrations

In order to prepare and submit SBIR proposals to DHS under this Solicitation, Offerors must be registered in the DHS SBIR electronic online proposal submission system at <https://sbir2.st.dhs.gov>.

Company registration is also required in the U.S. Small Business Administration's (SBA) Company Registry Database at <http://sbir.gov/registration>. Prior to submitting the complete proposal to DHS, each Offeror must:

1. Affirm registration in the SBA Company Registry;
2. Input the company's SBC Control ID number in the Company Data section of the DHS SBIR Cover Sheet;

PROPOSALS WHICH FAIL TO COMPLY WITH THE ABOVE REQUIREMENT ARE NON- RESPONSIVE AND WILL NOT BE CONSIDERED FOR AWARD.

Before an SBIR contract can be awarded, proposing firms must also be registered in the System for Award Management (SAM). SAM is the official U.S. Government system that consolidated the capabilities of the Central Contractor Registration (CCR)/Federal Register, Online Representations and Certifications Application (ORCA), and the Excluded Parties List System (EPLS) databases. Although not required at the time of proposal submission to the DHS SBIR Program, it is highly recommended that Offerors register in SAM during the proposal process. To register in SAM and/or update company's records, visit <https://www.sam.gov/portal/public/SAM/>.

Offerors are encouraged, but not required, to have a DUNS number and a CAGE code at the time of proposal submission. Companies must obtain these before a contract can be awarded to the company. To obtain a DUNS number, visit <https://fedgov.dnb.com/webform>. CAGE Codes are automatically assigned upon registration in SAM. For more information about the Commercial and Government Entry (CAGE) code, please visit www.fsd.gov.

2.2 Required Certifications

At the time of proposal submission, each SBC must certify via the Cover Sheet of the proposal that it meets the size, ownership and other requirements of the SBIR Program. In addition, the Policy Directive includes certifications requirements set forth in the SBIR/STTR Reauthorization and Improvement Act of 2016. The certifications require SBCs to certify that they are meeting

the Program's requirements during the life cycle of the funding agreement.

The DHS SBIR Programs will implement the certifications as follows:

1. SBIR Funding Agreement Certification – Time of Award (**Attachment 1**) – If selected for award, this certification will be provided by the Contracting Officer to the small business concern for completion prior to issuing the Phase I and Phase II award.
2. SBIR Funding Agreement Certification – Life Cycle Certification (**Attachment 2**) - The Life Cycle Certification will be included in resultant Phase I and Phase II contracts and considered a deliverable.

2.3 Data Collection Requirement

Each Phase I and Phase II applicant is required to either enter information into SBA's database at www.SBIR.gov or to update previously entered information. Companies should login to www.SBIR.gov using the account created when registering for the SBA company registry database. The following are examples of data to be entered into the database:

- Any business concern or subsidiary established for the commercial application of a product or service for which an SBIR award is made.
- Revenue from the sale of new products or services resulting from the research conducted under each Phase II award;
- Additional investment from any source, other than Phase I or Phase II awards, to further the research and development conducted under each Phase II award.

The SBC may apportion sales or additional investment information relating to more than one Phase II award among those awards, if it notes the apportionment for each award.

In addition, each Phase II awardee is required to update the appropriate information on the award in the database upon completion of the last deliverable under the funding agreement and is requested to voluntarily update the information in the database annually thereafter for a minimum period of 5 years.

3.0 PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

3.1 Proposal Preparation and Length of Proposal

Offerors responding to this Solicitation must submit a direct, concise, and informative research or research and development proposal. Each complete proposal must be submitted via the DHS SBIR online proposal submission portal at <https://sbir2.st.dhs.gov>.

The SBC will need to submit all the mandatory proposal sections. Some sections will be generated by the proposal submission portal and some will require a PDF upload. Some sections which required PDF upload have a page limit.

The table below describes each mandatory section and, when applicable, page limitations. Proposals submitted which do not contain all mandatory sections and/or exceed page limitations as described in the table below, will be deemed **NON-RESPONSIVE** and will not be evaluated. It is the responsibility of the SBC to ensure that once the proposal is submitted and uploaded into the system, it complies with the page limits.

Mandatory Proposal Requirements		Phase I	Phase II
System Generated	Cover Sheet	As generated by system	
	Cost Proposal	As generated by system	
PDF Uploads	Technical Proposal	Limited to 20 pages	Limited to 40 pages
	Briefing Chart ¹	Limited to 1 page	Limited to 1 page
	Commercialization Report	N/A	No Page Limit- if applicable

¹ Briefing Chart Template is Attachment 3 in the solicitation.

The Cover Sheet and the Cost Proposal are completed electronically via the DHS SBIR online proposal submissions system, while the Technical Proposal, Briefing Chart, and the Commercialization Report, if applicable, are uploaded as PDF documents.

3.2 Proposal Cover Sheet, Technical Abstract, Project Aims, and Summary of Results

It is a requirement for the Offeror to provide basic details about the proposed effort on the proposal Cover Sheet. Additionally, the Cover Sheet includes the following fillable sections: Technical Abstract, Project Aims, and Summary of Results.

The Technical Abstract is limited to 250 words. The abstract must identify the purpose of the work and briefly describe the work to be carried out, the finding or results, and the potential commercial applications of the effort. If the Offeror's proposal is selected for award, the Technical Abstract section will be publicly posted on the DHS SBIR website and on the SBA's website; therefore, do not include proprietary or classified information in the Technical Abstract section of the Cover Sheet.

The Project Aims section is limited to 500 words and is for Government use only.

For Phase I proposals only, the Offeror should state the specific objectives of the Phase I R/R&D effort, including the technical questions the Offeror will answer to determine the Phase I feasibility of the proposed approach and the impact that the results of the proposed research will exert on the research field(s) involved. The Offeror should state concisely and realistically what the proposed research is intended to accomplish in terms of its potential for technological innovation and commercial application. The proposed product, process or service that will ultimately be developed must be defined. Milestones for each of the aims should be included, as these will be used in the evaluation process.

For Phase II proposals only, the Offeror should state the specific objectives of the Phase II research and development effort including the impact that the results of the proposed research will exert on the research field(s). The Offeror should state concisely and realistically what the proposed research is intended to accomplish in terms of its potential for technological innovation and commercial application. The proposed product, process or service that will ultimately be developed must be defined. Milestones for each of the aims should be included, as these will be used in the evaluation process.

The Summary of Results section is limited to 500 words, must not contain proprietary information, and is for Government use only. The Offeror should provide the anticipated results and implications of the approach (both Phases I and II) and the potential commercial applications of the research.

3.3 Technical Proposal Format and Content

Prepare the Technical Proposal in single column format, 12-point Times New Roman, with 1” margins on 8 ½” x 11” paper. Company name, topic number, and proposal number must be included in the header of each page. (The header may be included in the 1” margin.) The use of 10-point font is permissible for imbedded tables, figures and graphics. See **Section 3.1** for page limitations for Phase I and Phase II proposals.

The Technical Proposal must be a single file, including tables, figures, graphics and table of contents (if included). Do not lock, password protect, or encrypt the file to be uploaded. Perform a virus check before uploading the Technical Proposal file. If a virus is detected, it may cause rejection of the proposal.

The Technical Proposal must include the following sections in the order provided:

PROPOSAL FORMAT	
PHASE I PROPOSAL	PHASE II PROPOSAL
I. Identification and Significance of the Problem or Opportunity	I. Identification and Significance of the Problem or Opportunity
II. Phase I Technical Objectives	II. Phase I Technical Objectives and Results
III. Phase I Work Plan	III. Phase II Work Plan
IV. Related R/R&D	IV. Related R/R&D
V. Key Individuals and Bibliography of Directly Related Work	V. Key Individuals and Bibliography of Directly Related Work
VI. Relationship with Future R/R&D	VI. Relationship with Future R/R&D
VII. Commercialization Strategy	VII. Commercialization Plan
VIII. Facilities/Equipment	VIII. Facilities/Equipment
IX. Subcontractors/Consultants	IX. Subcontractors/Consultants
X. Potential Post Applications	X. Prior, Current, or Pending Support of Similar Proposals or Awards
XI. Prior, Current, or Pending Support of Similar Proposals or Awards	

The following is a brief description of each section of the Technical Proposal as applicable for each Phase:

- Identification and Significance of the Problem or Opportunity – Succinctly define the specific technical problem or opportunity addressed; the proposed innovation; the relevance and significance of the proposed innovation to a need(s) within the topic description; the proposed innovation relative to the state of the art; and the importance of the work proposed.
- Technical Objectives (Phase I proposals only) – State the specific objectives of the Phase I R/R&D effort, including the technical questions that must be answered to determine the feasibility of the proposed innovation/approach.
- Technical Objectives and Results (Phase II proposals only) – State the specific

objectives of the Phase I R/R&D effort including the technical questions addressed to determine the feasibility. Address the progress, results and findings of the Phase I effort.

- **Work Plan (Phase I proposals only)** (including the efforts of the subcontractor(s)/consultant(s), if applicable) – Provide an explicit, detailed description of the Phase I approach. The Plan should indicate what tasks are planned, how, when, 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 determine the technical feasibility of the proposed concept, and address the questions cited in the Technical Objectives immediately above. The methods planned to achieve each objective or task should be discussed explicitly and in detail. Task descriptions, schedules, resource allocations, estimated task hours for each key personnel and planned accomplishments, including project milestones, should be included. This section will be a substantial portion of the total Technical Proposal.
- **Work Plan (Phase II proposals only)** (including the efforts of the subcontractor(s)/consultant(s), if applicable) – Provide an explicit, detailed description of the Phase II approach. The Plan should indicate what tasks are planned, how, when, and where the work will be conducted, a schedule of major events, the final product to be delivered, and the completion date of the effort. The Phase II effort should satisfy the anticipated results, as specified in the topic description. The methods planned to achieve each objective or task should be discussed explicitly and in detail. Task descriptions, schedules, resource allocations, estimated task hours for each key personnel and planned accomplishments, including project milestones, should be included. This section should be a substantial portion of the total proposal.
- **Related Research/Research and Development** – Describe significant (current and/or previous) R/R&D activities that are directly related to the proposed effort, including any conducted by the principal investigator, the Offeror, consultants, or others. Discuss any planned coordination with outside sources. Describe how these activities relate to the proposed project. Describe previous efforts similar but directly related to the proposed effort. For each effort, provide the following: (a) short description, (b) client for which work was performed (including individual to be contacted and phone number), and (c) date of completion. The Offeror should persuade reviewers of his or her awareness of key, recent R/R&D conducted by others in the specific topic area.
- **Key Individuals and Bibliography of Directly Related Work** – Identify key personnel who will be involved in the effort including information on directly related education, experience, and bibliographic information. A concise resume for the Principal Investigator and all key personnel, including a list of relevant publications (if any), should be included. All resumes will count toward the appropriate page limitation, see **Section 3.1. Offerors must identify any non-U.S. citizen(s) expected to be involved on proposed project** [including direct employees, subcontractors and consultants], their country of origin, type of visa or work permit under which they are performing, and an explanation of their anticipated level of involvement on this project. **Do not include Privacy Act Information.**
- **Relationship with Future Research/Research and Development (Phase I proposals only)** – State the anticipated results of the proposed approach if the project is successful through Phase I and Phase II. Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort, application and commercialization efforts (Phase III).
- **Relationship with Future Research/Research and Development (Phase II proposals only)** – State the anticipated results of the proposed approach if the project is successful through Phase II and Phase III. Discuss the significance of the Phase II effort in providing a foundation for Phase III commercialization efforts.

- **Commercialization Strategy (Phase I proposals only)** – (1) Explicitly describe the company's strategy (vision) for commercializing the proposed technology and how it will transition to the specific operational component in DHS, other Federal Agencies, and/or private sector markets. (2) Provide specific information on what related technologies, if any, already exist in the market and why the technology being proposed will be superior and how this information was ascertained. (3) Include a discussion on the Offeror's current capability to commercialize previously developed technologies, as well as how the Offeror intends to develop the proposed technology all the way to the market. Responses to (1), (2), and (3) should be specific to the technology being proposed. Failure to respond to any of the items listed will result in a lower valuation for criterion c (See **Section 4.1** for Phase I evaluation criteria). If the Offeror has no commercial experience (item (3)) this should clearly be stated, and Offeror should describe how Offeror intends to bring the necessary experience to the company.
- **Commercialization Plan (Phase II proposals only)** – The Commercialization Plan should address the following: (Failure to address each item listed below in some detail will result in a lower valuation for criterion b (See **Section 4.1** for Phase II evaluation criteria):
 - a. *Company Information.* Focused objectives/core competencies; specialization area(s); products and significant product sales; and history of previous Federal and non-Federal funding, regulatory experience, and subsequent commercialization. Does the Offeror have marketing expertise and, if not, how does the Offeror intend to bring that expertise into the company?
 - b. *Customer and Competition.* Provide a clear description of key technology objectives, current competitors, and advantages (cost and technical) compared to competing products or services; description of hurdles to acceptance of the innovation. Address who the customers will be, and for non-DHS customers explain the demand drivers for this technology. Estimate the market size. Has the Offeror contacted anyone in the projected target customer base including DHS customers? Identify potential factors that could have positive and/or negative impacts regarding the transition of the proposed product.
 - c. *Market.* Provide milestones, target dates, analyses of market size, and the estimated market share after first and five-year sales. Provide detailed explanation on the plan to obtain market share.
 - d. *Financing.* Provide detailed information on the identification and acquisition of costs associated in transitioning the proposed product/services into the market. If available, provide brief discussion on potential financial sources. What are the plans for securing necessary funding for Phase III?
 - e. *Intellectual Property (IP).* Provide a detailed description on how the company plans to acquire and protect appropriate IP of the proposed product/service. What is the IP strategy and how will it be protected? Address patent status, technology lead, trade secrets or other demonstrations of a plan to achieve sufficient protection to realize the commercialization stage and attain at least a temporal competitive advantage.
 - f. *Assistance and Mentoring.* Provide plans for securing needed technical or business assistance through mentoring, partnering, or through arrangements with state assistance programs, small business development centers, Federally-funded research laboratories, Manufacturing Extension Partnership centers, or other assistance providers. Address how the product will be produced.

The Commercialization Plan should also include a schedule and the basis for that schedule showing the quantitative results from the Phase II project that the company expects to report in its Company Commercialization Report Updates one year after the start of the Phase II, at

the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.).

- Facilities/Equipment – Provide information to allow the evaluators to assess the ability of the Offeror to carry out the activities of the proposed phase as well as all subsequent phases. Describe available instrumentation and physical facilities necessary to carry out the proposed effort. Equipment to be purchased, as detailed in the Cost Proposal, should be justified under this section. Also state whether the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state, 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.
- Subcontractors/Consultants – Involvement of any subcontractor(s) or consultant(s) (including Federal Laboratories, FFRDCs, universities, and technical assistance providers) is permitted. If such involvement is proposed, it should be described in detail in this section and in the Cost Proposal. Subcontractors' or consultants' involvement under Technical and Business Assistance (see **Section 5.11**) should be clearly delineated from involvement by other subcontractors and consultants. A minimum of two-thirds of the research and/or analytical work in Phase I, as measured by total contract value, should be carried out by the proposing SBC. A minimum of one-half of the research and/or analytical work in Phase II, as measured by total contract value, should be carried out by the proposing SBC. If the SBC determines that it needs to acquire services from a non-U.S. source, it must fully explain in its proposal why a non-U.S. source must be used, and why no qualified U.S. source exists to perform the same services.
- Potential Post Applications – Briefly describe the following: (1) whether and by what means the proposed project appears to have potential commercial application; and (2) whether and by what means the proposed project appears to have potential use by the Federal Government.
- Prior, Current, or Pending Support of Similar Proposals or Awards – WARNING – While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work (see **Appendix B**) for consideration under numerous Federal program solicitations, it is unlawful to enter into funding agreements (contracts or grants) requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

If an Offeror elects to submit identical proposals or proposals containing a significant amount of essentially equivalent work in response to this Solicitation, or other Federal program solicitations, or is substantially the same as another proposal that has been funded, is now being funded, will be submitted to other agencies for funding consideration, or is pending with DHS or another Federal Agency, the Offeror must indicate so on the Proposal Cover Sheet and provide the following information in the Technical Proposal:

- a. Name and address of the Federal Agency(s) 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 principal investigator or project manager for each proposal submitted or award received
- e. Title, number, and date of 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 SBIR Proposal submitted or award received

Note: If this section does not apply, the following statement should be included in the Technical Proposal: "No prior, current, or pending support for proposed work."

3.4 Cost Proposal

All Offerors must submit a cost proposal via <https://sbir2.st.dhs.gov>. Proposed costs must not exceed the maximum thresholds outlined below.

SBIR Topic Structure	
Phase I	Phase II
\$150,000*	\$1,000,000 **
6 months	24 months

Note: * Phase I total is not inclusive of Discretionary Technical and Business Assistance

** Phase II total IS inclusive of the Discretionary Technical and Business Assistance

Please see **Section 5.11**.

For additional information on the items in the Cost Proposal, reference *the DHS SBIR Cost Proposal Guide* at <https://sbir2.st.dhs.gov> under "Resources."

Additionally, more information about cost proposals and accounting standards can be found in the DCAA publication, *Information for Contractors*, available at www.dcaa.mil/dcaam_7641.90.pdf.

Proposals submitted under this Solicitation will be considered valid for 180 days. If a proposal is selected for award, Offerors should be prepared to submit further cost/pricing documentation to the Contracting Officer in order to justify items on the cost proposal.

The following are required elements of the cost proposal:

- Direct Labor – list the name, labor category, labor hours and labor rate of each employee working on the project
- Overhead Cost – specify the current overhead rate. Use overhead rate approved by a cognizant federal agency, if available.
- Other Direct Cost – include direct material, special testing, equipment, travel, subcontracts, etc.

For Phase I planning purposes, Offerors should budget for two mandatory trips to Washington, DC – a post-award kick-off meeting and a one-day meeting to present the results in the final report. Refer to the table below for details:

PHASE I TRAVEL	
Day	S&T Topics Post Award Conference
1	(Mandatory) Session includes: <ul style="list-style-type: none"> • Program background and contracting overview • One-on-One sessions with Topic Managers
2	(Mandatory) Commercialization workshop
3	(Optional) Showcasing and Presentation Workshop - venue where small business concerns can enhance their presentation skills in front of Government, Industry and representatives from the investment community

3.5 Briefing Chart

The mandatory one-page Briefing Chart should provide a very concise summary of the overall effort. The Briefing Chart is uploaded during proposal submission and may be used in the evaluation process. The briefing chart **MUST NOT** contain proprietary or classified data. Offerors must use the Briefing Chart template provided in **Attachment 3**.

3.6 Commercialization Report

All Phase II Offerors with previous Phase II awards must submit a Commercialization Report. It is important to note that this is a separate document from the Commercialization Plan required as part of the Phase II Technical Proposal.

Offerors that have not received any Phase II awards should check the appropriate box on the Cover Sheet certifying that the company has not received SBIR Phase II funding from any agency. Offerors with no prior Phase II awards will not be negatively impacted in the evaluation process. Instead, such companies will be evaluated based on the Commercialization Plan, see **Section 3.3**.

If applicable, the succinct Commercialization Report should be in PDF format and submitted as a separate upload during the Phase II proposal submission. The following are examples of company commercialization data expected in the Commercialization Report:

- Any business concern or subsidiary established for the commercial application of a product or service for which an SBIR award is made.
- Revenue from the sale of new products or services resulting from the research conducted under each Phase II award; delineate revenue by government, open market, prime contractors, other awards, and when this revenue event occurred.
- Additional investment from any source, other than Phase I or Phase II awards, to further the research and development and/or commercialization conducted under each Phase II award.
- Whether the Phase II technology has been used in a fielded DHS system or acquisition program, and, if so, which system or program.
- The number of patents resulting from the contractor's participation in the SBIR Program and whether any licenses based on these patents have been issued.

- Whether the company has completed an initial public offering (IPO) of stock, merged or been acquired resulting, in part, from any DHS SBIR Phase II project.

The Commercialization Report for any prior Phase II award received by the company must be current as of the end of the company's last full fiscal year (FY). The company may apportion sales or additional investment information relating to more than one Phase II award among those awards, if it notes the apportionment for each award.

3.7 DHS Phase II Transition Rate Benchmark

The Phase I to Phase II Transition Rate requirement applies only to SBIR and STTR Phase I applicants that have received more than 20 (21 or more) Phase I awards over the past 5 fiscal years, excluding the most recent year. These companies must meet the required benchmark rate of transition from Phase I to Phase II. The current Transition Rate requirement, agreed upon and established by all 11 SBIR agencies and published for public comment at 77 FR 63410 (link is external) in October 2012 and amended at 78 FR 30951 (link is external) in May 2013, is that an awardee must have received an average of one Phase II for every four Phase I awards received during the most recent 5-year time period (which excludes the most recently-completed fiscal year) to be eligible to submit a proposal for a new Phase I (or Direct-to-Phase II) award. That is, the ratio of Phase II to Phase I awards must be at least 0.25.

For SBIR/STTR awardees that have received more than 20 Phase I awards during the time period, SBA calculates the company Transition Rate and displays it on the company registry page at www.sbir.gov. Companies with less than that number of past Phase I awards will only see "N/A" because the benchmark requirement does not apply to them. To calculate the company Transition Rate, SBA divides the total number of SBIR and STTR Phase II awards a company received from all agencies during the past 5 fiscal years by the total number of SBIR and STTR Phase I awards it received during the past 5 fiscal years excluding the most recently-completed year. The 5-year period over which Phase I awards are counted excludes the most recently completed fiscal year because not all Phase II awards can occur within the same year as the Phase I award.

3.8 Questions

General Questions

Questions pertaining to the S&T's SBIR Program should be submitted to STSBIR.PROGRAM@hq.dhs.gov.

Technical Questions

Questions related to specific topics must be received by 12:00 (NOON) ET January 3, 2020.

Technical questions received after this date will not be considered. Technical Questions should be submitted to the Contracting Officer Danette Williams, Danette.Williams@hq.dhs.gov

These questions are limited to technical information related to improving the understanding of a topic's requirements. Any questions or inquiries seeking advice or guidance on a solution approach are unacceptable and will not receive a response.

Responses to the questions received by 12:00 (NOON) ET January 3, 2020, will be posted on <https://beta.sam.gov/> and the DHS SBIR Program website at <https://sbir2.st.dhs.gov> as an amendment to the Solicitation.

All Offerors are advised to monitor both <https://beta.sam.gov/> and the DHS SBIR Program website during the Solicitation period for supplemental posting of questions and answers, and other information relevant to the research topics in this Solicitation.

Electronic Submission Questions

Questions regarding the electronic submission of proposals should be submitted to the Help Desk at (703) 480-7676, or via email to dhssbir@reisystems.com. The Help Desk may be contacted from 9:00 a.m. to 5:00 p.m. ET, Monday through Friday excluding Federal Holidays .

4.0 METHOD OF SELECTION AND EVALUATION CRITERIA

4.1 Evaluation Criteria, Factors and Ratings

The **Phase I evaluation criteria**, listed in decreasing order of importance, are as follows:

- a. Technical Merit – the soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
- b. Staff Qualifications and Capability – the qualifications of the proposed principal investigator, key personnel, supporting staff, and consultants. Qualifications include the ability to perform the research and development.
- c. Potential for Commercialization – the potential for commercial application, either in the Government or private sector, and the benefits expected to accrue from this commercialization.
- d. Cost/Price The reasonableness of the cost proposal. The evaluation of cost/price will include whether the level of effort and other direct costs are appropriate for the proposed work.

The **Phase II evaluation criteria**, listed in decreasing order of importance, are as follows:

- a. Technical Merit – the soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
- b. Potential for Commercialization – the potential for commercial application, either in the Government or private sector, and the benefits expected to accrue from this commercialization.
The lack of a Company Commercialization Report, due to the offeror having no prior Phase II awards, will not affect its ability to receive an award.
- c. Staff Qualifications and Capability – the qualifications of the proposed principal investigator, key personnel, supporting staff, and consultants. Qualifications include the ability to perform the research and development.
- d. Cost/Price – The reasonableness of the cost proposal. The evaluation of cost/price will include whether the level of effort and other direct costs are appropriate for the proposed work.

Evaluators will assess the strengths, weaknesses, and deficiencies of the above criteria using

the following definitions:

- a. Strength – An aspect of the proposal that benefits the Government in terms of the quality of the Offeror’s performance, cost effectiveness, or reduced risk towards successful contract performance.
- b. Weakness – A flaw in the proposal that decreases the likelihood successful contract performance. A “significant weakness” is a flaw that dramatically increases the risk of unsuccessful contract performance. When weaknesses are identified, the Government will provide comment(s) on the significance of the weakness.
- c. Deficiency – A material failure of a proposal that would result in an unacceptable risk level of contractor performance.

Evaluators will use one of the following adjectival ratings for each of the Technical Merit, Staff Qualifications and Capability, and Potential for Commercialization criterion:

- a. Excellent – The proposal demonstrates a superior understanding of the requirements and an approach that significantly exceeds all topic objectives. Proposal has exceptional strengths that will significantly benefit the Government and risk of unsuccessful performance is very low.
- b. Very Good – Offeror’s proposed approach is likely to satisfy most of the topic objectives and shows a high probability of successful contract performance. Offeror’s proposal has strengths that will benefit the Government and one or more weaknesses, but no significant weaknesses.
- c. Good – Offeror’s proposed approach has a reasonable likelihood of satisfying the topic objectives and shows a good probability of successful contract performance. Offeror’s proposal has some strengths that will benefit the Government, and some weaknesses.
- d. Fair – Offeror’s proposed approach is unlikely to meet the topic objectives and shows a low probability of successful contract performance. Offeror’s proposal has weaknesses, some that may be significant, and few strengths, if any, that will benefit the Government.
- e. Unacceptable – The Offeror’s proposed approach fails to meet the topic objectives and requirements.

The Cost/Price criterion is not adjectively rated as outlined above; rather, the evaluation team will determine if the cost proposal is either acceptable or unacceptable as defined below:

- a. Acceptable - The proposed cost elements, including labor mix, labor hours, material, special testing, special equipment, travel, subcontracts, if applicable, are appropriate for the proposed effort.
- b. Unacceptable - The proposed cost elements, including labor mix, labor hours, material, special testing, special equipment, travel, subcontracts, if applicable, are not appropriate for the proposed effort.

4.2 Proposal Review Feedback

DHS will make award decisions, and notify applicants of its decisions, within 90 calendar days from the closing date of this Solicitation. Specific instructions on requesting feedback will be provided to each Offeror upon notification that their proposal was not selected for award.

Requests for proposal feedback must be received within three (3) business days of the notification and will only be provided to Offerors upon request.

4.3 Contractor Support Services in Support of the Selection Process

Offerors are advised that non-federal, contract support personnel will be used to carry out administrative functions for the SBIR Program Office and topic program managers. The contract support personnel will have access to proposals. Administrative duties may include, but are not limited to, making and distributing copies of proposal, scheduling and attending meetings, taking and compiling notes, etc.

5.0 CONSIDERATIONS

5.1 Awards

While it is the intent of the DHS SBIR Program to award a negotiated contract for each proposal selected, selection does not guarantee award. No contracts will be awarded until all relevant proposals submitted in response to a specific topic have been evaluated and an award decision rendered. The number of SBIR Phase I and Phase II awards will be consistent with the SBIR budget. The number of Phase I awards is estimated to be 33. All DHS SBIR awards resulting from this Solicitation will be posted at <https://sbir2.st.dhs.gov>.

A firm-fixed price (FFP) contract will be awarded for all Phase I awards. Phase II contracts can either be awarded as a cost-plus fixed-fee (CPFF) contract or firm-fixed price contract; however, in accordance with FAR 16.301-3, to award a CPFF contract, Offerors must have an accounting system that is adequate for determining cost applicable to the contract.

Additionally, certified cost and pricing data may be required for Phase II contracts over \$750,000.00 - See FAR 15.403-4(a). Fee and profit may be included in the Cost Proposal (see **Section 5.6**).

5.2 Reports and Deliverables

Monthly reports (Phase I), Quarterly Reports (Phase II) and a final comprehensive report (both Phase I and Phase II) will be required in all SBIR awards.

In addition, if you are proposing and awarded a contract with Technical and Business Assistance an additional report is required (see **Section 5.11**).

Other deliverables appropriate to the proposed effort will be identified in the topic area description. Phase I and II awardees will be required to submit the *SBIR Funding Agreement Certification – Life Cycle Certification (Attachment 3)* during the contract period of performance.

5.3 Invoice Instructions

The specific invoicing instructions will be incorporated into the contract upon completion of negotiations between the Government and the successful Phase I or Phase II Offeror.

5.4 Innovations, Inventions and Patents

Proprietary Information. Information contained in unsuccessful proposals will remain the property of the applicant. The Government will, however, retain copies of all proposals. Public release of information in any proposal submitted will be subject to existing statutory and regulatory requirements.

If proprietary information is provided by an applicant in a proposal, which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or data affecting the national security, it will be treated in confidence, to the extent permitted by law. This information must be clearly marked by the applicant with the term “proprietary information” and the following legend must appear on the title page of the proposal:

“These data shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than evaluation of this proposal. If a funding agreement is awarded to this applicant as a result of or in connection with the submission of these data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the funding agreement and pursuant to applicable law. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction are contained on pages ___ of this proposal.”

DHS assumes no liability for inadvertent disclosure or use of unmarked data. The Government will limit dissemination of such proprietary information to within official channels.

Marking of Proprietary Information. To properly mark proprietary information on the proposal, use an asterisk (*) in the right and left margins on pages deemed proprietary. If all information on a page is deemed proprietary, include this statement, “ENTIRE PAGE IS PROPRIETARY,” in both the header and footer of the associated page. Do not label the entire proposal “proprietary.” All other markings (e.g., “Company Confidential”, “Business Sensitive”, etc.) will not be recognized.

Rights in Data Developed Under SBIR Funding Agreements. Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this Solicitation generally remain with the contractor, except that the Government obtains a royalty-free license to use such technical data only for Government purposes during the period commencing with contract award and ending twenty years after award of the project under which the data were generated. To preserve the SBIR data rights of the awardee, the legend (or statements) used in the SBIR Data Rights clause included in the SBIR award must be affixed to any submissions of technical data developed under that SBIR award. Upon expiration of the restrictive license, the Government has unlimited rights in the SBIR data. During the license period, the Government may not release or disclose SBIR data to any person other than its support services contractor except with permission of the contractor. These rights may be extended beyond the initial period in accordance with the SBIR Policy Directive update of May 2, 2019

If the Offeror’s proposal is selected for funding, the Contracting Officer will contact the apparent awardee so that the apparent awardee has the opportunity to submit assertions in accordance with FAR clause 52.227-20. The assertions must be identified, and assertion of use, release, or disclosure must be provided for the government’s review and acceptance. Contracts cannot be awarded until assertions have been approved.

Copyrights. With prior written permission of the Contracting Officer, the awardee normally may assert its copyright and publish (consistent with appropriate national security considerations, if any) material developed with DHS SBIR support. DHS receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.

Patents. Small business concerns normally may retain the principal worldwide patent rights to any invention developed with Government support. In such circumstances, the Government receives a royalty-free license for Federal Government use, reserves the right to require the patent holder to license others in certain circumstances, and may require that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. To the extent authorized by 35 U.S.C. 205, the Government will not make public any information disclosing a Government-supported invention for a twenty-year period (that may be extended by subsequent SBIR funding agreements) to allow the awardee a reasonable time to pursue a patent.

Invention Reporting. SBIR awardees must report inventions to the awarding agency within 2 months of the inventor's report to the awardee. Awardees must report inventions to DHS through the NIH iEdison Invention Reporting Systems at www.iedison.gov. Use of the iEdison System satisfies all invention reporting requirements mandated by 37 CFR Part 401, with particular emphasis on the Standard Patent Rights Clauses, 37 CFR 401.14.

5.5 Cost-Sharing

Cost-sharing is permitted for proposals under this program solicitation; however, cost-sharing is not required and will not be considered in evaluation of proposals.

5.6 Profit or Fee

In accordance with FAR 15.404-4, Offerors may include a reasonable fee or profit consistent with R/R&D work.

5.7 Joint Ventures or Limited Partnerships

Joint ventures and limited partnerships are eligible provided that the entity created qualifies as a small business concern in accordance with the Small Business Act, 15 U.S.C. 631.

5.8 Research and Analytical Work

For Phase I, a minimum of two-thirds of the research and/or analytical work must be performed by the proposing small business concern. For Phase II, a minimum of one-half the research and/or analytical work must be performed by the proposing small business concern. Subcontract cost will be calculated as a percentage of the total contract value.

5.9 Awardee Commitments and Summary Statements

Upon award of an SBIR contract, the awardee will be required to make certain legal commitments through acceptance of numerous clauses in the Phase I and Phase II contracts. The outline that follows is illustrative of the types of clauses to which the contractor would be committed. This list is not a complete list of clauses to be included in Phase I funding agreements and is not the specific wording of such clauses. Copies of complete terms and conditions are available upon request.

- a. *Standards of Work.* Work performed under the funding agreement must conform to high professional standards.
- b. *Inspection.* Work performed under the funding agreement is subject to Government inspection and evaluation at all times.
- c. *Examination of Records.* The Comptroller General (or a duly authorized representative) must have the right to examine any pertinent records of the awardee involving transactions related to this funding agreement.
- d. *Default.* The Government may terminate the funding agreement if the contractor fails to perform the work contracted.
- e. *Termination for Convenience.* The funding agreement may be terminated at any time by the Government if it deems termination to be in its best interest, in which case the awardee will be compensated for work performed and for reasonable termination costs.
- f. *Disputes.* Any dispute concerning the funding agreement that cannot be resolved by agreement must be decided by the contracting officer with right of appeal.
- g. *Contract Work Hours.* The awardee may not require an employee to work more than 8 hours a day or 40 hours a week unless the employee is compensated accordingly (for example, overtime pay).
- h. *Equal Opportunity.* The awardee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.
- i. *Affirmative Action for Veterans.* The awardee will not discriminate against any employee or application for employment because he or she is a disabled veteran or veteran of the Vietnam era.
- j. *Affirmative Action for Handicapped.* The awardee will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.
- k. *Officials Not To Benefit.* No Government official must benefit personally from the SBIR funding agreement.
- l. *Covenant Against Contingent Fees.* No person or agency has been employed to solicit or secure the funding agreement upon an understanding for compensation except bona fide employees or commercial agencies maintained by the awardee for the purpose of securing business.
- m. *Gratuities.* The funding agreement may be terminated by the Government if any gratuities have been offered to any representative of the Government to secure the award.
- n. *Patent Infringement.* The awardee must report each notice or claim of patent infringement based on the performance of the funding agreement.
- o. *American Made Equipment and Products.* When purchasing equipment or a product under the SBIR funding agreement, purchase only American-made items whenever possible.
- p. *Advertisements, Publicizing Awards, and News Releases.* All press releases or announcements about agency programs, projects, and contract awards must be cleared by the Contracting Officer's Representative (COR) and the Contracting Officer. Under no circumstances shall the Contractor, or anyone acting on behalf of the Contractor, refer to the supplies, services, or equipment furnished pursuant to the provisions of this contract in any publicity news release or commercial advertising without first obtaining explicit written consent to do so from the Program Manager/COR and the Contracting Officer. The Contractor agrees not to refer to awards in commercial advertising in such a manner as to state or imply that the product or service provided is endorsed or preferred by the Federal Government or is considered by the Government to be superior to other products or

services.

- q. E-Verify. Contracts exceeding the simplified acquisition threshold may include the FAR clause 52.222-54 “*Employment Eligibility Verification*” unless exempted by the conditions listed at FAR 22.1803.
- r. Prohibition on Contracting with Inverted Domestic Corporation. Section 835 of the Homeland Security Act, 6 U.S.C. 395, prohibits the Department of Homeland Security from entering into any contract with a foreign incorporated entity which is treated as an inverted domestic corporation as defined in HSAR 3052.209-70. The Prohibition on Contracting with Inverted Domestic Corporation clause will be incorporated into awards resulting from this solicitation.

5.10 Release of Proposal Information

In submitting a proposal, the Offeror agrees to permit the Government to publicly disclose basic company information (e.g.- company size, company name, award amount, award date etc.) upon award. Other proposal data is considered to be the property of the Offeror, and DHS will protect it from public disclosure to the extent permitted by law including the Freedom of Information Act. Please note, in accordance with the Small Business Administration’s SBIR Policy Directive, the DHS SBIR Office will provide the basic proposal information to the Small Business Administration’s Application Information database at www.SBIR.gov, as identified in the Policy Directive.

In an effort to increase the transition of SBIR technologies and facilitate partnerships between small business concerns, large integrators, and program offices, the DHS SBIR Program Office may provide proposal information to the Department of the Navy’s SBIR Program Office for inclusion in its Navy SBIR/STTR search database at www.navysbirsearch.com. Awardees who do not want their proposal to be included in this database must opt out by answering “No” on the Cover Sheet.

5.11 Discretionary Technical and Business Assistance (TABA)

Per the Policy Directive, SBC may request the authority to select their own TABA provider. If requested and approved, DHS SBIR will provide up to \$6,500.00 during Phase I and \$50,000 during Phase II, for Technical and Business Assistance to an SBIR awardee. The Phase I funding thresholds ARE NOT inclusive of TABA allowance. Phase II thresholds ARE inclusive of TABA allowance, see Section 3.4. Regardless of whether the Offeror proposes TABA, the period of performance thresholds for the proposal remain the same. In order for awardee request to be approved, the request must comply with Section 9(b) of the Policy Directive. If approved, the awardee shall be required to comply with the reporting requirements from Section 9 (b) and will not be eligible to participate in the DHS provided TABA (referred to as the Commercialization Assistance Program, see **Section 5.12**).

These subcontract costs must be clearly identified as TABA accounted for in the Cost Proposal; however, profit or fee, or indirect rates, shall not be applied to TABA. Offerors must provide a budget justification, an outline of the specific services technical assistance to be provided, and the detailed qualifications and experience of the proposed subcontractor/consultant being requested.

5.12 Commercialization Assistance Program

Awardees can receive Commercialization Assistance through the DHS SBIR Program Office. The SBIR Program Office is under contract with a company that can provide commercialization

assistance to Phase II awardees. Awardees will receive notification from the DHS SBIR Office on what services are available and how to obtain these services at no cost to the small business concern.

5.13 Classified Proposals

Classified proposals are NOT accepted under the DHS SBIR Program. Classified proposals will be appropriately destroyed upon receipt.

5.14 Animal and/or Human Subjects

Funds cannot be released or used for any portion of the project involving animal and/or human subjects until all the proper approvals have been obtained in accordance with applicable regulations. See **Appendix B** for more details concerning the use of Animal and/or Human Subjects.

5.15 Export Control

Offerors are advised that the export of any goods or technical data from the United States, and the disclosure of technical data to foreign nationals, may require some form of export license from the U.S. Government. Failure to obtain necessary export licenses may result in criminal liability of Offerors under U.S. laws.

Offerors are responsible for ensuring compliance with the International Traffic in Arms Regulations administered by the U.S. Department of State (22 C.F.R. Parts 120 to 130), Export Administration Regulations administered by the U.S. Department of Commerce (15 C.F.R. Parts 730 to 774), and Foreign Assets Control Regulations administered by the U.S. Department of Treasury (31 C.F.R. Parts 501 to 598), as warranted, and with compliance with all recordkeeping requirements under U.S. export regulations. Offerors are responsible for compliance with any applicable export license, reporting, or other preapproval requirements by the U.S. Government. DHS neither represents that a license or preapproval shall not be required nor that, if required, it shall be issued. Nothing granted herein to Offerors provides any such export license or other preapproval.

Offerors are asked to identify any anticipated export compliance issues in their response to this solicitation. Specifically, Offerors are advised to include information in their response regarding any known equipment, software or technical data that will be developed as a result of work to be performed under this solicitation that is subject to export control restrictions.

To the extent that export-controlled information may be provided to DHS by Offerors in response to a solicitation, Offerors are responsible for ensuring that such information is appropriately marked and are responsible for complying with all applicable export controls and regulations in the process of providing such information.

5.16 DHS SBIR Phase II Enhancement Programs

To further encourage the transition of SBIR-funded research into DHS acquisition programs as well as to the private sector, the DHS SBIR Program offer offers Cost Match

Cost Match. The DHS S&T and CWMD SBIR Programs include a Cost Match feature for their respective SBIR projects that attract matching funds from an outside investor for the Phase II SBIR effort. The purpose of the cost match is to focus DHS SBIR funding on those projects that are most likely to be developed into viable new products that DHS and others will purchase and that will make a major contribution to homeland security and/or economic capabilities. The cost

match can only occur during the Phase II period of performance.

Outside investors may include such entities as another company, a venture capital firm, an individual investor, or a non-SBIR government program; they do not include the owners of the small business concern, their family members, and/or affiliates of the small business concern. In order to be considered for DHS SBIR cost match, the outside investors must commit a minimum of \$100,000. DHS will, at its discretion and subject to availability of funds, match up to 50% of funds received, for a maximum DHS SBIR contribution of \$250,000.

The additional work proposed for the Cost Match feature should be an expansion of the technical work being performed in the Phase II project and must fall within the general scope of the present Phase II project.

For more information about Cost Match visit <https://sbir2.st.dhs.gov>.

5.17 Additional Information

This Solicitation is intended for informational purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting SBIR funding agreement, the terms of the funding agreement are controlling.

Before award of an SBIR funding agreement, the Government may request the applicant to submit certain organizational, management, personnel, and financial information to assure responsibility of the applicant.

DHS shall not be liable for any costs incurred by the Offerors prior to award of any SBIR contract.

This Solicitation is not an offer by the Government and does not obligate the Government to make any specific number of awards. Also, awards under the SBIR Program are contingent upon the availability of funds.

If an award is made pursuant to a proposal submitted under this Solicitation, a representative of the contractor or grantee or party to a cooperative agreement will be required to certify that the concern has not previously been, nor is currently being, paid for essentially equivalent work by any Federal agency.

In the event that DHS has a need to share sensitive information with the SBIR awardee, the contractor must clear DHS suitability.

6.0 SUBMISSION OF PROPOSALS

Proposals are due no later than 12:00 noon ET on January 22, 2020. The DHS SBIR Programs use an electronic online proposal submission system located at <https://sbir2.st.dhs.gov>. All Offerors must submit proposals through this online system. Paper submissions and proposals received by any other means will not be accepted, evaluated, or considered for award.

Offerors are strongly encouraged to read the *Portal Registration and Submissions Training Guide* and follow the instructions for proposal submission. This guide can be found at

<https://sbir2.st.dhs.gov> under “Resources.” The Guide provides step-by-step instructions for company registration and proposal submission.

Questions about the electronic submission of proposals should be submitted to the Help Desk. The Help Desk may be contacted at (703) 480-7676, or dhssbir@reisystems.com from 9:00 a.m. to 5:00 p.m. ET, Monday through Friday.

Late proposals will not be accepted or evaluated.

Note: As the close of the Solicitation approaches, heavy traffic on the web servers may cause delays. Plan ahead and leave ample time to prepare and submit your proposal. Offerors bear the risk of website inaccessibility due to heavy usage in the final hours before the Solicitation closing time. In accordance with the FAR clause 52.215-1, Offerors are responsible for submitting proposals, and any modifications or revisions, so as to reach the Government office designated in the Solicitation by the time specified in the Solicitation. FAR clause 52.215-1, Instructions to Offerors – Competitive Acquisition (Jan 2004) is hereby incorporated in this Solicitation by reference.

7.0 Research Topics

7.1 S&T Directorate Topic

The following are the topics for the FY20 S&T Directorate’s SBIR Program:

DHS201-001 - Next Generation 9-1-1 (NG 9-1-1) Multimedia Content Analysis Engine Capability for the Emergency Communications Cyber Security center (EC3)

DHS201-002 - Remote Sensor Data Protection and Anti-Spoofing

DHS201-003 - Digital Paging over Public Television

DHS201-004 - Soft Targets and Crowded Places Security

DHS201-005 - In-building Coverage Analysis System (ICAS) Using Existing First Responder’s Radio and Smartphone

DHS201-006 - Handheld Advanced Detection/Imaging Technology System

DHS201-007 - Enhanced Explosives and Illicit Drugs Detection by Targeted Interrogation of Surfaces

DHS201-008 - Urban Canyon Detection Tracking and Identification of Small Unmanned Aerial Vehicles

DHS201-009 - Machine Learning Module for Detection Technologies

Specific details for each topic are included in **Appendix A**.

APPENDIX A – RESEARCH TOPIC DESCRIPTIONS

SBIR Topic Number: DHS201-001

TITLE: Next Generation 9-1-1 (NG9-1-1) Multimedia content analysis engine capability for the Emergency Communications Cyber Security Center (EC3)

TECHNOLOGY AREAS: *Cybersecurity, Artificial Intelligence (AI), Analytics, Next Generation 9-1-1 (NG9-1-1), Voiceover Internet Phone (VoIP), Session Initiation Protocol*

OBJECTIVE: To establish approaches, develop, demonstrate, or pilot technology for implementing the security, and content analysis of multimedia messages from the public to the NG9-1-1 Public Safety Answering Point (PSAP) EC3 within NG9-1-1 Emergency Service Internet Protocol Networks (ESINets).

DESCRIPTION: As public safety answering points (PSAPs) adopt Next Generation 9-1-1 technology and are interconnected via regional Internet Protocol networks, it is important to establish standards and best practices to minimize the risk of cyber-attacks and to ensure appropriate and robust NG9-1-1 system security, as well as maintaining complete interoperable features and promoting better situational awareness and operational/incident coordination. Currently PSAPS have minimal capabilities for analyzing multi-media 9-1-1 data, and the timing of this project would coincide with the initial first PSAPS having the capability to receive multimedia content which must be properly analyzed prior to the PSAP opening and possibly jeopardizing the integrity of the 911 center.

The Federal Communications Commission (FCC) Task Force on the Optimal PSAP Architecture recommends a National Network Security Operations Center be established to coordinate cybersecurity across the NG9-1-1 landscape in the US. This national level entity could assist with defining NG9-1-1-specific policy related to cybersecurity for public safety networks and would benefit greatly from the enhanced situational awareness and security the technology developed under this SBIR project could provide. Additional lower level SOC's could deploy this technology for use in their PSAP, regional, state or nationwide NG911 networks. One of the new and evolving threats NG9-1-1 will bring is the possibility of malicious content in multimedia messages originating from the public. There is the need for technologies that can assist in the content and security analysis of these messages originating from the public in a time critical manner.

The EC3 concept includes small to medium units supporting multiple small or medium size PSAPS, as well as larger units capable of supporting multiple medium to large PSAPS with significant traffic and that support current cyber technologies to protect and defend ESINet and PSAP networks.

Interconnected Voice and Data networks could be a source of cyber threats to NG9-1-1 but, also a source of intelligence needed to gauge the size and potential impacts of an incident. NG9-1-1 gives citizens the ability to provide multimedia incident data such as voice, text, and imagery, although not all services will be available to all PSAPs. Some areas of possible investigation and development include the following:

- a. Capabilities to analyze NG9-1-1 call data in near real time to insure valid information is presented to PSAP operators.
- b. Capabilities to ensure content does not contain any malicious code that could damage or disable first responder networks.
- c. Capabilities to ensure the content is valid and relevant to the incident that is presented to operators and responders.
- d. Capabilities to consolidate and normalize data from the same or related incidents.
- e. Capabilities to ensure content is not duplicative and does not contribute to information overload for PSAP operators and responders.

This project should explore developing a processing engine and algorithms for conducting near real time analysis of NG911-related content to analyze, classify, and filter via data mining to avoid overwhelming PSAP transport, hardware, software, CAD, and personnel resources. This should support the ability to geo-fence the incident more quickly and classify media as related to the primary or secondary event, avoiding duplication of effort. The project shall analyze geocode data from NG911 content to increase confidence in validity and location of an event to minimize malicious distributed attacks, Swatting, etc.

This project should also research leveraging AI/machine learning to more quickly contextualize public safety events and respond faster with the proper First Responder personnel. Other areas to consider include creating PSAP event/use case baseline for machine/AI-based learning via contextualizing/organizing existing electronic logged incident to determine classification parameters for each event. Determine the visual/audio/sensor-based information/parameters most common across similar events to allow AI to data-mine incoming ESINet NG911 media. For example, to determine active shooter event, what are the typical flags/identifiers (e.g. acoustic gunshot signatures)?

Research and identify methods of classifying and displaying near real time accuracies of location and time delay to continuously update areas of probability of 911/emergency caller location(s) from various geo-location sources and methods into E911 and NG9-1-1 proposed services.

This project shall research and identify processes to identify, detect, and mitigate the effects of integrity manipulation of perspective NG9-1-1 enterprise public safety video delivery services including: video altering, video time stamping, video authentication, video malware delivery attack and defense, video storage and retrieval services, and shared video distribution analysis services.

PHASE I:

Complete an overall examination of NG-9-1-1 architecture focusing on the threats and mitigations related to multimedia content originating from the public and propose how to better process, understand, and use this data in incident management. Propose how to develop and implement technologies to address these vulnerabilities, how to develop advanced data analysis capabilities as specified above, and how this can be done in a relevant operational environment suitable for piloting in partnership with DHS and other stakeholders the performer identifies and investigates.

Recommend a piloting environment, including participants and technologies to develop and deploy during Phase II. Develop a practical plan for technology development and implementation into a prototype and pilot.

PHASE II:

Develop and implement a prototype of the technologies defined in Phase I, in a relevant operational environment suitable for piloting in partnership with DHS Emergency Communications Division (ECD), DHS S&T, and other state or local government stakeholders. Lab testing should be conducted for the USG to verify the capabilities operate correctly, and then a pilot shall be conducted involving stakeholders, demonstrating and validating the concepts, technologies, and information sharing capabilities defined during Phase I.

Project plan and Systems Engineering deliverables such as design information, test plans, and test results should be included in the project. Provide recommendations on implementing the developed technologies in a large-scale deployment involving large, medium, and small ESINets and PSAPS.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

The technologies and methodologies developed in this SBIR will have possible wide-ranging application in the evolving NG9-1-1 landscape. NG9-1-1 will be replacing legacy E911 and 911 technology in the coming years. Funding opportunities will come from Federal NG9-1-1 grant programs to State and Local NG9-1-1 implementers. There will also be Federal NG9-1-1 implementations and organic State and Local funding.

REFERENCES:

FCC Task Force on Optimal Public Safety Answering Point Architecture (TFOPA) Working Group 1 Supplemental Report, 2016:

https://transition.fcc.gov/pshs/911/TFOPA/TFOPA_WG1_Supplemental_Report-120216.pdf

DHS Cyber Risks to Next Generation 9-1-1, November 2018:

<https://www.dhs.gov/sites/default/files/publications/NG911%20Cybersecurity%20Primer%20041216%20-%20508%20compliant.pdf>

Next Generation 9-1-1 Cost Estimate: A report to Congress, 2018: Appendix A: NG9-1-1 Architecture, pages 69 – 161;

https://www.911.gov/pdf/Next_Generation_911_Cost_Estimate_Report_to_Congress_2018.pdf

KEY WORDS: Next Generation 9-1-1, Cybersecurity, Task Force on the Optimal PSAP Architecture, Artificial Intelligence (AI), Analytics, Voiceover Internet Phone (VoIP), Session Initiation Protocol (SIP)

POINT OF CONTACT:

Danette Williams, Danette.Williams@hq.dhs.gov

SBIR Topic Number: DHS201-002

TITLE: Remote Sensor Data Protection and Anti-Spoofing

TECHNOLOGY AREAS: *Data Protection, Remote Sensing, Bit Data, Machine Learning, Artificial Intelligence*

OBJECTIVE: Develop sensors or a sensor system capable of deployment in tactical, harsh, and rugged environments that are resistant to spoofing or data manipulation. Also required is a distributed sensor protection platform.

DESCRIPTION: Sensors of all types (e.g. range finders, thermal imaging devices, radar, ground sensors, radio frequency sensors, GPS, etc.) are actively being deployed to collect a wealth of data to inform critical law enforcement and intelligence missions. This data, while very valuable, is also at risk of manipulation, which can have adverse effects for these very same missions. There are multiple points of failure: the data being collected by sensors can be spoofed, resulting in false data being pushed upstream by an uncompromised sensor; alternatively, the sensor can be compromised, either physically or remotely, and false data can be generated by the sensor and then pushed upstream. This is especially of concern given that sensors tend to be the least-protected components of systems, as they are networked but often difficult to harden or physically protect.

There is an urgent need for a solution to be able to evaluate sensor data and prevent false data from being pushed upstream to operators, analysts and decision-makers. Furthermore, it is critical that this solution be deployable to tactical/harsh/rugged environments, so that data can be evaluated closer to the point of collection to avoid wasting critical bandwidth on bad or false data. Examples of such environments are at a US border, at a port, or on a shipping container.

The solution must:

1. Provide Multi-Domain Operation (MDO) capabilities required for data sharing and dissemination
2. Facilitate stateful inspection of sensor data, with a preference for remote inspection
3. Capability to process at least two data types, GPS sensor data and at least one other sensor data type. The ability to accommodate additional sensor data is preferred.
4. Evaluate valid sensor data packets and connections and detect anomalies
5. Provide a score for individual sensors, to identify sensors providing good or poor-quality data
6. Be customizable for edge devices
7. Quarantine bad/anomalous sensor data
8. Index and store qualified/standard sensor data

PHASE I: Proof of feasibility will include the delivery of reported spoofed sensor examples, spoofed sensor ingests, scanning and mitigation strategies, as well as scanning and mitigation interface design and description documents. The offerer will research and provide reported examples of at least two types of spoofed sensor data to include GPS, and the recommended mitigation strategies to be implemented in future research phases. As such, the offerer shall research, develop and document a minimum set of spoofing mitigation strategies to be implemented in future research phases. To demonstrate feasibility the offerer will provide these spoof and mitigation description documents as well as an interface design document for spoofed

sensor data ingest filtering. This interface design document will include an example of a spoofed sensor data use case manually navigated through the ingest, filtering and mitigation process.

PHASE II: During this phase, the contractor will develop, test and demonstrate a prototype based on the research and development conducted in Phase I. The prototype demonstration should simulate a tactical/harsh/rugged environment. The prototype must be tested to verify that it is resistant to spoofed data, and resistant to manipulated data. A relevant test environment, as described, may be developed and used for the testing and demonstration, or a pre-existing test environment may be used.

At the conclusion of Phase II, the performer will conduct a technical demonstration of the prototype. In the technical demonstration, the contractor will demonstrate and validate the performance of the prototype. The demonstration and validation will include prototype resistance to spoofed sensor data, where sensors can be both physically and remotely compromised. Resistance to data manipulation will also be demonstrated and validated.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Transitions is to Customs and Border Protection (CBP) for sensor monitoring along the US border, at ports, on shipping containers, or other rugged environments. There are potential DoD warfighter applications as well, depending on the particular sensor involved. For GPS sensors, if satellite navigation is not available, ground sensors may be used to identify relevant locations. The locations identified need to be accurately calculated from the sensor data, with confidence that the data has not been manipulated.

One potential commercial path is to guarantee that medical device sensor information has not been modified. This applies to implanted pacemakers or infusion pumps in particular.

REFERENCES:

1. “A Machine Learning Approach for Detecting Spoofing Attacks in Wireless Sensor Networks”; Eliel Marlon de Lima Pinto; Rosana Lachowski ; Marcelo Eduardo Pellenz ; Manoel Camillo Penna ; Richard Demo Souza; IEEE; 2018.
<https://ieeexplore.ieee.org/document/8432315>
2. “GPS spoofing detection and mitigation using Cooperative Adaptive Cruise Control system”; [Nathaniel Carson](#) ; [Scott M. Martin](#) ; [Joshua Starling](#) ; David M. Bevely; IEEE; 2016
<https://ieeexplore.ieee.org/document/7535525>
3. “Effective GPS Spoofing Detection Utilizing Metrics from Commercial Receivers”; Esteban Garbin Manfredini, Politecnico di Torino; Dennis M. Akos, University of Colorado at Boulder; Yu-Hsuan Chen, Sherman Lo, Todd Walter, Per Enge, Stanford Univeristy; 2018.
https://web.stanford.edu/group/scpnt/gpslab/pubs/papers/GarbinManfredini_IONITM_2018_SpoofDetection.pdf
4. “GPS Vulnerabilities for Critical Infrastructure”, Department of Homeland Security, Science and Technology Directorate, 2016.
<https://www.dhs.gov/sites/default/files/publications/GPS%20Vulnerabilities%20for%20Critical%20Infrastructure%20Fact%20Sheet.pdf>
5. “This Ain't Your Dose: Sensor Spoofing Attack on Medical Infusion Pump”; Youngseok Park, Yunmok Son, Hocheol Shin, Dohyun Kim, and Yongdae Kim, Korea Advanced Institute of Science and Technology (KAIST); 2016.

<https://www.usenix.org/conference/woot16/workshop-program/presentation/park>

KEY WORDS: Distributed sensor system; sensor system integrity; manipulation of sensor data; GPS data manipulation; sensor spoofing; data spoofing

POINT OF CONTACT: Danette Williams, Danette.Williams@hq.dhs.gov

SBIR Topic Number DHS201-003

TITLE: Digital Paging over Public Television

TECHNOLOGY AREAS: Interoperable Communications and Data Program; Community and Infrastructure Resiliency Program

OBJECTIVE: Define and demonstrate a secure, standards-based, public safety one-way digital paging system for daily and disaster uses.

DESCRIPTION:

Fire and EMS services across the United States still rely on analog voice pagers to communicate emergency incident information. The infrastructure for these paging systems is typically operated by the local agency providing coverage to that geographic jurisdiction. The limited coverage does not provide notification to individuals that have traveled outside of the area, for work or vacation. It also creates a silo and information is not shared outside the coverage area. This voice pager is also based on technology that is slow at delivering emergency information as it takes time for a dispatcher to read the information. This type of pager uses a “selective call” feature to keep the pager silent until the pager’s programmed code or tone is detected. Each unique tone can be 2-3 seconds long and when multiple tones need to be sent, all the tones must be transmitted sequentially before any of the dispatch information can be delivered. Then, the actual voice dispatch can take 20-40 seconds depending on how much verbal information is provided. During all of this, other emergencies are queued waiting for the paging transmitter to become available.

Today’s digital television uses the Advanced Television Systems Committee (ATSC) standard, also known as ATSC 1.0. ATSC 1.0 is used to broadcast many other types of useful information besides video, such as TV program guides, emergency alerts, etc. An enhancement to the current ATSC 1.0 digital broadcast system, known as ATSC 3.0, is now being deployed. ATSC 3.0 utilizes a different delivery scheme that is far more robust and useful for mobile applications. It also has the added benefit of better building penetration and is four times more efficient than the current system. The increased bandwidth will be available for non-video applications.

ATSC 3.0 may present the perfect opportunity to research a solution for the current challenges found with existing analog voice paging (speed, coverage, silo, and capacity). An ATSC 3.0 solution could provide such robust coverage to reach an entire state’s geography, including tribal lands and rural areas utilizing existing infrastructure.

Such a solution has not been tried in the past as ATSC 1.0 is not designed for reception from a moving receiver, as needed by a volunteer firefighter driving down the road would be wearing.

The requirements for this solution include:

- Establish a direct connection with the Public Safety Answering Point (PSAP, aka 911 Center) that does not rely on the public internet for relay of dispatch information
- Creation of a centralized server to process emergency dispatch information from various PSAPs to be injected into the ATSC 3.0 broadcast stream
- Develop an ATSC 3.0 receiver that would decode the emergency dispatch information
- Allow the receiver to determine the alert trigger (programming should be maintained at the receiver level to mimic today’s analog pagers)
- Based on standards to allow multiple receiver manufacturers

- Receiver could utilize a smartphone to achieve the following features or such features would need to exist on a portable stand-alone device:
 - Receiver should have a battery life of at least 18 hours
 - Receiver should have a low battery alarm
 - Receiver should support a text to speech function
 - Receiver should have a display
 - Additional requirements found in National Fire Protection Association (NFPA) Handbook 1221

PHASE I:

In order to determine feasibility the potential awardee should, at a minimum, address the following:

- A defined data standard used to export emergency dispatch information coming from the PSAPs Computer Aided Dispatch (CAD) software.
- A design and development plan for a paging server that would collect and conform the dispatch information into a common protocol that would then be delivered to the ATSC 3.0 enabled transmission system. Such information will include event type (fire, car crash, stroke, etc.), event location, units dispatched, etc.), and the date and time of dispatch, among other fields.

PHASE II:

By the end of Phase II, the performer shall provide:

- A demonstration of a prototype of an ATSC 3.0 paging receiver that displays the CAD information sent from the paging server to the ATSC 3.0 transmitter.
- Results from research of the ATSC 3.0 delivery chain to explore various configurations that optimizes delivery to the paging receiver without compromising the Public Broadcasters FCC requirement for television program delivery.
- Results from performance modeling and testing of ATSC 3.0 receptibility in a controlled environment for anticipated paging receiver design (for example, body worn small device on a belt).
- Prototype two different paging receiver designs, one based on a stand-alone model and the other based on a smartphone integration with the ATSC 3.0 information passed along to a smartphone application. Provide a practical demonstration of the capability with at least 10 receivers located with different first responder organizations from different jurisdictions within a state. The organizations should represent different types of jurisdictions from urban to rural, career to volunteer, mountainous to coastal.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Phase III will involve the productization of the server and receiver designs, resulting in the validation of the paging server by connecting to several PSAPs in operation and finalize any field mapping or other challenges presented by multiple CAD vendors, and developing a scalable process for the centralized paging server to receive data from new CAD vendors or versions that have not been encountered prior.

The technology could be developed into a business model that would allow the local public television station to partner on a bid for replacement of a local first responder agencies' current paging system. This technology will need to be evaluated by the NFPA and/or ISO Mitigation (VeriRisk) to gain acceptance as a dispatch technology used by the fire service. This concept can easily be expanded to other areas and use cases for one-way directed paging such as law enforcement agencies, search and rescue teams, government leadership, federal responders, etc. Partnering with PBS could lead to a nationwide public safety paging system that could be utilized by FEMA, the National Guard, and other federal assets. ATSC 3.0 can also represent a delivery method for public notification of weather events or disaster, possibly even replacing the National Oceanic and Atmospheric Administration's (NOAA) Weather Radio All Hazards (NWR) network of 1000+ radio stations.

REFERENCES:

1. NFPA 1221 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems. (2019)<https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1221>
2. ATSC 3.0 Standards <https://www.atsc.org/standards/atsc-3-0-standards/>

KEY WORDS: Communications, Paging, Datacasting, ATSC 3.0, Dispatch, Alerting, Emergency Communications, Fire Station Alerting

POINT OF CONTACT: Danette Williams Danette.Williams@hq.dhs.gov

SBIR Topic Number DHS201-004

TITLE: Soft Targets and Crowded Places Security

TECHNOLOGY AREAS: Soft Target Security, Emerging and Evolving Threats, Active Assailant Attacks, Improvised Explosive Device, Firearms, Unmanned Aircraft Systems, Vehicles Ramming, Security Screening, Mass Gatherings, Special Events, Mobile Technology, Artificial Intelligence, Augmented Reality

OBJECTIVE: Develop a capability to identify and mitigate threats toward reducing the overall risk to soft targets and crowded places.

DESCRIPTION:

Soft targets and crowded places continue to be attractive targets for violent extremists determined to inflict harm and disrupt the American way of life. As such, protecting these inherently vulnerable locations has become a National imperative and priority for DHS. “As the DHS lead for the soft targets and crowded places security effort, Cybersecurity and Infrastructure Agency (CISA) supports partners to identify, develop, and implement innovative and scalable measures to mitigate risks to these venues; many of which serve an integral role in the country’s economy” (*Page 8, CISA Strategic Intent, 2019*). To support these efforts, CISA Infrastructure Security Division (ISD) has made mitigating threats to soft targets and crowded places its top priority (*CISA Security of Soft Targets and Crowded Places- Resource Guide, February 2019*).

CISA ISD is actively engaged with public and private sector partners to enhance their security and preparedness through awareness and training. However, protecting soft targets and crowded places against future active assailant attacks requires a more comprehensive approach that includes advanced technology. Development of a capability to identify and mitigate risks to soft targets, with the ultimate goal of incorporating an augmented reality platform applications is needed. Such a technology would enable security professionals to view their environment through a mobile device while applying augmented reality and artificial intelligence to consider the advantages and disadvantages of various mitigation methods against known threats.

PHASE I:

Phase I will include a concept with an incremental approach to ensure proper applicability, including:

- Planning to identify and acquire sourcing material information
- Identifying initial risk indicators
- Scaling and surveying landscapes and environments
- Developing an initial methodology and assessing the potential effectiveness of the approach.

PHASE II:

Phase II will focus on executing the Phase I project plan. This will include:

- Continuing methodology development toward identifying key aspects of soft target risk assessment and mitigation techniques
- Surveying and designing environmental layering
- Injecting threat vectors into artificial intelligence
- Assessing the approach in a set of relevant scenarios
- Organizing design elements and data toward future implementation of an augmented reality capability

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Development of technology building off of the findings from Phase II. This technology will be developed for use by both private sector, and government applications, but in an iterative order, pending success and lessons learned of the GOTS application, then deployment to COTS.

The government applications will be leveraged by federal and contract staff to use in both headquarters and field assessments, planning, and special events security coordination. For example, prior to a special event, a Protective Security Advisory or other field staff could deploy this technology to conduct a security assessment of a facility, enabling the assessment team to visualize placements of certain security features or physical measures.

The private sector or commercial use of this technology is intended to be leverage directly by security managers, event planners, owners/operators of critical infrastructure, and other private entities that have equities in security of soft targets. This commercial application will be off-the-shelf and available for entities to use not necessarily requiring government oversight or assistance.

REFERENCES:

1. DHS Soft Targets and Crowded Places Security Plan Overview (<https://www.dhs.gov/publication/securing-soft-targets-and-crowded-places-resources>)
2. CISA Strategic Intent- Defend Today, Secure Tomorrow- 2019 (<https://www.dhs.gov/publication/cisa-strategic-intent>)
3. CISA Security of Soft Targets and Crowded Places- Resource Guide - AD Harrell welcome letter (https://www.dhs.gov/sites/default/files/publications/19_0424_cisa_soft-targets-and-crowded-places-resource-guide.pdf)

KEY WORDS: Soft Targets, Crowded Places, Active Shooter, Vehicle Ramming, Unmanned Aircraft Systems

POINT OF CONTACT: Danette Williams, Danette.Williams@hq.dhs.gov

SBIR Topic Number DHS201-005

TITLE: In-building Coverage Analysis System (ICAS) Using Existing First Responder's Radio and Smartphone.

TECHNOLOGY AREAS: Interoperable Communications and Data Program, In-building Public Safety Communications, Public Safety Land Mobile Radio and Broadband Communications, FirstNet.

OBJECTIVE: Develop a capability to acquire and document network signals inside of buildings for public safety land-mobile radio (LMR) and the FirstNet broadband network to inform public safety users about wireless service availability in designated buildings and to plan for in-building coverage enhancement solutions.

DESCRIPTION: First Responders must maintain access to communications tools at all times – yet, in many instances, this access is hampered due to partial and/or total attenuation of the communication signals inside of a building, making it difficult for first responders to maintain proper situational awareness during dangerous indoor operations. First Responders must rely on their agency's LMR radios as the primary means for voice communications in indoor settings. At the same time, the availability of FirstNet LTE network is increasingly providing additional indoor data services such as physiological and health monitoring and location tracking to enhance personnel safety. However, the LMR and FirstNet networks are two completely separate networks, and more importantly, neither of these networks currently afford reliable in-building network coverage levels as mandated by the National Fire Protection Association (NFPA) or the International Fire Code (IFC). In short, there is a need to allow first responders to record, access and update the in-building service availability of each of these two different networks for the next ten years or even longer.

Existing systems and methods allow for the characterization of indoor service availability for either LMR or FirstNet individually, but not both at the same time. Commercially-available tools and/or solution do not provide a side-by-side comparison of the service availability of both LMR and FirstNet networks, and each network is expected to play crucial roles in supporting public safety users in the foreseeable future for interoperable voice and data communications.

There exists a need for a system and method to:

- 1) Simultaneously measure and map LMR and FirstNet network's service availability inside of vital and institutional buildings (such as underground subway stations, and airport);
- 2) Interface with existing first responder's radio and LTE devices to ensure the results reflect what the responders will experience while operating indoor; alternatively, if the measurement devices do not utilize existing first responder's prevailing devices, then the proposed user device(s) (e.g., software-defined radio) must produce measured results which align with typical end-user devices (LMR radios and LTE smartphones) 90% of the time in at least 5 buildings designated as "vital" by DHS in a given locality (e.g., airport, subway station, or a large mall or an apartment complex);
- 3) Establish a portable software application to allow public safety or third-party personnel to plan and carry out in-building coverage test and upload the data to a central database;
- 4) Develop a user interface to view the central database to give first responders the ability to perform side-by-side comparison of the in-building coverage, help inform and improve any potential indoor coverage service gaps for both LMR and FirstNet;

- 5) Equip the central database to ingest and archive test results measured at different times/dates for a same building to enable the viewing of historical coverage test results;
- 6) Devise in-building test method and system verification and conform with grid-based coverage test procedures – refer to National Fire Protection Association (NFPA-72-2010) or International Fire Code (IFC 2012) guidelines (reference document is provided).

Any identified indoor coverage gaps will further inform any remedial actions such as distributed antenna systems (DAS), radio repeaters, or similar technologies to further improve indoor coverage to meet appropriate locally-mandated laws and regulation.

Additionally, a robust in-building coverage assessment program serves to address indoor personnel geolocation capability needs as described by the DHS S&T Project Responder 5 Capability Need report, also known as the PR5 report.

PHASE I: The selected offeror will conduct a complete feasibility analysis of the requirements outlined above and develop a framework for the operating components of the ICAS. A report must include the results from a sample test conducted by the offeror for three sample 10-15-story buildings depicting the side-by-side coverage of the LMR vs. FirstNet coverage.

PHASE II: Develop ten ICAS prototypes providing fully integrated hardware and software components to address the in-building coverage acquisition requirements outlined in this request. Tools and functionalities shall encompass:

1. Develop an integrated ICAS measurement tool and process for a single end-user to hand-carry on commercial tablet or hand-held devices for the purpose of measuring and storing in-building network coverage information;
2. Provide interface to obtain network coverage data for up to three commercial LMR radio models and three smartphone models;
3. Define measurement process in accordance with industry-accepted procedures – NFPA-72-2010 and IFC document for public safety communications shall be used as guidelines;
4. User-definable indoor maps to display the coverage data;
5. User-definable coverage thresholds (in dBm) to depict network coverage;
6. User interface to allow user to query a central coverage database for historical test results for a given building; at a minimum, such query must provide a visual coverage results (heat maps) for each floor where test results were collected; at a minimum, such query must provide quantitative comparison between two different test runs on a) per floor basis, and b) on a per building basis;
7. Provide a scalable coverage database to accommodate test results for a minimum of 1,000 buildings (and scalable to 10,000 buildings in the future if required) and store least five distinct test results per building;

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Further development shall be required in Phase III to support both Homeland Security and commercial applications, and shall include:

1. Complete documentation required to operate the ICAS tool;
2. Certify the ICAS measurement application for use on both iOS and Android mobile devices;

3. Provide ICAS tool updates and maintenance for a period of 24 months following the completion of the project;
4. Provide up to five 1-day user training sessions on the operation of the ICAS.

Homeland Security Application: ICAS can be used by DHS Component users to conduct in-building coverage at key installations such as airports, ports-of-entry, border crossings, and Coast Guard maritime assets.

Commercial Application: ICAS can be used by state, local, and tribal public safety agencies, as well as by commercial cellular carrier personnel to conduct in-building test to fully characterize the service availability of LMR and FirstNet network coverage.

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1. “Public Safety Radio Indoor Coverage Systems – Rules and Regulations”, Publicsafetydas.org; <http://fuzewireless.com/wp-content/uploads/2015/02/publicsafetymandates1.pdf>
2. The NFPA-72 National Fire Alarm and Signaling Code, <http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=72>
3. The International Fire Code (IFC) section 510, available at <https://www.diversifiedelectronics.com/ifc-510-testing/>
4. 700 MHz In-Building Coverage App & Measurement System Development, National Institute of Science and Technology (NIST) Public Safety Communications Research (PSCR) program, <https://www.nist.gov/programs-projects/700-mhz-building-coverage-app-measurement-system-development>
5. Project Responder 5 Final Report, https://www.dhs.gov/sites/default/files/publications/Project-Responder-5-Report_170814-508.pdf, DHS S&T FRRG

KEY WORDS: public safety broadband communications, in-building wireless coverage, land-mobile radio, mission-critical communications services, 3GPP networking standards, 4G and 5G services, FirstNet, resilient communications networks.

POINT OF CONTACT: Danette Williams, Danette.Williams@hq.dhs.gov

SBIR Topic Number: DHS201-006

TITLE: Handheld Advanced Detection/Imaging Technology System

TECHNOLOGY AREAS: *Aviation Security, Passenger Screening, Alarm Resolution, Radar*

OBJECTIVE: Develop a handheld passenger screening device capable of detecting prohibited items relevant to aviation security.

DESCRIPTION:

Currently fielded aviation passenger screening systems are large, fixed systems capable of detecting concealed objects on a person. While this approach is useful for standard passenger screening, there are additional requirements for a handheld system to enable concepts of operations that the fixed systems cannot accommodate. These include:

- Pop-up checkpoint environments suitable for employee screening or other random supplemental security measures
- Alarm resolution procedures where additional inspection is required but may prevent a physical pat-down
- Locations that cannot accommodate a fixed system due to size, weight, power, or cost limitations

Key requirements of a proposed solution must include:

- Active illumination with non-ionizing radiation
- Ability to compensate for intentional (deliberate sweeps) or unintentional (shaking) motion of the handheld device
- Ability to run automated detection algorithms to distinguish between a concealed object and clothing/skin while respecting privacy
- Low-power, able to run from a battery for 3-4 hours without recharging
- Low-cost, targeted volume cost of \$5,000 or less

Previous systems have tended to be passive systems that lacked the resolution to detect more complex threats at a reasonable price point. However, recent developments in low cost components for 5G wireless networks and associated handheld electronics may allow for solutions that meet performance, size, weight, power, and cost requirements.

PHASE I:

Develop requirements and a system concept backed by sufficient modeling and simulation to determine technical feasibility of the proposed approach. The final technical report shall include performance specifications, design feasibility, and a draft test and evaluation plan for evaluating system performance against the defined requirements.

PHASE II:

Complete detailed design, fabrication, and testing of initial handheld screening prototypes. If testing results show that the system meets the system requirements defined in the description, Phase II may include an operational evaluation in a laboratory and/or operational test environment. The Phase II deliverables include three prototype units and relevant testing in accordance with the test and evaluation plan defined in Phase I.

PHASE III - COMMERCIAL OR GOVERNMENT APPLICATIONS:

Phase III includes additional design for manufacturing efforts to adapt the prototypes developed in Phase II to full volume production. Depending on the design, Phase III may also include certification and qualification of the system against relevant Transportation Security Administration (TSA) standards. Potential applications of the technology include TSA deployment at the aviation checkpoint or for employee screening but could also be deployed by the private sector for screening at sporting events, concerts, or other secure areas.

REFERENCES:

Aviation Security Advisory Committee, “FINAL REPORT OF THE AVIATION SECURITY ADVISORY COMMITTEE’S WORKING GROUP ON AIRPORT ACCESS CONTROL”, <https://www.tsa.gov/sites/default/files/asac-employee-screening-working-group-04-15.pdf>

National Academies of Sciences, Engineering, and Medicine. 2017. “Airport Passenger Screening Using Millimeter Wave Machines: Compliance with Guidelines (Chapter 2)”. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24936>.

Microwave Journal, August 2007, “The Next Wireless Wave is a Millimeter Wave” <https://pdfs.semanticscholar.org/435a/ba0e91b60fbbd5a12f7ee390491953c2f898.pdf>

MDPI, “Survey of Motion Tracking Methods Based on Inertial Sensors: A Focus on Upper Limb Human Motion” <https://www.mdpi.com/1424-8220/17/6/1257>

KEY WORDS: Passenger Screening, Radar, Explosives Detection, Inertial Measurement Unit, Automatic Threat Recognition, Low-Cost, Sensor

POINT OF CONTACT: Danette Williams Danette.Williams@hq.dhs.gov

SBIR Topic Number: DHS201-007

TITLE: Enhanced Explosives and Illicit Drugs Detection by Targeted Interrogation of Surfaces

TECHNOLOGY AREAS: *Explosives and illicit drugs detection, non-contact sampling, Screening at speed, Alarm Resolution, Trace*

OBJECTIVE: Develop quick and efficient targeted surface interrogation technique(s) by locating and detecting trace residues of interest on carry-on baggage and items.

DESCRIPTION: Screening, detection, and identification of explosives and illicit drugs at aviation checkpoints, border crossings, and U.S. ports of entry play a critical role in supporting mission spaces of the Homeland Security Enterprise, especially that of DHS Transportation Security Administration (TSA) and Customs and Border Protection (CBP). Since 9/11, TSA has employed contact and non-contact sampling of personnel and baggage in conjunction with Ion Mobility Spectrometry (IMS) as a standard explosives trace detection tool to maintain safety in air transportation environments. CBP employed chemical identification equipment such as IMS, Raman and Fourier Transformed Infrared spectroscopy at U.S. ports of entry and U.S. Border Patrol checkpoints to detect and identify illicit drugs. These detectors are employed as part of a multi-layered, risk-based approach to combat the flow of illicit drugs especially that of emergent and dangerous synthetic opioids.

In all aforementioned operational environments, sampling is a critical step in enhancing sensitivity of explosives and illicit drugs detectors. The more sample is delivered to a detector's sampling inlet, the more sensitive the detection.

Targeted interrogation of surfaces would enhance non-contact explosives and illicit drugs detection technologies by directing these modalities toward surfaces that have residues of interest for interrogation. This would increase the amount of sample to be collected and ultimately detection sensitivity.

In order to meet screening at speed requirements and enable targeted interrogation, DHS S&T is looking for a solution that can:

- 1) Locate trace residues and particles within a few seconds on surfaces of various carry-on items such as luggage, laptops, and others.
- 2) Communicate with trace detection modalities on the locations of the trace residues and particles.
- 3) Integrate with trace detectors including, but not limited to, optical techniques, vapor jets that dislodge particles, vacuum-type of samplers, and IMS.
- 4) Potentially integrate with TSA and CBP in-line carry-on baggage screeners.

PHASE I: Conceptualize, design, and develop a proof of concept for an innovative solution to detect, locate, and determine range (range finding) of trace residues and particles of interest. The residues are sub-microgram amounts of materials of interest imprinted on carry-on items such as bags, laptops, and other items. This phase will provide proof that the proposed concept can accomplish the detection, location, and range finding of the residues of interest within two seconds from start to end of the scanning sequence.

PHASE II: Develop, deliver, and demonstrate two prototypes of the proposed design in Phase I that successfully locate trace particle of interest on luggage and laptops. Trace residues are imprinted on five different surface substrates to be communicated by the Government. The prototype demonstration should include the ability to communicate with trace detection modalities on the locations and ranges of the trace residues and particles, and be integration ready with trace detectors. The solution could include both software and hardware into a low-cost prototype of less than \$20,000. Size and weight is negotiable, but the prototypes are expected to be the size of a shoe-box.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Up to three prototypes are expected to be further developed to send to an independent laboratory for technical assessment. The proposer will work with the government to determine realistic testing and assessment scenarios to include an expanded list of surfaces that can be sampled. The government will also work with the performer to identify and execute additional field assessment opportunities with end-users to provide feedback. Results from these assessments are expected to be incorporated into further refinement of the prototypes which shall then be ready for integration into systems ready for Test & Evaluation by a government laboratory. A successful solution will produce a quick and efficient way to find trace particles in Homeland Security environments such as airports, ports of entry, and other screening venues.

REFERENCES:

- <https://www.dhs.gov/science-and-technology/apex-screening-speed>
- https://www.tsa.gov/sites/default/files/resources/technology_factsheet.pdf
- <https://www.dhs.gov/science-and-technology/secondary-screening>
- <https://www.tsa.gov/videos/inside-look-inline-baggage-screening-systems-0>

KEY WORDS: Explosives and illicit drugs detection, standoff detection, alarm resolution, trace, non-contact sampling, targeted interrogation of surfaces, screening at speed, checkpoint, checked baggage

POINT OF CONTACT: Danette Williams Danette.Williams@hq.dhs.gov

TITLE: Urban Canyon Detection Tracking and Identification of Small Unmanned Aerial Vehicles

TECHNOLOGY AREAS: *Air Domain Awareness, ADA, Counter Unmanned Aerial System , UAV, Covered Assets, Critical Infrastructures, Acoustic Sensors, Radio Frequency Sensors, Light Detection and Ranging*

OBJECTIVE: Demonstrate the ability to detect, track, and identify small (55 pounds or less including payload but could be up to 100 pounds for some systems) unmanned aircraft vehicles (UAV) in an urban canyon environment.

DESCRIPTION: The commercial use of unmanned aerial systems (UAS) in urban environments for applications such as package deliveries and surveying are expected to start soon. Nefarious uses of UAS in the urban environment will follow. Current technology for UAV detection, tracking, and identification is problematic. The detection and tracking of UAVs (both singular and swarms) is a critical task complicated by low flight height, small radar cross sections, and a complex background that include birds, insects, and flying debris. The problems for this task increase further with complex structures and high buildings that form urban canyons that block lines of sight.

Urban canyons are characterized by dense and uneven clutter, strong multipath, and limited line-of-sight. In addition, targets can perform evasive maneuvers or undergo a track swap owing to congested environments. Urban canyons can be described by their geometric aspect ratio - the ratio of the sum of the average building height on either side of street divided by street width. A deep urban canyon will have a ratio of >2 .

To fill this capability gap DHS needs a blend of detection and tracking technologies that can both discriminate different kinds of UAVs and identify nefarious UAVs, while subtracting out the other kinds of nuisance urban air traffic. These technologies have to perform in concert within tactical timelines envisioned for nefarious mitigation (tens of seconds).

Current systems enjoy uninterrupted lines of sight, elevated pointing angles, and have intended targets with ample radar cross sections and consistent visual profiles.

Demonstrate a small UAV detection, tracking, and identification sensor system that:

- Discriminates small UAS from common urban chaff such as birds, insects, and other flying debris,
- Performs discrimination and tracking concurrently against multiple air targets of interest,
- Performs within timelines useful for completing a fire control loop needed for mitigating nefarious UAVs,
- Operates in a complex urban radio frequency and acoustic environment,
- Performs at night and in weather consistent with small UAV capabilities,
- Can be safely operated in the presence of human beings down range without biological damage (e.g., retina damage from laser light),
- Meets FCC and FAA requirements for use in urban environments.

PHASE I:

Provide a small UAV urban canyon sensor concept feasibility design described in a Phase I technical report. This description shall contain a concept viability analysis with expected performance. Aspects that should be considered for a small UAV detection, tracking, and identification sensor in the hardware, electrical and software feasibility design include:

- Discriminating small UAS from common urban chaff such as birds, insects, and other flying debris,
- Performing tracking concurrently against multiple air targets of interest,
- Completing a fire control loop timeline needed for mitigating nefarious UAVs
- Operating in a complex urban radio frequency and acoustic environment,
- Addressing night and weather environments consistent with small UAV capabilities,
- Can be safely operated in the presence of human beings down range without biological damage (e.g., retina damage from laser light),
- Complying with FCC and FAA requirements for use in urban environments.

Activities in the Phase I produces artifacts addressing the following areas;

- Sensor concept feasibility descriptions,
- Intended software architecture,
- Notional electrical architecture,
- Envisioned hardware layout.

There shall be an urban canyon sensor concept feasibility design report that incorporates the above.

PHASE II:

Complete the design of the demonstration sensor system, deliver a system for a demonstration, and conduct a demonstration of the system. Development of the Phase II demonstration prototype design produces artifacts that address the following areas;

- Software module descriptions,
- Electronics and power distribution,
- Final packaging layout,
- Other items such as specifications, cut-sheets, drawings, schematics, software artifacts (including source code) and all other documents developed under the effort.

Full operation of system capacities may be demonstrated in an operational environment that is yet to be determined. There shall be a demonstration technical report on design and demonstration of system.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS:

Successful completion of Phase II will allow for evaluation of the sensor system for future enhancements. Locations envisioned for the operational capability could include; airports, critical infrastructure, U.S. borders and events designated with a Special Event Assessment Rating of 1 or 2.

REFERENCES:

1. <https://uasmitigationatairports.org/blue-ribbon-task-force-on-uas-mitigation-at-airports-interim-report/>
2. <https://www.srcinc.com/pdf/Whitepaper-Countering-the-CUAS-shortcomings.pdf>
3. <https://fas.org/irp/doddir/army/atp3-01-81.pdf>

4. <https://dronecenter.bard.edu/files/2018/02/CSD-Counter-Drone-Systems-Report.pdf>
5. <https://jrupprechtlaw.com/drone-jammer-gun-defender-legal-problems/>

KEY WORDS: Counter unmanned aircraft system (CUAS), air domain awareness (ADA), unmanned aircraft system (UAS), unmanned aircraft vehicle (UAV), SUAS,

POINT OF CONTACT: Danette Williams Danette.Williams@hq.dhs.gov

SBIR Topic Number: DHS201-009

TITLE: Machine Learning Module for Detection Technologies

TECHNOLOGY AREAS: *Standoff detection, Screening at Speed, Optical Trace, Secondary Screening*

OBJECTIVE: Develop a standard compact high-performance software and/or hardware module that rapidly classifies unknown spectra as safe or a threat.

DESCRIPTION:

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) is looking towards next generation technologies that provide non-contact, inexpensive, quick, and accurate detection of explosive threats. DHS S&T is researching, developing, and evaluating optical technologies as part of this effort with the potential to be used across multiple Concepts of Operations (CONOPs) in the DHS enterprise. Through DHS S&T, sophisticated spectrometer systems, apparatuses used for recording and measuring spectra, have been built and designed to deliver a signal that can then be fed to an algorithm for “threat” detection. Each system and vendor take their own approach to the algorithm, at significant cost to the vendor and DHS S&T, and with highly variable results. Offering a standard machine learning (ML) platform would expedite the algorithm component of programs, allowing more resources to be dedicated to hardware development.

While machine learning can take many forms, numerous successful, convolutional neural network (CNN) routines, such as Alexnet or Googlenet, follow a similar “image recognition” paradigm. Such routines are ubiquitous and are freely available for download in the internet. They have been developed over many years to identify objects (such as cats, dogs, faces, cars, etc.) and have converged toward very high success rates in open competitions. Applying these algorithms to signals such as the output of spectrometers offers a rapid development path. What is required is a standard executable user interface that can accept training data, convert it to a format compatible with the CNN (such as a JPG image), and then return a classification (detection) value for an “unknown” signal.

In addition, large desktops and laptop computers are used for data processing for most projects. This is despite the promise of building compact advanced feasibility demonstrators (AFD) or prototypes. Ultimately, this processing capability needs to be available to the portable system in near real time. Developments in Graphical Processing Units (GPU) can offer high performance in a compact platform. Because ML algorithms are computationally intensive, the board level processor running the user interface must have high performance. Although CNN networks may require many hours of training on large data sets, once trained, they can perform detection or classification tasks in milliseconds. Because the trained CNNs are typically just a small file, they offer the opportunity for the fielded “testing” processor to require only a fraction of the computational power of the laboratory “training” processor.

Being able to offer a standard compact high-performance software and/or hardware machine learning algorithm platform would dramatically accelerate technology development and ultimately save DHS the cost of redundancy.

PHASE I - SOFTWARE DEVELOPMENT AND HARDWARE DESIGN:

Demonstrate proof of concept of proposed interface for classifying spectrometer signals for standardizing a machine learning algorithm. Determine feasibility of generalizing the parameters required to input spectrometer data into a CNN. This includes standardizing the input properties of the training data set, as well as the output properties of the classifier algorithm.

The end user will deliver a preliminary software interface document describing the format and requirements for all data inputs such as training and unknowns. This document will also describe the user interface and format for the data outputs. If applicable, a preliminary hardware design document shall be included, specifying the components to be used, their expected performance, cost, size, weight, and power consumption.

PHASE II - PROTOTYPE DELIVERY AND TESTING:

Build, deliver, and test two prototypes that include sufficient processing power to run the machine learning algorithm for training and classification. Prototypes will be tested against relevant data sets. Prototype performance metrics include training time, the time to return an output (detection) value, the accuracy, false alarm rate, and receiver operating characteristic (ROC). If applicable, prototype hardware design should be a shoebox size, weigh no more than 50 lbs., and balance power consumption with performance. It is acceptable, even preferred, for hardware to include two separate processor units, a larger stand-alone box for training on large data sets and a much smaller “testing” processor capable of classifying individual unknown spectra.

PHASE III - COMMERCIAL OR GOVERNMENT APPLICATIONS:

Applications for the Machine Learning Module can include both government and commercial programs. DHS S&T could offer replicates of the Module directly to selected technical performers or to commercial vendors. The Module is designed to serve two functions for DHS. The first is to expedite algorithm development for performers developing spectroscopic (ion mobility, Raman, Infrared, mass spectrometry, etc.) technologies. This reduces risk, increases return on investment, and reduces redundancy across performers. The second benefit is to offer a compact fieldable module compatible with prototype spectroscopic systems, thereby enabling them as “detectors” of threats such as explosives, chemical agents, and drugs of abuse based on pre-trained “library” spectra. This expedites the advancements of technology into fieldable systems, increasing the pace and likelihood that they can be delivered to end users. Numerous DHS programs, such as Next Generation Explosive Trace Detector (ETD) and Apex Screening at Speed (SaS), would benefit from access to such a Module. In addition, any vendor developing spectroscopic technology for the Homeland Security market, would benefit from utilizing the Module as part of their process.

REFERENCES:

1. Alexnet Convolutional Neural Network: <https://neurohive.io/en/popular-networks/alexnet-imagenet-classification-with-deep-convolutional-neural-networks/>
2. Googlenet Convolutional Neural Network: <https://ai.google/research/pubs/pub43022>
3. "Active LWIR hyperspectral imaging and algorithms for rapid standoff trace chemical identification," Proc. SPIE 10986, Algorithms, Technologies, and Applications for Multispectral and Hyperspectral Imagery XXV, 109860K (14 May 2019); doi: 10.1117/12.2518720
4. Receiver Operating Curve: <https://www.statisticshowto.datasciencecentral.com/receiver-operating-characteristic-roc-curve/>

KEY WORDS: Machine learning, Algorithm, Prototype, User interface. Neural network, Spectroscopy, Detection

POINT OF CONTACT: Danette Williams Danette.Williams@hq.dhs.gov

APPENDIX B - DEFINITIONS

Commercialization. The processes of developing products, processes, technologies, or services and the production and delivery (whether by the originating party or others) of products, processes, technologies, or services for sale to or use by the Federal Government or commercial markets.

Conflicts of Interest. Contract awards made to small business concerns owned by or employing current or previous Federal Government employees could create conflicts of interest for those employees, which may be a violation of federal law of FAR Part 3.601 and the Ethics in Government Act of 1978, as amended. Small business Concerns that are owned by or employ current or previous Federal Government employees should seek guidance from the cognizant Ethics Counselor from the employee's Government agency.

Essentially Equivalent Work. Work that is substantially the same research, which is proposed for funding in more than one contract proposal or grant application submitted to the same Federal agency or submitted to two or more different Federal agencies for review and funding consideration; or work where a specific research objective and the research design for accomplishing an objective are the same or closely related to another proposal or award, regardless of the funding source.

Foreign National (Foreign Person). A foreign national (foreign person) means any person who is not:

- a) A citizen or national of the United States; or
- b) A lawful permanent resident; or
- c) A protected individual as defined by 8 U.S.C. 1324b(a)(3).

“Lawful permanent resident” is a person having the status of having been lawfully accorded the privilege of residing permanently in the United States as an immigrant in accordance with the immigration laws and such status not having changed.

“Protected individual” is an alien who is lawfully admitted for permanent residence, is granted the status of an alien lawfully admitted for temporary residence under 8 U.S.C. 1160(a) or 8 U.S.C. 1255a(a)1, is admitted as a refugee under 8 U.S.C. 1157, or is granted asylum under 8 U.S.C. 1158; but does not include (i) an alien who fails to apply for naturalization within six months of the date the alien first becomes eligible (by virtue of period of lawful permanent residence) to apply for naturalization or, if later, within six months after November 6, 1986, and (ii) an alien who has applied on a timely basis, but has not been naturalized as a citizen within two (2) years after the date of the application, unless the alien can establish that the alien is actively pursuing naturalization, except that time consumed in the Service's processing the application shall not be counted toward the 2-year period.

False Statements. Knowingly and willfully making any false, fictitious, or fraudulent statements or representations, may be a felony under the False Statement Act (18 U.S.C. § 1001), punishable by a fine of up to \$10,000, up to five years in prison, or both.

APPENDIX B - DEFINITIONS

Fraud, Waste and Abuse.

Fraud – Includes any false representations about a material fact or any intentional deception designed to deprive the United States unlawfully of something of value or to secure from the United States a benefit, privilege, allowance, or consideration to which an individual or business is not entitled.

Waste – Includes extravagant, careless or needless expenditure of Government funds, or the consumption of Government property, that results from deficient practices, systems, controls, or decisions.

Abuse – Includes any intentional or improper use of Government resources, such as misuse of rank, position, or authority or resources.

Funding Agreement. Any contract, or grant, or cooperative agreement entered into between any Federal Agency and any small business concern for the performance of experimental, developmental, or research work, including products or services, funded in whole or in part by the Federal Government.

Joint Venture. See 13 CFR 121.103(h).

Key Individual (Key Personnel). The principal investigator/project manager and any other person named as a “key” employee in a proposal submitted in response to this program solicitation.

Principal Investigator/Project Manager. The one individual designated by the Offeror to provide the scientific and technical direction to a project supported by the funding agreement.

Proprietary Information. Proprietary information is information that is provided which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or data affecting the national security.

Research or Research and Development (R/R&D). Any activity that is:

- a) A systematic, intensive study directed toward greater knowledge or understanding of the subject studies;
- b) A systematic study directed specifically toward applying new knowledge to meet a recognized need; or
- c) A systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Research Involving Animal Subjects. DHS has adopted the principles of the U.S. Department of Agriculture (USDA) implementation of the Animal Welfare Act, the Public Health Service (PHS) implementation of the Health Care extension Act, and the other related federal principles and guidelines as they represent the ethical foundation for the care and use of animals in research. All research involving the care and use of animals in research shall be conducted in accordance with DHS Management Directive Number 026-01.

APPENDIX B - DEFINITIONS

Research Involving Human Subjects. DHS has adopted Department of Health and Human Services (HHS) policies governing human subjects research, as set forth in 45 C.F.R. Part 46 (Subparts A-D). Subpart A of 45 C.F.R. part 46 is HHS' codification of the Federal Policy for the Protection of Human Subjects (also known as The Common Rule) which represents the basic foundation for the protection of human subjects in most research conduct or supported by U.S. Federal departments and agencies. All research involving human subjects shall be conducted in accordance with DHS Management Directive Number 026-04.

SAFETY Act. Congress enacted the Support Anti-terrorism by Fostering Effective Technologies Act of 2002 (the "SAFETY Act") as part of the Homeland Security Act of 2002. The SAFETY Act provides limitations on the potential liability of those concerns that develop and provide qualified anti-terrorism technologies. The DHS Science and Technology Directorate, acting through its Office of SAFETY Act Implementation, encourages the development and deployment of anti-terrorism technologies by making available the SAFETY Act's system of "risk management" and "liability management."

Offerors submitting proposals in response to this solicitation are encouraged to submit SAFETY Act applications on their existing technologies/products and are invited to contact the Office of SAFETY Act Implementation (OSAI) for more information at 1-866-788-9318 or visit OSAI's website at www.safetyact.gov.

SBIR Technical Data. All data generated during the performance of an SBIR award.

SBIR Technical Data Rights. The rights an SBIR awardee obtains in data generated during the performance of any SBIR Phase I, Phase II, or Phase III award that an awardee delivers to the Government during or upon completion of a Federally-funded project, and to which the Government receives a license. See FAR 52.227-20.

Small Business Concern. A concern that meets the requirements set forth in 13 C.F.R. 121.702.

State Assistance. Many states have established programs to provide services to those small business concerns and individuals wishing to participate in the Federal SBIR Program. These services vary from state to state, but may include:

- Information and technical assistance;
- Matching funds to SBIR recipients; and/or
- Assistance in obtaining Phase III funding.

Visit https://www2.ed.gov/programs/sbir/state_awards.html for further information.

Subcontract. Any agreement, other than one involving an employer-employee relationship, entered into by an awardee of a funding agreement calling for supplies or services for the performance of the original funding agreement. This includes consultants.

ATTACHMENT 1: SBIR FUNDING CERTIFICATION – TIME OF AWARD

All small business concerns that are selected for award of an SBIR funding agreement must complete this certification at the time of award and any other time set forth in the funding agreement that is prior to performance of work under this award. This includes checking all of the boxes and having an authorized officer of the awardee sign and date the certification each time it is requested.

Please read carefully the following certification statements. The Federal government relies on the information to determine whether the business is eligible for a Small Business Innovation Research (SBIR) Program award. A similar certification will be used to ensure continued compliance with specific program requirements during the life of the funding agreement. The definitions for the terms used in this certification are set forth in the Small Business Act, SBA regulations (13 C.F.R. Part 121), the SBIR Policy Directive and also any statutory and regulatory provisions referenced in those authorities.

If the funding agreement officer believes that the business may not meet certain eligibility requirements at the time of award, they are required to file a size protest with the U.S. Small Business Administration (SBA), who will determine eligibility. At that time, SBA will request further clarification and supporting documentation in order to assist in the verification of any of the information provided as part of a protest. If the funding agreement officer believes, after award, that the business is not meeting certain funding agreement requirements, the agency may request further clarification and supporting documentation in order to assist in the verification of any of the information provided.

Even if correct information has been included in other materials submitted to the Federal government, any action taken with respect to this certification does not affect the Government's right to pursue criminal, civil or administrative remedies for incorrect or incomplete information given in the certification. Each person signing this certification may be prosecuted if they have provided false information.

The undersigned has reviewed, verified and certifies that (all boxes must be checked):

1. The business concern meets the ownership and control requirements set forth in 13 C.F.R. §121.702.

Yes No

(2) If a corporation, all corporate documents (articles of incorporation and any amendments, articles of conversion, by-laws and amendments, shareholder meeting minutes showing director elections, shareholder meeting minutes showing officer elections, organizational meeting minutes, all issued stock certificates, stock ledger, buy-sell agreements, stock transfer agreements, voting agreements, and documents relating to stock options, including the right to convert non-voting stock or debentures into voting stock) evidence that it meets the ownership and control requirements set forth in 13 C.F.R.

§121.702.

Yes No N/A Explain why N/A: _____

(3) If a partnership, the partnership agreement evidences that it meets the ownership and control requirements set forth in 13 C.F.R. §121.702.

Yes No N/A Explain why N/A: _____

(4) If a limited liability company, the articles of organization and any amendments, and operating agreement and amendments, evidence that it meets the ownership and control requirements set forth in 13 C.F.R.

§121.702.

Yes No N/A Explain why N/A: _____

(5) The birth certificates, naturalization papers, or passports show that any individuals it relies upon to meet the eligibility requirements are U.S. citizens or permanent resident aliens in the United States.

Yes No N/A Explain why N/A: _____

(6) It has no more than 500 employees, including the employees of its affiliates.

Yes No

(7) SBA has not issued a size determination currently in effect finding that this business concern exceeds the 500 employee size standard.

Yes No

(8) During the performance of the award, the principal investigator will spend more than one half of his/her time as an employee of the awardee or has requested and received a written deviation from this requirement from the funding agreement officer.

Yes No Deviation approved in writing by funding agreement officer: __%

(9) All, essentially equivalent work, or a portion of the work proposed under this project (check the applicable line):

Has not been submitted for funding by another Federal agency.

Has been submitted for funding by another Federal agency but has not been funded under any other Federal grant, contract, subcontract or other transaction.

A portion has been funded by another grant, contract, or subcontract as described in detail in the proposal and approved in writing by the funding agreement officer.

(10) During the performance of award, it will perform the applicable percentage of work unless a deviation from this requirement is approved in writing by the funding agreement officer (check the applicable line and fill in if needed):

SBIR Phase I: at least two-thirds (66 2/3%) of the research.

SBIR Phase II: at least half (50%) of the research.

Deviation approved in writing by the funding agreement officer: %

(11) During performance of award, the research/research and development will be performed in the United States unless a deviation is approved in writing by the funding agreement officer.

Yes No Waiver has been granted

(12) During performance of award, the research/research and development will be performed at my facilities with my employees, except as otherwise indicated in the SBIR application and approved in the funding agreement.

Yes No

(13) It has registered itself on SBA's database as majority-owned by venture capital operating companies, hedge funds or private equity firms.

Yes No N/A Explain why N/A: _____

(14) It is a Covered Small Business Concern (a small business concern that:

(a) was not majority-owned by multiple venture capital operating companies (VCOCs), hedge funds, or private equity firms on the date on which it submitted an application in response to an SBIR solicitation; and (b) on the date of the SBIR award, which is made more than 9 months after the closing date of the solicitation, is majority-owned by multiple venture capital operating companies, hedge funds, or private equity firms).

Yes No

It will notify the Federal agency immediately if all or a portion of the work proposed is subsequently funded by another Federal agency.

I understand that the information submitted may be given to Federal, State and local agencies for determining violations of law and other purposes.

I am an officer of the business concern authorized to represent it and sign this certification on its behalf. By signing this certification, I am representing on my own behalf, and on behalf of the business concern that the information provided in this certification, the application, and all other

information submitted in connection with this application, is true and correct as of the date of submission. I acknowledge that any intentional or negligent misrepresentation of the information contained in this certification may result in criminal, civil or administrative sanctions, including but not limited to: (1) fines, restitution and/or imprisonment under 18 U.S.C. §1001; (2) treble damages and civil penalties under the False Claims Act (31 U.S.C. §3729 *et seq.*); (3) double damages and civil penalties under the Program Fraud Civil Remedies Act (31 U.S.C. §3801 *et seq.*); (4) civil recovery of award funds, (5) suspension and/or debarment from all Federal procurement and nonprocurement transactions (FAR Subpart 9.4 or 2 C.F.R. part 180); and (6) other administrative penalties including termination of SBIR/STTR awards.

<i>Signature</i>	<i>Date</i>
<i>Print Name (First, Middle, Last)</i>	
<i>Title</i>	
<i>Business Name</i>	

ATTACHMENT 2: SBIR FUNDING CERTIFICATION – LIFE CYCLE CERTIFICATION

All SBIR Phase I and Phase II awardees must complete this certification at all times set forth in the funding agreement (see §8(h) of the SBIR Policy Directive). This includes checking all of the boxes and having an authorized officer of the awardee sign and date the certification each time it is requested.

Please read carefully the following certification statements. The Federal government relies on the information to ensure compliance with specific program requirements during the life of the funding agreement. The definitions for the terms used in this certification are set forth in the Small Business Act, the SBIR Policy Directive, and also any statutory and regulatory provisions referenced in those authorities.

If the funding agreement officer believes that the business is not meeting certain funding agreement requirements, the agency may request further clarification and supporting documentation in order to assist in the verification of any of the information provided.

Even if correct information has been included in other materials submitted to the Federal government, any action taken with respect to this certification does not affect the Government's right to pursue criminal, civil or administrative remedies for incorrect or incomplete information given in the certification. Each person signing this certification may be prosecuted if they have provided false information.

The undersigned has reviewed, verified and certifies that (all boxes must be checked):

(1) The principal investigator spent more than one half of his/her time as an employee of the awardee or the awardee has requested and received a written deviation from this requirement from the funding agreement officer.

Yes No Deviation approved in writing by funding agreement officer: ____%

(2) All, essentially equivalent work, or a portion of the work performed under this project (check the applicable line):

Has not been submitted for funding by another Federal agency.

Has been submitted for funding by another Federal agency but has not been funded under any other Federal grant, contract, subcontract or other transaction.

A portion has been funded by another grant, contract, or subcontract as described in detail in the proposal and approved in writing by the funding agreement officer.

(3) Upon completion of the award it will have performed the applicable percentage of work, unless a deviation from this requirement is approved in writing by the funding agreement officer (check the applicable line and fill in if needed):

SBIR Phase I: at least two-thirds (66 2/3%) of the research.

SBIR Phase II: at least half (50%) of the research.

Deviation approved in writing by the funding agreement officer: ____%

(4) The work is completed, and it has performed the applicable percentage of work, unless a deviation from this requirement is approved in writing by the funding agreement officer (check the applicable line and fill in if needed):

- SBIR Phase I: at least two-thirds (66.6%) of the research.
- SBIR Phase II: at least half (50%) of the research.
- Deviation approved in writing by the funding agreement officer: _____%
- N/A because work is not completed

(5) The research/research and development is performed in the United States unless a deviation is approved in writing by the funding agreement officer.

- Yes No Waiver has been granted

(6) The research/research and development is performed at my facilities with my employees, except as otherwise indicated in the SBIR application and approved in the funding agreement.

- Yes No
- It will notify the Federal agency immediately if all or a portion of the work proposed is subsequently funded by another Federal agency.
- I understand that the information submitted may be given to Federal, State and local agencies for determining violations of law and other purposes.
- I am an officer of the business concern authorized to represent it and sign this certification on its behalf. By signing this certification, I am representing on my own behalf, and on behalf of the business concern, that the information provided in this certification, the application, and all other information submitted in connection with the award, is true and correct as of the date of submission. I acknowledge that any intentional or negligent misrepresentation of the information contained in this certification may result in criminal, civil or administrative sanctions, including but not limited to: (1) fines, restitution and/or imprisonment under 18 U.S.C. §1001; (2) treble damages and civil penalties under the False Claims Act (31 U.S.C. §3729 *et seq.*); (3) double damages and civil penalties under the Program Fraud Civil Remedies Act (31 U.S.C. §3801 *et seq.*); (4) civil recovery of award funds, (5) suspension and/or debarment from all Federal procurement and nonprocurement transactions (FAR Subpart 9.4 or 2 C.F.R. part 180); and (6) other administrative penalties including termination of SBIR/STTR awards.

<i>Signature</i>	<i>Date</i>
<i>Print Name (First, Middle, Last)</i>	
<i>Title</i>	
<i>Business Name</i>	

ATTACHMENT 3: BRIEFING CHART TEMPLATE

<u>Proposal Title</u> <u>Company</u> <u>City, State</u>	
<p>Place a clear photograph, drawing, graphic or diagram of the concept related to innovation here</p> <p><i>Provide a simple, legible, but sufficiently detailed graphic to convey the main concept or idea of the research effort and/or development prototype.</i></p>	<p><u>Relevance and Goals and Commercialization</u></p> <p>Relevance and Goals:</p> <ul style="list-style-type: none"> • Research goals and desired end state including performance targets • Advantages over other state-of-the-art solutions • Key technical challenges <p>Commercialization Strategy:</p> <ul style="list-style-type: none"> • Describe the current market potential for product/service development and estimated unit cost of the product • Identify end user interests or agreements
<p><u>Technical Objectives and Work Plan Address:</u></p> <ul style="list-style-type: none"> • Technological innovations supporting the approach, as appropriate • How the problem will be addressed • The current status of the proposed effort • The key technical challenges and/or risks • The planned technical accomplishments/key milestones <p><u>Estimate the Technology Readiness Level (TRL 1 – 9) at beginning and end of contract</u></p>	<p><u>Milestones, Deliverables, Schedule and Team</u></p> <p>Milestones, Deliverables and Schedule:</p> <ul style="list-style-type: none"> • Provide milestones, primary deliverables, and task durations for Phase I and Phase II, as appropriate <p>Team:</p> <ul style="list-style-type: none"> • List the proposing organization and principal investigator • List subcontractors
<p>NON-PROPRIETARY, UNCLASSIFIED DATA</p>	

