



U.S. Department of Homeland Security (DHS)

Small Business Innovation Research (SBIR)

Program

**THIS IS A PRE-SOLICITATION
DHS IS NOT SEEKING PROPOSALS AT THIS TIME**

Due Date: See Section 3.8

Issued By:
DHS Office of Procurement
Operations on behalf of:
The Science and Technology Directorate
and the Countering Weapons of Mass
Destruction Office

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1.0 PROGRAM DESCRIPTION

1.1 Summary

The Department of Homeland Security (DHS) Small Business Innovation Research (SBIR) Program, comprised of the Science and Technology (S&T) Directorate's SBIR Program and the Countering Weapons of Mass Destruction Office's (CWMD) SBIR Program, invites small business concerns (SBCs) to submit innovative proposals under this Pre-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, to submit proposals in response to topics described in this Pre-Solicitation.

IMPORTANT:

- Please read the Pre-Solicitation carefully. This Pre-Solicitation is being provided for planning purposes, to allow SBCs to become familiar with the requirements for the upcoming 21.1 Solicitation. Failure to comply with the requirements in the 21.1 Solicitation will likely result negatively in the proposal evaluation or elimination from consideration for award. The final 21.1 Solicitation may differ from the Pre-Solicitation.
- This Pre-Solicitation contains topics for both the DHS SBIR Program and CWMD's SBIR Program. **Section 7.0** outlines the Twelve (12) research topics – ten (10) S&T topics and two (2) CWMD topics. Proposals will not be accepted at this time.
- Prior to proposal submission, SBCs must register with the SBA Company Registration Database. See Section 2.1.
- 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 the 21.1 Solicitation. See **Section 1.5**.
 - Per the Small Business Administration (SBA) SBIR Policy Directive, dated October 1, 2020 (hereafter referred to as “the Policy Directive”) to be eligible for a Phase I award, Offerors must meet or exceed the Phase II Transition Rate Benchmark, 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 as follows:

- (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

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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 Pre-Solicitation incorporates and uses the flexibility of the Policy Directive to encourage innovative proposals in response to the research topics listed in **Appendix A**.

1.3 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 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 the 21.1 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.

1.4 Key Dates and Events

The following chart shows the projected important events and corresponding dates of the

21.1 DHS SBIR Solicitation:

KEY DATES*	
EVENT	DATE*
Pre-Solicitation issued:	November 12, 2020
Direct questions to Topic POC permitted:	November 12, 2020 – December 10, 2020
Solicitation released:	December 11, 2020
Phase I proposals submission:	December 11, 2020 – January 20, 2021
Questions for public response:	January 4, 2021, 1:00 pm, ET
Q&A Posted on FBO.gov	January 11, 2021
Deadline for receipt of proposals:	January 15, 2021, 1:00pm, ET
Phase I POP (5 months):	May 2021 – Oct 2021
Phase II Proposals Due:	~November 2021
Phase II Begins:	~March 2022
*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 the 21.1 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 in accordance with **Section 5.8** Research and Analytical Work

16 SBIR Office Contacts

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

For general questions about the CWMD SBIR Program, please contact CWMD.SBIR@hq.dhs.gov.

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1.7 Definitions

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

1.8 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):

DHS Office of Inspector General/MAIL STOP 0305
Attn: Office of Investigations - Hotline
245 Murray Lane SW
Washington, DC 20528-0305

Online: [Allegation Form: https://hotline.oig.dhs.gov/#step-1](https://hotline.oig.dhs.gov/#step-1)

Call: 1-800-323-8603 toll free

TTY: 1-844-889-4357 toll free

Fax: 202-254-4297

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.

To reach someone within the CWMD SBIR Program Office about fraud, waste and abuse, please contact the DHS CWMD SBIR PM at CWMD.SBIR@hq.dhs.gov.

2.0 REGISTRATION, CERTIFICATIONS, DATA COLLECTION

2.1 Mandatory Registrations

In order to prepare and submit SBIR proposals to DHS under the 21.1 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

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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. Award cannot be made to a company unless they are registered in SAM. To register in SAM and/or update company's records, visit <https://www.sam.gov/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

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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 the 21.1 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 (CWMD topics will also require documents submitted via email). 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
Email Submissions	Non-disclosure Agreement ²	CWMD Topics ONLY	CWMD Topics Only NDA from Phase I applies to Phase II

¹ Briefing Chart Template is Attachment 3 in the Pre-Solicitation.

² CWMD topics ONLY - NDA must not be included in the proposal but submitted separately via provided email; See **Section 4.3**.

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.

No additional attachments, appendices or referenced material beyond the page limitations shall be considered in proposal evaluation.

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

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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:

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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

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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.** SBC foreign national(s) must first be cleared by S&T's Foreign Disclosure Office prior to working and accessing data or information on awarded SBIR efforts. Foreign nationals must receive separate clearances for each award including awards from multiple topics and multiple awards on the same topic. All foreign nationals requiring SBIR access must complete DHS foreign access management screening. Foreign Nationals must complete the DHS Form, 11000-55 upon request during award negotiation.
- **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

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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

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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 the 21.1 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

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- 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 Proposal Structure*

Phase I	Phase II
\$150,000**	\$1,000,000***
5 months	24 months

Notes: * Proposal Structure may be modified in 21.1 Solicitation or in Phase II Proposal Submission Instructions.

Phase I total is not inclusive of Discretionary Technical and Business Assistance. If requesting assistance, the potential total is \$150K plus assistance. Please see **Section 5.11

***Phase II total IS inclusive of the Discretionary Technical and Business Assistance. If requesting assistance, the total must not exceed \$1M. 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 on the DCAA customer guidance page, available at <https://www.dcaa.mil/Customers/Guidance/>

Proposals submitted under the 21.1 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,

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DC – a post-award conference and a one-day meeting to present the results in the final report. In the event that an in-person post award conference is not feasible, then a virtual event will take place. The structure of the post award conference is different for S&T and CWMD topics. Refer to the table below for details:

PHASE I POST AWARD DETAILS		
Day	S&T Topics	CWMD Topics
1	(Mandatory) Session includes: <ul style="list-style-type: none"> • Program background and contracting overview • One-on-One sessions with Topic Managers 	(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	N/A
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	N/A

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

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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](https://www.federalregister.gov/documents/2012/10/16/2012-25328/sbirsttr-phase-i-to-phase-ii-transition-benchmarks) (<https://www.federalregister.gov/documents/2012/10/16/2012-25328/sbirsttr-phase-i-to-phase-ii-transition-benchmarks>) in October 2012 and amended at [78 FR 30951](https://www.federalregister.gov/documents/2013/05/23/2013-12312/sbirsttr-phase-i-to-phase-ii-transition-benchmarks) (<https://www.federalregister.gov/documents/2013/05/23/2013-12312/sbirsttr-phase-i-to-phase-ii-transition-benchmarks>) 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.

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3.8 Questions

General Questions

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

Questions pertaining to the CWMD's SBIR Program should be submitted to CWMD.sbir@hq.dhs.gov.

Technical Questions

The **Pre-Solicitation period** is from November 12, 2020 through December 10, 2020.

During the Pre-Solicitation period, technical questions concerning the topics should be directed towards the Technical Point of Contact (POC) for each topic, listed in the **21.1 Pre-Solicitation SBIR Topic Areas**.

During this Pre-Solicitation period, interested parties have an opportunity to contact topic authors via email to ask technical questions about specific technical topics attached to this notice.

Telephone inquiries will not be addressed.

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.

No further contact between offerors and Technical Points of Contact shall occur after 5pm on December 10, 2020.

Rules for submitting questions after Pre-Solicitation ends, on December 10, will be outlined in the 21.1 Solicitation.

The Government anticipates releases of the 21.1 Solicitation on December 11, 2020.

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

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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.

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- 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 the 21.1 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 carryout 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.

In addition to administrative functions, CWMD will use contractor support as advisors in the source selection process.

In accomplishing their duties related to the source selection process, the contractor support may

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require access to proprietary information contained in the Offerors' proposals. Therefore, pursuant to FAR 9.505-4, this firm must execute an agreement with each Offeror that states that they will (1) protect the Offerors' information from unauthorized use or disclosure for as long as it remains proprietary and (2) refrain from using the information for any purpose other than that for which it was furnished.

Offerors may use the standard one-page company-to-company, non-disclosure agreements found in Attachment 4. Offerors that choose to negotiate their own non-disclosure agreement should be aware that additional review will be required and should allow for additional time in order to submit. It is imperative that Offerors submitting proposals for Topics DHS211-011 through DHS211-012 submit a copy of their signed agreement to CWMD.SBIR@hq.dhs.gov. **Proposals submitted to these topics will not be considered complete until the submission of the dually signed non-disclosure agreement. Failure to execute such an agreement with the above company will result in the Offeror's proposal submission being found non-compliant. Non-compliant submissions will not be reviewed or evaluated.**

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 36. All DHS SBIR awards resulting from the 21.1 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 will be awarded as a cost-plus fixed-fee (CPFF) contract. 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

At a minimum, 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. See topic write up for further details on additional deliverables.

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.

SBIR Data, all Data developed or generated in the performance of an SBIR award, including Technical Data and Computer Software developed or generated in the performance of an SBIR or STTR award, is subject to the SBIR data protection period. Upon expiration of the protection period for SBIR Data, the Government has a royalty-free license to use, and to authorize others to use on its behalf, these Data for Government Purposes, and is relieved of all disclosure prohibitions and assumes no liability for unauthorized use of these Data by third parties. The Government receives Unlimited Rights in all Form, Fit, and Function Data, OMIT Data, and unmarked SBIR Data. Please see the Policy Directive update of October 1, 2020 for additional information.

If the Offeror’s proposal is selected for funding, the Contracting Officer will contact the apparent

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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 minimum 4-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 the 21.1 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

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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

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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 the 21.1 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 (TAB A)

Per the Policy Directive, SBC may request the authority to select their own TAB A provider. The SBC must request TAB A as a part of their proposal. 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 TAB A allowance. Phase II thresholds ARE inclusive of TAB A allowance, see Section 3.4. Regardless of whether the Offeror proposes TAB A, the period of performance thresholds for the proposal remain the same.

In order for awardee TAB A 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 may not be eligible to participate in the DHS provided TAB A (referred to as the Commercialization Assistance Marketplace, see **Section 5.12**).

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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 Marketplace

Awardees may 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. If eligible, 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 the 21.1 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 the 21.1 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

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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 Pre-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 Pre-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 the 21.1 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.

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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

Proposal due date will be contained in the 21.1 Solicitation. The estimated due date is January 15, 2021. This date is subject to change and SBCs interested in submitting proposals will need to verify the actual due date in the 21.1 Solicitation.

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 21.1 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 Pre-Solicitation by reference.

7.0 Research Topics

7.1 S&T Directorate Topic

The following are the topics for the FY21 S&T Directorate’s SBIR Program:

DHS211-001 - Non-Invasive “Breathalyzer” Detection System to Screen for Presence of Viral Respiratory Infections

DHS211-002 - 5G & Wifi6 Coexistence for Secure Federal Networks

DHS211-003 – Improved Curved Transparent Ceramic Structural Components

DHS211-004 - Vehicle Infectious Diseases Protection

DHS211-005 - Amphibious XTV for Ice Rescue

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DHS211-006 - Artificial Intelligence to Augment the 911 Telecommunicator Function

DHS211-007 - Software Supply Chain Identification for Compiled Binary Executables

DHS211-008 - Intelligent Document Design: Combating Industry Trends that Incentivize Weak Security

DHS211-009 – High Throughput Non-Ionizing Screening Capability for Identifying Contraband

DHS211-010 - Screening Sensor Technology as part of Passenger Checked Luggage

7.2 CWMD Office Topics

The following are the topics for the FY21 CWMD SBIR Program:

DHS211-011- Fieldable multiplex detection of Biothreats

DHS211-012 - Diagnostic tools for detection of African Swine Fever (ASF) virus

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

APPENDIX A – RESEARCH TOPIC DESCRIPTIONS

SBIR Topic Number: DHS211-001

TITLE: Non-Invasive “Breathalyzer” Detection System to Screen for Presence of Viral Respiratory Infections

TECHNOLOGY AREAS: Biosurveillance, volatile organic compound detection, emerging threats, viral pathogens, nanosensors, algorithm development, internet of things

OBJECTIVE: Demonstrate plausibility of a mobile, handheld, or badge-type detection system as a diagnostic tool to screen breath for the presence of communicable respiratory viral infections, particularly those with pandemic potential. End applications could include use as a personal health monitor or at check or choke points in open space venues to include office buildings, arenas, airports, subway systems, and borders.

DESCRIPTION: The ongoing COVID-19 pandemic has highlighted the global need for a rapid, low-cost, selective and non-invasive testing method for identifying individuals who may be infected with a communicable disease. The current methodology used by most businesses and government agencies to allow access into buildings is the temperature check. A standoff IR thermometer is pointed at the forehead of each individual and access is granted if the temperature reading is below 100.4° (<https://www.cdc.gov/coronavirus/2019-ncov/hcp/dialysis/screening.html>). While checking for fever can be a helpful tool in identifying potentially ill or infected individuals or encouraging such individuals to stay home, the approach is not foolproof. As an example, during the COVID-19 outbreak in 2020 only 20% of the individuals testing positive for SARS-CoV-2 in two emergency departments of one hospital system had a fever >100.4°F at arrival⁴. This topic is searching for a non-thermal screening approach, more specifically, the analysis for volatile organic compounds (VOCs) produced only when the individual is sick with a viral respiratory infection.

Detecting viral or bacterial respiratory infections via analysis of exhaled breath for the presence of VOCs offers a capability that will meet this need. There is some evidence in the literature that several types of VOCs are produced as a result of viral infection¹. These include fatty acids, aldehydes, alkanes, and ketones, many of which are amenable to detection by vapor analysis techniques. Couple this evidence with the recent emergence of nanosensors demonstrated to detect vapors at low concentrations (ppb) with response time of seconds², the development of a VOC device to detect the presence of viral respiratory infections is now a possibility.

Currently, most viral respiratory infections are detected by demonstrating the presence of the pathogen’s genetic material or proteins (i.e., antigens) in the bodily fluids of an individual, or retrospectively, demonstrating the presence of antibodies in an individual’s blood. Techniques used to detect a pathogen’s genetic material include polymerase chain reaction (PCR)-based methods, while detection of a pathogen’s antigens or the antibodies a person makes to them typically rely on immunological tests like enzyme-linked immunosorbent assays (ELISAs) or lateral flow assays (LFAs). Although these techniques can be performed outside the laboratory, in some cases, there are limitations. PCR-based tests and some immunological tests require specialized laboratories and skilled technicians to perform the test and analyze the resulting data. Immunological tests like LFAs are easier to perform but are often less sensitive, and those that detect the antibodies a person makes in response to infection often cannot be used diagnostically

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because antibodies appear sometime after onset of infection. The sampling methods for these diagnostic tests are also generally quite invasive. The detection of many respiratory pathogens require nasal, throat, or nasopharyngeal swabs, and are only effective if enough virus is available in the upper respiratory tract (nose, mouth, and throat) which may not develop until late in the infection. Other pathogens can only be detected currently using blood samples. Upper respiratory swabs and blood samples also may only be collected by trained medical professionals. However, sampling exhaled breath is an ideal sample since it is not invasive and does not require a trained medical professional to collect.

As a result of this research, the Offeror is expected to develop a deployable sensor with the following metrics: (i) noninvasive, (ii) easy to administer; (iii) low cost to purchase end device (\$100-\$250 per device for commercialized product); (iv) results must be presented rapidly (Goal: less than or equal to 1 min; Threshold: 5 minutes); (v) stable under reasonable storage conditions (ice chest or equivalent); (vi) accurate and sensitive (low false negative and positive rates); and (vii) ability to provide record of results at site of use.

Training needs must be minimal since it is anticipated that these testing capabilities will expand and be a significant part of a mitigation strategy to prevent rampant spread of communicable respiratory disease, particularly those with pandemic potential.

PHASE I: Produce a market analysis of VOC sensors/detectors that have been or could be used to detect or measure infectious agents or associated markers (including VOCs). Provide a final report in which these findings are presented and from these findings, propose one or more technical approaches to develop and demonstrate in Phase II. The final report must include a technically rigorous evaluation of the feasibility of the approach or approach(es), a preliminary test plan (with suggested viral simulants) for the candidate technical approach(es), and describe success criteria for the metrics indicated above (e.g., target response times, stability, accuracy and sensitivity anticipated, and how diagnostic results would be recorded). A physical description of the brassboard prototypes to be built in Phase II, as well as anticipated challenges, risks and mitigation strategies should be included in the final report. The analytical concept should be able to distinguish between different respiratory pathogens and uninfected individuals including those taking common over the counter and prescription medicines. Anticipated operational environments are described in the objective section above. Finally, it is critical that the final report describe how any conclusions or technical expectations and capabilities were determined since these will be strictly judged for scientific integrity for entrance into Phase II.

Monthly telecons (with supporting PowerPoint slides) are also a required deliverable during this Phase.

PHASE II: Develop at a minimum, 3 (three) brassboard prototypes of candidate approach(es). Perform in-house experiments to demonstrate the capability of the candidate approach(es) to detect unique VOC markers of viral infection with appropriate criteria (described in Phase I). Simulant viral samples should include single-stranded Ribonucleic Acid (RNA) type. Tests should show the ability to distinguish between different types of respiratory viral infections (the eventual viruses to be tested will be agreed upon by Offeror and DHS S&T scientists at the beginning of Phase II). The prototype data must be validated using a ground truth analytical approach during testing.

During in-house experiments, Offeror must run an analytically significant number of trails (triplicate replicates, at least three different viral concentrations, tested at two or more different

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temperatures and relative humidity) and demonstrate successful detection of markers in the presence of other VOC interferents. More details of required testing conditions will be determined toward the end of Phase I and the beginning of Phase II via consultation between the Offeror and DHS S&T scientists.

The Offeror is expected to deliver a comprehensive Phase II final report to include all testing results, engineering design plans for final product to be commercialized, updated risk register, anticipated concepts of operation, and transition/commercialization activities.

More specifics for the final Phase II report include a description of the eventual product (form factor), with target characteristics of the eventual deployable prototype, including, response time (or time to answer), size/weight/power requirements, cost of device, associated consumables and costs, and concept of operations in environments indicated in the objective section above. An analysis of anticipated R&D investment needed to realize the final product to market should also be included in final Phase II report. Monthly telecons (with supporting PowerPoint slides) are also a required deliverable.

The Offeror is also responsible for researching and reporting on any FDA or Public Health requirements or standards that may be applicable to deployment of detector for the purposes and environments described above in the objective section. If action is required, the Offeror must describe a plan to secure necessary approvals (and anticipated costs to do so). This includes any privacy concerns.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: There are several potential commercial and government applications including (i) Passenger and Port of Entry People Screening (Airports, TSA, CBP); (ii) Detention Centers (ICE); (iii) Workforce Health Protection; (iv) Federal Building Checkpoint Screening (FPS); (v) Veterinary medicine/diagnostics (CWMD); and (vi) Broad Public Health Applications.

During Phase III, further development and independent laboratory testing will be undertaken with the ultimate goal of this SBIR being a deployable device, with sufficient commercial applicability, that can be used as a diagnostic tool to screen breath for the presence of communicable respiratory viral infections, particularly those with pandemic potential. During Phase III, the Offeror will complete regulatory and policy requirements for deployment.

REFERENCES:

(1) Oliver Gould, Norman Ratcliffe, Ewelina Krol, and Ben de Lacy Costello (16 July 2020). *Breath analysis for detection of viral infection, the current position of the field*, J. Breath Res., 14. <https://pubmed.ncbi.nlm.nih.gov/32531777/>.

(2) B. Thomson¹, R. Debnath¹, A. Rani¹, C. Shi, A. Timilsina, I. Diagne¹, A. Motayed (2019). *Wearable Chemical Hazard Detection Systems using Chip-scale Microsensors*. Retrieved from <https://www.ama-science.org/proceedings/details/3057>.

(3) Michael Schivo, Alexander A. Aksenov, Angela L. Linderholm, Mitchell M. McCartney, Jason Simmons, Richard W. Harper and Cristina E. Davis (September 2014). *Volatile Emanations From In Vitro Airway Cells Infected With Human Rhinovirus*, J Breath Res., 8(3). <https://pubmed.ncbi.nlm.nih.gov/25189196/>.

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(4) Gary M. Vilke, Jesse J. Brennan, Alexandra O. Cronin, Edward M. Castillo (2020) “Clinical Features of COVID-19 patients: is temperature screening useful?” J. Emerg. Med.
<https://doi.org/10.1016/j.jemermed.2020.09.048>.

KEY WORDS: Breath analysis, volatile fingerprinting, viral infection detection, biomarker identification, infection screening, mobile device

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SBIR Topic Number DHS211-002

TITLE: 5G & Wi-Fi 6/6E Coexistence for Secure Federal Networks

TECHNOLOGY AREAS: 5G Security, Wi-Fi 6/6E, Securing Federal Networks

OBJECTIVE: Investigate the interoperability and security of 5G and Wi-Fi 6/6E as coexisting technologies to support secure federal networks

DESCRIPTION: Wi-Fi and wireless carrier services have co-existed for decades. Each technology has met the needs of its consumers satisfactorily, but for the most part have been separately addressing these needs. Currently, there has been no real convergence on these physical layers, and therefore, no real interoperability between the two technologies. Wi-Fi has provided a great in-home and office experience with limited street-level experience. Prior-generation wireless networks have provided a good experience for their customers. With 3rd Generation Partnership Project (3GPP) Release 15 and 16, fifth generation (5G) wireless networks have made significant advancements in security, data-rates, latency, and connectivity. Similarly, Wi-Fi 6/6E have made tremendous improvements in the same categories. Both technologies have common lineage: Multi-User Multiple Input, Multiple Output (MU-MIMO), Orthogonal Frequency Division Multiple Access (OFDMA) technologies, 1024 Quadrature amplitude modulation mode, and beamforming. Both technologies are using similar spectrum bands. If the technologies can co-exist on the physical layer, then it may be possible to provide a best-of-both-worlds experience for mobile users.

The objective is to investigate and research the physical layer convergence, co-existence, interoperability, and security implications of 5G and Wi-Fi 6/6E as complementary technologies to best support the efficient operation of secure federal networks and user experience. Specifically, the list of factors to be researched and reported on include:

1. Network convergence
2. Interoperability to include the handoff between the two networks
3. Reliance on carrier networks (including core networks)
4. Mobility
5. Quality of Service
6. Licensed vs. Unlicensed Spectrum (including the Citizens Broadband Radio Service (CBRS))
7. End-to-End Security Implications
8. User Authentication
9. Cost to deploy and flexibility
10. Device interoperability to include existing mobile devices
11. Federal Use-Cases (and applications): Enhanced mobile broadband, Massive Internet of Things, Ultra Reliable Low Latency. Specifically, determine what services are best suited for Wi-Fi 6/6E versus 5G
12. Data-Rates/Throughput

DHS's Cybersecurity & Infrastructure Security Agency (CISA) understands there is no perfect wireless technology available in the marketplace. Each technology has its pros and cons.

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However, 5G and Wi-Fi each will play a significant role soon and can enhance federal government use-cases and missions. DHS also believes CBRS will be an integral part of this space.

Additionally, as DHS CISA aligns with and supports the National Security to Secure 5G and seeks to implement its own 5G Strategy, understanding the security and interoperability challenges that come with the convergence of wireless technologies (e.g., 5G and Wi-Fi 6/6E) is essential to enabling U.S. leadership going forward.

DHS CISA's operational priorities are protecting federal networks from adversarial entities and governments from 1) security and supply-chain risks that come via 5G or Wi-Fi networks, and 2) cybersecurity risks posed to Federal Government networks, applications, and data.³ We are seeking to investigate and develop technologies that will enhance mission capabilities and protect government network and data from adversarial influences.

PHASE I: Investigate and report on the interoperability and security implications of 5G and Wi-Fi 6/6E as coexisting technologies to support secure Federal Government networks. Via a documented technical report, determine the technical feasibility of the two technologies to interoperate and coexist as complementing technologies to support federal voice/data-related use-cases. Evaluate the factors identified and model/simulate how the interoperability/coexistence of 5G and Wi-Fi technologies may enhance operational efficiencies. Upon conclusion, document the proposed product, solution, technical design, model, architecture, software or tool via its technical report.

PHASE II: Build, test, validate and demonstrate the prototype/concept developed in Phase I on its proposed solution for the interoperability of 5G and Wi-Fi 6/6E. A detailed technical report, test results, and an operational plan of the prototype/solution is to be provided.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Implement the operational plan identified in Phase II and build a real-world solution associated with the prototype described in Phase II. Identify a go-to-market strategy on how this technology/solution can be commercialized in addition to making it available to federal government departments/agencies. Provide a complete solution for operational deployment to support protecting federal networks.

REFERENCES:

- CISA. August 2019. Cybersecurity and Infrastructure Security Agency Strategic Intent: Defend Today, Secure Tomorrow. https://www.cisa.gov/sites/default/files/publications/cisa_strategic_intent_s508c.pdf
- The White House. March 2020 National Strategy to Secure 5G of the United States of America. <https://www.whitehouse.gov/wp-content/uploads/2020/03/National-Strategy-5G-Final.pdf>
- CISA. 2020. CISA 5G Strategy: Ensuring the Security and Resilience of 5G Infrastructure In Our Nation. https://www.cisa.gov/sites/default/files/publications/cisa_5g_strategy_508.pdf

KEY WORDS: 5G Security, Wi-Fi 6/6E Security, Network Security, Wireless Security & Interoperability, Network Interoperability, 5G & Wi-Fi 6/6E Coexistence, 5G & Wi-Fi 6/6E

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Convergence

TECHNICAL POINT OF CONTACT: Vincent Sritapan, Vincent.Sritapan@hq.dhs.gov

SBIR Topic Number DHS211-003

TITLE: Improved Curved Transparent Ceramic Structural Components

TECHNOLOGY AREAS: Transparent Ceramic Structures

OBJECTIVE: Develop cost-effective novel technique/s to shape and polish both convex and concave sides of transparent ceramic blanks for window applications. Provide large size polished transparent ceramic blanks shaped to match the varying geometry of at least 500 mm x 700 mm.

DESCRIPTION: Transparent ceramics have proved to be effective ballistic enhancements to transparent structural components including armor sections, etc., incorporated in place of some or all of the glass components of a host platform. The resulting enhanced structural assemblies have incorporated the benefits of enhanced strength transparent ceramics which have proven useful in many ways. For example in resultant transparent armor, the material stops specified threats with lower overall weight, cross-section thickness or both. However, certain limitations of transparent ceramics has constrained its cost-effective adoption in transparent structural assemblies. One of these limitations is the ability to affordably and reliably polish the transparent ceramic into optically clear final size, shape or form factor without adversely affecting the transparent ceramic product, cost, production time, reliability of manufacture, physical properties (such as increase fragility) etc..

The goal of this SBIR is to optically polish, shape and provide ceramic specimens ($MgAl_2O_4$ spinel or AlON) transparent ceramic components with specified dimensions that are optically clear, through state-of-the-art fabrication methods, which may be incorporated into transparent structural components. The polishing method should be a time and cost effective process without negatively impacting the transparent ceramic production process or final product with provision for equipment long-term reliability and utility. The Army Purchasing Specification APTD 2352T, or latest version, applies to the activities under this SBIR as modified, with the APTD applying to multiple layers while the SBIR refers to only one layer. The APTD is a performance requirement.

Sample size requirements are: provide single piece uniform optically clear curved transparent ceramic samples of the specified thicknesses that have a height of 500 mm and a width of 700 mm with an 1850 mm convex outer surface radius of curvature (inner surface will require concave polishing to maintain a uniform thickness). Seamed multiple pieces are not acceptable for this SBIR. Phase II pieces may not have square sides, but will be within the stated size.

Current Process and Production Issues: There has been extensive research to produce transparent ceramics with larger sizes, curved geometries, increased optics, and using lower cost approaches. These efforts have increased the TRL for flat geometries but more investigation is needed for curved surfaces. Table 1 lists select previous technical process research thrusts. If further research is warranted, additional information must be supplied to state the difference with the new approach. An additional issue is the provision of ceramics that cannot be ground optically clear, the SBIR performer must provide optically clear specimens, thus provision of properly processed ceramics to be polished is also a key factor.

Table 1: Previous efforts

Technical Process	Challenge
Seamed methods	Not acceptable
Curved Transparent Ceramic: Near net shape forming	Difficult to reproduce
Curved Transparent Ceramic: Grinding/polishing of thicker part	Expensive and Time Consuming
Domes/ Conformal windows	Expensive polishing Need larger radius of curvature/large size
Scale-up of geometries	Fracture, inhomogeneity, transmission, haze, clarity issues across entire surface, manufacturing yield

Table 2: Additional Desired SBIR Requirements Table:

Requirement	Threshold	Objective
Ultimate Production Rates:	100 Specified Size Pieces per Year	120 Specified Size Pieces per Year
Optical Transmission:	Optically Clear with a maximum sample Haze of 5% and a minimum Transmission of 70%¹	Optically Clear with a maximum sample Haze of 5% and a minimum Transmission of 75%¹
Produce required curvature:	1875 mm R	1850 mm R
Sample Thickness:	≥10mm	≥ 15mm
Reproducibility (to 99% of the specified thickness, size, and shape):	≥ 65% of samples	≥ 85% of samples

Note:

1. % of Theoretical Maximum Transmittance when measured at five points (edges and center) with a Haze Gard Transparency Meter at visible wavelengths, approximately 400 to 750 nm

PHASE I: Provide a proof of concept viability with an illustrated hardware design that depicts the necessary requirements and technical solution to include, at minimum a block diagram of system, and any required processes and equipment. Briefly describe a general processing procedure which will be used as a starting point for proposed Phase II follow-on development, testing and demonstration of five polished transparent ceramic samples of the required thickness, size, and shape.

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PHASE II: Construct or produce a functional prototype polishing and shaping process and provide five (5) convex/concave polished transparent ceramic panels of uniform thickness to demonstrate feasibility of the polishing/shaping equipment and processes. Resultant polish should result in optical clarity in the large curved polished ceramic panels of the specified shape and size as described below.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Demonstrate production polishing and shaping of a sufficient number of production-representative articles (at least ten (10)) transparent ceramic specimens into optically clear transparent components of uniform thickness in the shape as specified and demonstrate cost-effectiveness and affordability of the process at production scale levels. This requires front-face convex polishing and rear-face concave polishing.

REFERENCES:

Surmet. Technology and Manufacturing Capabilities. <http://www.surmet.com/technology/alon-optical-ceramics/>

CoorTek. Transparent Ceramics. http://www.coorstek.co.jp/eng/rd/detail_04.html.

KEY WORDS: Sapphire, Magnesium aluminate spinel, spinel, aluminum oxynitride, AlON, transparent ceramic polishing, transparent ceramic, transparent armor

TECHNICAL POINT OF CONTACT: MK Tribbie, mk.tribbie@hq.dhs.gov

SBIR Topic Number DHS211-004

TITLE: Vehicle Infectious Diseases Protection

TECHNOLOGY AREAS: Agent/Officer Health and Safety

OBJECTIVE: Develop solutions to convert the current and future fleet of law enforcement vehicles to vehicles that offer a *Vehicle Infectious Disease Protection (VIDP)* capability to the entire interior compartment utilized to transport detained subjects.

DESCRIPTION: DHS/CBP agents encounter people entering the United States from any country in the world. Those entering can be potential carriers for any number of infectious diseases. If arrested, agents/officers must transport the detained subjects to a processing/holding facility. Currently, DHS/CBP utilizes standard law enforcement vehicles to transport these detained subjects from the field to the designated processing/holding area. These law enforcement vehicles consist of a caged passenger compartment to separate the detained subjects from the agent/officer compartment and share the same cabin air. Often, the detained subjects are sitting in close proximity (less than 6 feet), for extended periods of time (several hours), with the agents/officers, making all vulnerable to being exposed to certain communicable diseases. The DHS/CBP is seeking innovative, cost-effective solutions to convert the current and future fleet of law enforcement vehicles to vehicles that offer a *Vehicle Infectious Disease Protection (VIDP)* capability to the entire interior compartment utilized to transport detained subjects.

At present, there are no VIDP solutions for transport vehicles. Currently, DHS/CBP requires agents, officers, and detained subjects to wear Personal Protective Equipment (PPE) during transport but this does not protect against breathing possibly infectious air during transport. In the past, DHS/CBP utilized pickup trucks with a passenger compartment in the bed of the vehicle to separate detained subjects from agents/officers. These units did not provide proper climate control and made it difficult to monitor and communicate with the passengers even when using an intercom system.

The solution the DHS/CBP is seeking will require a capability that will adapt to all current and future fleet (Table 1) utilized to transport detained subjects to a VIDP capability to ensure agents and detained subjects are provided this added layer of protection within the provided factory space. This conversion should be within cost range (Table 2) and compatible with any make and model of vehicle (Table 1) utilized by DHS/CBP for transport. The technology should meet the security measures of law enforcement vehicles. The technology should be compatible with or provide a physical barrier between detained subjects and the agent/officer area that sufficiently protects them from a detained subject. The technology should not interfere with seat belt usage and the ability to control the climate in the detained subject area. The area should provide the ability for agents/officers to have continuous monitoring and communication abilities and a sterilization capability with the detained subject area. The controlled area must have space to store personal property and other items where the passengers cannot gain access. The components of the developed technology will need to have the ability to be easily worked on or replaced when repair is needed. The developed technology will need to have the ability to be completely removed when a vehicle is dead lined or deemed inoperable so it can be reused on a new or replacement vehicle.

Table 1 USBP Fleet Vehicles

USBP Fleet Vehicles		
Vehicle type	Manufacture	Model
Van	Chevrolet	EXPRESS 3500
Van	Chevrolet	CG3300
SUV	Chevrolet	Tahoe
SUV	Chevrolet	Suburban 1500
SUV	Chevrolet	Durango
Truck	Chevrolet	C1500
Truck	Chevrolet	C2500
Truck	Chevrolet	C3500
Sedan	Chevrolet	Caprice
Truck	Dodge	1500
Truck	Dodge	2500
Sedan	Dodge	Charger
Van	Ford	Transit 350
Van	Ford	E350
SUV	Ford	Expedition
SUV	Ford	Interceptor
Truck	Ford	F150
Truck	Ford	F250
Bus	Bluebird	44 passenger

Note: all fleet vehicles are in service for seven years

The solution must meet factory power requirements, the capability size restrictions must fit within available space after agent and detainee storage, and the capability must be an integrated mount. Additionally, the solution should include climate control with/in factory specs, communications with detainees, ability to visually monitor detainees and sterilization of compartment air. The solution should not interfere with driving or LEO Operations.

Table 2 VIDP Performance Metrics

VIDP Performance Metrics		
Requirement	Threshold	Objective
Cost	< \$15000	\$2,000
Weight	<20lbs	< 10lbs
Power Source	12VDC/110 AC	12VDC / 110 AC
Mean Time to Install	<2 hr	<1 hr
Mean Time to Repair	1hr	<1hr
Agent equipment storage- per Agent -note 1	2 cubic feet	2 cubic feet
Detainee Storage	1 cubic feet	1 cubic feet

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Capability consumable cost per year- Pricing based on unit costs	<20%	<10%
Note: 1. In addition to Agent gear these items will be in the vehicle spikes strips, security box, car jack, spare tire and cold weather gear.		

PHASE I: The vendor shall develop and prepare an innovative concept design to mitigate the potential of getting exposed to infectious diseases inside CBP vehicles (Table 1). The required Phase I deliverables will include a feasibility study, conceptualize and design innovations, model key elements and demonstrate a breadboard design of the solution in accordance to performance metrics (Table 2).

PHASE II: The vendor shall develop, demonstrate a functional prototype with operational functional ability implementation design and method to mitigation exposure while transporting detainees in government vehicles. Demonstration should be in a relevant environment to the northern and southern border environment that include off road operations in rough, dusty humid, wet and extreme temperature changes, and during the summer and winter seasonal changes.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: The vendor shall provide testing of units on USBP fleet vehicles to ensure form fit and function of the solution and also provide an avenue for production units as specified in the performance metrics table (Table 2). Availability of the system will provide DHS and CBP with a safe and effective method to transport arrested subjects while keeping their Agents and Officers safe from exposure to possible infectious disease. If the concept is proven and workable the product would likely be of interest not only to the DHS joint operation community but all law enforcement nationwide due to the diseases that can be transmitted due to close contact.

REFERENCES:

- U.S. Customs and Border Protection Strategic Plan: Delivering safety, security, and prosperity through collaboration, innovation, and integration. <https://www.cbp.gov/sites/default/files/documents/CBP-Vision-Strategy-2020.pdf>
- Centers for Disease Control and Prevention. How to Protect Yourself & Others. 2020, September 11. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>
- U.S. Customs and Border Protection. COVID-19 Resource Page. http://cbpnet.cbp.dhs.gov/HRM/Pages/covid19_resources.aspx
- United States Department of Labor. Border Protection and Transportation Security Workers and Employers. <https://www.osha.gov/SLTC/covid-19/border-protection-transportation-security.html>

KEY WORDS: Officer Safety, Disinfectant, Personnel Protection, Aerosol Transmission, Health and Safety, Isolation, Negative Pressure, Contamination

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SBIR Topic Number DHS211-005

TITLE: Amphibious XTV for Ice Rescue

TECHNOLOGY AREAS: Rapid Rescue, Emergency Responders, Amphibious Vehicle

OBJECTIVE: Develop an amphibious Xtreme Terrain Vehicle (XTV) for ice rescue transport to perform missions with sub-freezing temperatures.

DESCRIPTION: Within the Coast Guard Search and Rescue (SAR) regions, a wide variety of lakes, rivers, and tributaries develop ice cover and are extensively utilized by the public during the winter for commercial and recreational purposes. Limited rescue resources are available for deployment on ice (also referred to as 'hard water') to meet USCG 24/7 response. Freezing air and water temperatures significantly decrease survivability time for subjects trapped in those conditions. Therefore, SAR responses must use the quickest on-scene resources without sacrificing the safety of responding personnel.

An amphibious XTV would allow the Coast Guard (CG) to efficiently and effectively respond to life-saving and marine missions that take place on land, on snow, ice, and water without the need for a separate transport system with separate teams. Amphibious XTV is a solution to augment boat capabilities for ice rescue units where a wide spectrum of maritime climates and environmental situations exist. Current ice rescue missions are conducted aboard the Special Purpose Craft Airboats. Though these craft are essential to ice rescue missions, they are extremely expensive (at around \$250k). Additionally, substitute craft should be considered to augment ice rescue capabilities when the Special Purpose Craft – Ice Rescue Transport (SPC-Air/IRT) are undergoing maintenance and for the 27 Ice Rescue Units whom don't have an SPC-Air/IRT. These crafts would be especially useful for short-haul rescue missions leaving the SPC-Air/IRT available for long-haul missions.

Ice-rescue teams are comprised of a minimum four persons; a team leader (coxswain), two ice-rescuers, and a communications operator. In some cases, a fifth team member will deploy to act as an on-scene coordinator if the response is multi-agency in nature. However, the Ice Rescue Program Managers are working on a 3-person Ice Rescue Response Team for the SPC-Air/IRTs to reduce the amount of weight and leaving more room for survivors.

Once deployed, the XTV travels to the designated response location. Throughout the transit, the crew communicates to prepare for the response as well as with the SAR controller to report status throughout the response. During this trip, the XTV may encounter both hard and soft water, including ice shelves, cracks and broken ice, and need to transition from one to the other. A XTV may also encounter icing and other adverse conditions from precipitation that will require mitigation.

When on-scene, the XTV may be required to conduct search patterns to locate the person(s) in distress. It also acts as a means to transport potential rescue victims in distress until an alternate means of transportation can arrive. Upon completion of the response effort, the ice-rescue team uses the XTV to traverse back to the point of embarkation, and ultimately back to the parent unit using the trailer.

Pre-Solicitation

The XTV should meet the following requirements:

- Not exceed 25' and 8' 6 in based on road towing regulations
- Able to maintain a speed of 15NM in seas up to 6 inches
- Capable of continuous operation for 5 hours in water at the most economical planning speed with a 10% fuel reserve.
- The amphibious XTV can be transported via trailer on standard roads and highways (without need for a commercial license or special permit) to the nearest point of embarkation on land.
- The XTV may be deployed on land from the trailer and then transition to the 'hard water' environment without a boat ramp.
- Able to traverse dry land (grass, dirt, concrete). Open water in 2 feet seas operational, 4 feet seas survivability. All ice conditions (solid, broken, snow covered). Traverse ice compression ledges of 2 ft.
- Operate up to 10 NM offshore in soft water, on hard water, and a combination of both.
- Operate in air and water temperatures ranging from -30F up to 105F
- Able to operate in winds of 30kts constant and 40kts gusts on ice.
- Able to operate in reduced visibility down to 1/10NM. Caused by all forms of heavy precipitation (rain, snow, sleet, fog)
- Operate in 0% to 100% relative humidity
- Able to operate in fresh and salt water environments.
- Able to accommodate 6 individuals estimated at 200 pounds each with 25 and additional 25 pounds personal protection equipment.
- Have storage for all rescue gear
- Equipped with rotating spot lights
- Equipped with exterior flood lights (sides) covering a 270 degree arc between the vessel's quarters.
- Equipped with a mounted blue law enforcement light
- Compatible with current night vision equipment and unaided eye night/day operations
- Communications shall conform to FCC regulations
- Equipped with current USCG communications including: Standard Horizon Very High Frequency (VHF) Marine Band radio with Digital Selective Calling (DSC), Shipboard Loudhailer & Siren (must be loud enough to be heard while vessel is in operation)

PHASE I: Determine technical feasibility for an amphibious Xtreme Terrain Vehicle (XTV) for ice rescue transport that includes a project plan and supporting documentation that demonstrates a proof-of-concept. Design a concept for technical feasibility and develop approaches for addressing the requirements in the description and provide a detailed plan of a fully operational prototype that meets requirements to be reviewed and evaluated at the end of Phase I.

PHASE II: Develop a prototype that can be demonstrated in a realistic test and evaluation environment. Demonstrate end-to-end operational viability to include requirements.

The XTV shall be designed and built to minimize life-cycle cost and be sustained by maintenance programs of record. The equipment shall have maintenance procedure cards developed to detail the schedule and procedures for sustainment by Coast Guard personnel. Maintainability and equipment access should be strongly considered in the XTV's design. The design shall employ sustainment efficiencies by incorporating common boat components, such as electronics, engines, and hardware/software.

Pre-Solicitation

The amphibious XTV shall operate in and around sensitive environmental areas including harbors, navigable inland waterways, encompassing the Great Lakes and Canada. The XTV shall comply with federal, state, and local environmental laws and regulations, and international treaties. Environmental considerations for the boat shall include the proper management of bilge water, air and noise emissions, oily discharge, fuel efficiency, and avoiding harm to aquatic species. The engine will comply with exhaust emission regulations of the International Convention for the Prevention of Pollution from Ships (MARPOL).

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Phase III may include further technical development to address gaps discovered during the test and evaluation and further end-user feedback. The research and development efforts from Phase III will result in a mature commercial or government application that can be delivered for operational use.

This vehicle will be capable of deploying from and operated in the Ninth Coast Guard District Area of Responsibility (AOR). Missions would include; Search and Rescue, Living Marine Resource, Other Law Enforcement. These missions shall be performed during day and nighttime in a wide spectrum of maritime climates and environmental situations. These maritime climates and situation include but are not limited to; sub-freezing temperatures, inland environments, and coastal environments. It shall be a Coast Guard standard boat platform capable of performing missions that require the projection of CG capabilities onto the ice environment, aquatic environment, and shall not sink. It shall be crewed as required by the Boat Operations and Training (BOAT) Manual, VOL I, COMDTINST M16114.32 (Series).

REFERENCES:

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2. U.S. Coast Guard Boat Operations and Training (Boat) Manual, Volume I; Publication Number - CIM_16114_32E: <https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-C4IT-CG-6/The-Office-of-Information-Management-CG-61/About-CG-Directives-System/Commandant-Instruction-Manuals/smdpage2823/3/smdsort2823/description/>
3. U.S. Coast Guard Boat Operations and Training (Boat) Manual, Volume II; Publication Number - CIM_16114_33D: <https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-C4IT-CG-6/The-Office-of-Information-Management-CG-61/About-CG-Directives-System/Commandant-Instruction-Manuals/smdpage2823/3/smdsort2823/description/>

KEY WORDS: Ice-Search-and-Rescue, ice rescue, vehicle-ice-rescue, multi-surface, track-vehicle-ice, ice-amphibious

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SBIR Topic Number DHS211-006

TITLE: Artificial Intelligence to Augment the 911 Telecommunicator Function

TECHNOLOGY AREAS: Public Safety, Next generation 911, Public Safety Answering Point, Artificial Intelligence, Machine Learning, Video analytics, Telecommunicator function

OBJECTIVE: Identify a commercially viable technical design to process, analyze, and share multimedia video sent from 911 callers; augment the 911 Telecommunicator function by reducing burden and workload and to efficiently share relevant multimedia content with emergency responders.

DESCRIPTION: With the advent of Next Generation 911 technology, it will be possible for 911 callers to send multimedia to the Emergency Communications Center (ECC) as part of a 911 “call.” This form of information has the potential to augment the current voice-only model to add useful, actionable data that can result in a more effective and efficient response by law enforcement, fire departments, and emergency medical services.

Multimedia has the potential to complicate the 911 Telecommunicator’s job. Many questions have not been answered about how multimedia such as video will be processed, analyzed, and shared by 911 centers. When multiple videos are received as part of a large, local incident – how will decisions be made regarding which videos contain the most relevant information and how will that information be effectively inserted into the dispatch and response phases of the call? Could predictive analysis based on data from machine learning be used to identify relevant, actionable information contained in video? Solutions should address potential concerns related to bandwidth utilization (identify what should be shared and with whom?).

Solution proposed should address defining the requirements including use of Artificial Intelligence and Machine Learning (AI/ML) for analysis of video and the integration of video into the 911 call processing; currently, there is only voice.

PHASE I: Design a technical model and determine feasibility to incorporate the use of artificial intelligence (AI) and machine learning (ML) into the process of evaluating multimedia, for its potential to augment voice information, in the 911 Telecommunicator’s response to 911 voice calls. Effort should identify and document requirements and transition strategy to bring capability to the public safety marketplace. This design should address:

1. Requirements of the AI/ML (by conducting interviews of Telecommunicators, 911 center managers, and 911 center IT support)
2. AI/ML analysis of video
3. Appropriate operational incorporation of video into 911 call processing
4. Technical methods for efficient sharing of relevant multimedia information with emergency responders in the field. The design should also include evaluation parameters for the successful demonstration of the technical design.
5. How solutions will reduce burden and workload of the telecommunicator. Examples include:
 - a) Group content associated with an incident to ensure that redundant calls are coordinated and correlate data for improved dispatching and response.

- b) Score call urgency to alert the telecommunicator on the most important calls including identifying prank
6. Define approach for “training” AI including the required data

PHASE II: Develop and demonstrate a prototype that incorporates the use of AI and machine learning into the process of evaluating multimedia, for its potential in augmenting voice information, in responding to 911 voice calls. This design should include: 1) analysis of video/data including data requirements for training AI/ML, 2) appropriate operational incorporation of multimedia into 911 call processing, and 3) sharing of relevant information with emergency responders in the field; based on Phase I modeling. Effort should also include a detailed analysis of the technologies, use cases and implementations, with recommendations on how to implement these in a large-scale deployment.

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. Currently, there are over 6,000 911 centers that will be migrating to NG911 and the proposed solution that enables efficient and effective management of incident data will be greatly needed.

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https://www.911.gov/pdf/Guidelines_for_Developing_a_Public_Safety_Telecommunicator_Job_Description.pdf
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3. Gates, N. September 2020. AI can be trusted to take our 911 calls
<https://thenextweb.com/podium/2019/03/24/ai-can-be-trusted-to-take-our-911-calls/>
4. NENA. January 2011. Non-Voice-Centric Emergency Services.
https://cdn.ymaws.com/www.nena.org/resource/resmgr/Standards/NENA_73-501_v1.1_Use_Cases_a.pdf
5. Jackson, D. June 2019. Rave Mobile Safety unveils support for live video streaming.
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KEY WORDS: Next Generation 911 (NG911), Machine Learning, Video Analytics, Telecommunicator, dispatch, multimedia analysis, Public Safety, Situational awareness, Public Safety Answering Point

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SBIR Topic Number DHS211-007

TITLE: Software Supply Chain Identification for Compiled Binary Executables

TECHNOLOGY AREAS: Cybersecurity

OBJECTIVE: Develop a commercial capability to analyze compiled binary executables for Windows systems that can detect and report embedded software library information in multi-faceted software packages.

DESCRIPTION: Computing systems contain increasing and changing software applications from a wide variety of vendors and sources. These applications contain numerous libraries for them to function, which are often not known to the end-user and considered a black box. When these libraries or their dependencies are discovered to have a vulnerability, the end-user relies exclusively on the software publisher to recognize the vulnerability, potentially leaving a time-gap where the vulnerability can be exploited before the publisher notifies affected end-users of the issue. This use-case is magnified when the publisher no longer maintains a piece of software. Current market capabilities lack the sophisticated detection techniques that are needed by the homeland security enterprise (HSE) to protect critical cybersecurity missions from vulnerable and embedded software libraries.

Currently, industry products can detect software libraries within scripting-language based software, byte-code software, and in source codes. As current capabilities do not detect software libraries in compiled binary executables without source codes, there is a need to address a gap that leaves out a significant portion of the software market used daily by professionals and government employees, especially in software that is used and no longer maintained, or “free”. Today’s market capabilities do not address this gap, and it affects DHS components and industry.

The goal of this research is to close this gap by providing a tool that identifies the libraries in compiled software (C/C++ developed software, without source code available) within 64-bit Microsoft Windows systems. This research will enable organizations to more strategically assess, rank, and prioritize security mitigation efforts in order to maintain a high-level of work efficiency and security throughout their organizations. A product that fills this gap could be advertised to chief information security officers, security operation centers, and information technology organizations as a tool to understand their current systems and be able to respond faster to emerging vulnerabilities. This capability could augment the DHS labor force with tools to increase the effectiveness and efficiency of cyber analysts by discovering vulnerabilities in software that come from the libraries they depend on and perform risk calculations on new software. Such a system might incorporate a database of libraries, a software analyzer, and an intuitive user interface.

The requirements for this effort are:

- A prototype software package that is able to detect at least 75 embedded software libraries in compiled software binary executables
- The system must be able to digest and process Windows x64 binaries, including .exe, .dll, and .sys files
- The system must run on a Windows or Linux host

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- The system must produce a report on the software libraries discovered, including version numbers
- The source code of the system, operating instructions, and any accompanying databases and signatures, must be delivered

PHASE I: Produce a report regarding the feasibility of the idea and plan, including milestones of how Phase II would be achieved. An alpha-prototype of the capability is encouraged. The performer shall provide monthly status reports and a final report at the end of the period of performance.

PHASE II: Provide a prototype that meets the requirements described in the description, and documentation to include compilation instructions and all source codes. The prototype will be tested against multiple binary executable samples (including both malicious and non-malicious samples from other DHS components) to determine the accuracy of the detection algorithms, the robustness of the prototype, and the intuitiveness of the interface.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: At the end of Phase III, there can be several applications of this technology:

- DHS and the HSE may be interested in licensing the tool, to include a background service on local endpoints, and a cloud service to submit other samples.
- CISA may be interested in having a license for this tool be a part of their analyst systems.
- Within the federal government, IT organizations can use this tool to scan their endpoint systems and gain an understanding of the software that they have and the libraries that they contain.
- Within the federal government, further development of the application can lead to a system to be deployed and assist in discovering vulnerable endpoints based on their application libraries.
- Regarding commercial applications, a technology like this can be used in IT organizations to scan their endpoint systems and gain situational awareness of the libraries that are being used in applications on those systems.
- Another commercial application includes a service where customers upload binaries to a system, which performs the scans, and provides cross references to published Common Vulnerabilities and Exposures (CVE) data.

REFERENCES: The following references are software packages that perform this kind of work for scripted codes and byte codes, but not compiled binaries.

- 19 Zero-Day Vulnerabilities Amplified by the Supply Chain (example of need for this kind of product) <https://www.jsf-tech.com/ripple20/>
- Black Duck Software Composition Analysis (example of a solution in another space) <https://www.synopsys.com/software-integrity/security-testing/software-composition-analysis.html>
- Veracode Software Composition Analysis (example of a solution in another space) <https://www.veracode.com/products/software-composition-analysis>
- Software Composition Analysis (example of a solution in a another space) <https://www.whitehatsec.com/platform/software-composition-analysis/>
- Software Composition Analysis: A Matter of Perspective and Experience (example of a solution in another space) <https://blog.sonatype.com/software-composition-analysis>

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KEY WORDS: Cybersecurity, software assurance, binary analysis, application security, software composition analysis, software triage

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SBIR Topic Number DHS211-008

TITLE: Intelligent Document Design: Combating Industry Trends Incentivizing Weak Security

TECHNOLOGY AREAS: Document Authentication, Fraud Prevention and Detection, Credentialing and Vetting, Security Printing

OBJECTIVE: Provide a means and/or the delivery of a document security feature(s) that can be integrated into existing security print processes that increases the security value of the document and provides frontline personnel an effective means to detect anomalies in genuine identity documents.

DESCRIPTION: Design and implement cost effective security features that provide frontline personnel of Department of Homeland Security (DHS) components an overt (Level 1) and/or covert (Level 2) detection vector(s) that can be used to identify anomalies from genuine document issuance and are more resistant to counterfeiting.

The challenge frontline personnel face is the result of two competing factors.

The first factor is that over the last 3 years, the United States Customs and Border Protection (CBP) Fraud Document Analysis Unit (FDAU) has seized an exponentially increasing number of high-quality counterfeit State licenses. These counterfeits typically simulate background artwork and ghost portraits using ink jet technologies. They also include accurate simulations of laser perforation, laminate features like UV, tactile data, plate features and laser images (Changeable Laser Image (CLI)/Multiple Laser Image (MLI)). While forensic level examinations can detect anomalies in a laboratory environment, frontline officers in multiple DHS components face enormous challenges to identify an anomaly in an operational setting. While machine authentication technologies are being deployed, significantly reducing the burden to the human end user, machine alarm resolution will remain contingent on the end user's skills and decision-making capabilities.

The second factor is the low-price bid strategy that many State issuing authorities use in awarding contracts for design and implementation of their identity documents. Industry is not incentivized to design/implement features that can withstand the efficiencies gained from mass-produced State document counterfeiting. Acknowledging that digital credentials are a medium-term future, it is not likely digital IDs will eradicate physical credentials.

In attempt to respond to these factors, DHS components are updating their training approach to increase the amount of hands-on activities comparing counterfeits against genuine exemplars and supplying Field operations with ID training kits to afford self-paced study of counterfeits.

PHASE I: Define and determine the technical feasibility of implementing a security feature or set of security features that can be integrated into the issuance and/or design of existing security printing at a low cost. Phase I includes a written plan to deliver a minimum viable product at the end of Phase II.

The Phase I assessment and plan does not have to be limited to a security feature(s); it can be a new or modified printing or design technique using new or existing security inks or materials.

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PHASE II: Provide a minimum viable product of a security feature or set of security features that can be integrated into existing identity document issuance or design. Deliverables may include a prototype of the new identity document, as blank exemplars or as an added feature to an existing genuine State exemplar.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Improving security to State identity documents is intended to improve DHS frontline personnel's ability to authenticate *and* detract from the ability of counterfeiters effectively simulating security features.

Commercial applications and opportunities exist with State issuing authorities. Successfully completing Phase II allows for a relatively easy-to-market transition given the objective. Small businesses may be able to enhance the existing industry that has contributed to weaker document security.

REFERENCES:

Terrorist use of Fraudulent Identity Documents:

- Todd Bensman. "What Terrorist Migration Over European Borders Can Teach About American Border Security", Center for Immigration Studies, 6 November 2019.
<https://cis.org/Report/Terrorist-Migration-Over-European-Borders>
- Senator Tom Coburn. "A Review of the Department of Homeland Security's Missions and Performance, January 2015."
<https://www.hsgac.senate.gov/imo/media/doc/Senator%20Coburn%20DHS%20Report%20FINAL.pdf>
- "Piecing together Salah Abdeslam's itinerary in Paris attacks: Days on end at the wheel and months of planning", The Associated Press, 10 December 2015.
<https://nationalpost.com/news/world/days-at-the-wheel-and-months-of-planning-mark-lead-up-to-the-paris-attack-for-man-still-on-the-run>
- Driver's License Security: Federal Leadership Needed to Address Remaining Vulnerabilities
<https://www.gao.gov/products/GAO-12-893>

KEY WORDS: Credential Authentication, Security Printing, Fraud, Identity Concealment, Terrorist pre-operational movement, Evasion, Terrorist evasion

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SBIR Topic Number DHS211-009

TITLE: High Throughput Non-Ionizing Screening Capability for Identifying Contraband

TECHNOLOGY AREAS: High throughput screening; contraband detection; using non-ionizing radiation or other methods.

OBJECTIVE: Develop deployable, low-cost, high throughput screening capability that does not use ionizing radiation to detect a variety of contraband and discriminate illicit from lawful materials

DESCRIPTION: DHS S&T desires to enhance the capability to detect the transport of contraband and threats in all vectors including cargo, containers, automobiles, rail, mail, and express consignment by improving the performance and operational resiliency of screening technologies. Screening is challenging because of the diversity in the commerce transported, the complexity of the supply chain across air, land and sea, the necessity for speed in the flow of commerce, the volume of traffic across the U.S. borders, and the safety of technologies used.

The goal is to improve the detection of illegal threats and materials transiting United States Customs and Border Protection (CBP) Ports of Entry (POE). This is challenging due to the large volume of conveyances, material and cargo entering the United States on a daily basis. These legal border crossings and checkpoints have concerns for both materials and persons that limit the type of inspection tools that can be safely used. Mail screening facilities may have physical limitations to introduce large format screening equipment.

While current systems provide a capability to screen vehicles and large cargo containers and conveyances, they can be costly to maintain and operate. Additional detection technologies are sought that offer similar or improved material discrimination and object/anomaly detection and to increase the likelihood of successful detection. Currently fielded screening technologies that use non-ionizing radiation are limited in their use due to slow identification processes, limited threat libraries, labor intensive collection of samples, cost to purchase and the use of systems consumables, and/or high false alarm rates and nuisance detection/alarms. Some examples of screening technologies currently used or commercially available are optical spectroscopy systems (IR, Raman, UV and other regions of the electromagnetic spectrum), mass spectrometry, ion mobility spectrometry or other analytical techniques for chemical analysis.

The solutions, used primarily for secondary inspection, should include the integration of classification and detection algorithms with state-of-the-art hardware demonstrating material identification, object detection and discrimination and their deployment.

The key objective of this effort is to deliver additional distributed screening modalities to CBP users. Functional requirements should include a capability to rapidly scan conveyances, cargo, or other complex surfaces, at standoff distances and at speed to include:

- **Functionality to Detect and Discriminate.** Must provide usable and relevant information to the screener in a manner suitable to distinguish materials of concern. Demonstrate the ability to identify, detect and discriminate a variety of materials and hazard types, including, but not limited to; animal, mineral, vegetable, drugs (e.g. opioids), frozen and liquid substances, radioactive, and other materials of concern. Must provide clear indication to the operator of alarm/clear conditions while operating in the proposed environment.

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- **Speed.** Performance must allow cargo to be scanned and assessed with results provided in seconds while scanning either from a moving platform or containers moving at speeds of up to 10 mph.
- **Portability.** Handheld unit that weighs under 10 lbs., while providing high resolution, relevant and accurate results.
- **High-resolution.** Provide adequate output resolution to allow effective screening discrimination.
- **Cost.** Capability must be under \$50,000

PHASE I: Design a concept of a non-ionizing screening capability with the Detection Discrimination functionality listed in the description. The concept should demonstrate the results and metrics of the screening ability to detect and distinguish the various materials of concern stated by the government. Phase I will include engineering and trade studies on the scientific basis for the design concept. The concept design should address a master schedule and program plan, technical documentation, drawings, security and privacy considerations, and CONOPS.

PHASE II: Develop an operational prototype demonstrating the screening capability designed in Phase I, that can be tested in a laboratory environment and then used in an operational environment.

The demonstrations will be held at a factory/ lab environment and then at one to two stakeholder locations.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Phase III will include commercialization to include manufacturing at scale; QA/QC for manufacturing and testing; import/export requirements for international applications; and expanded transition into DHS field operations.

Phase III transition and commercialization, funded separately, will look to implement the new technology (initially) with those DHS component stakeholders involved in Phase I and Phase II to include;

DHS Component Potential Transition Partners

- a) Customs and Border Protection: for cross-border inspections
- b) US Coast Guard: for vessel border and interdiction (will require a different design for USCG Boarding teams)

Commercialization Dual Use

Security users and police

REFERENCES:

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2) Environmental Protection Agency. Radiation and Airport Security Scanning <https://www.epa.gov/radtown/radiation-and-airport-security-scanning>

3) NSI Homeland Security Panel. 2010. Standards for Non-Invasive Inspection Systems for Homeland Security, Final Workshop Report.

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KEY WORDS: Cargo screening; contraband detection; non-ionizing radiation

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SBIR Topic Number DHS211-010

TITLE: Screening Sensor Technology as part of Passenger Checked Luggage

TECHNOLOGY AREAS: explosives detection, low power sensors, checked baggage screening, chemical sensing

OBJECTIVE: Develop a sensor for inclusion in passenger checked baggage that screens for threat exposure prior to check in, streamlining and improving the baggage screening process.

DESCRIPTION: The screening of passenger checked baggage using traditional Explosives Detection Systems (EDS) faces many challenges in developing a broadly applicable detection capability that addresses commercial, military and homemade explosives (HME) threats. Established primary checked baggage explosives detection technologies evolved from medical X-ray systems. These conventional transmission X-ray methods utilize two derived discriminating signatures: effective atomic number and density of screened objects. The requirements of high detection standards lead to primary screening false alarm rates which generate a greater demand for Transportation Security Officer (TSO) secondary screening to resolve false alarms. This results in increased TSO manpower requirements and reduced screening throughput, and therefore higher screening costs to Transportation Security Administration (TSA) and significant passenger inconvenience due to screening delays.

Signal to noise ratio is a limiting factor in the detection of explosives and related false alarm performance and increasing the signal at security checkpoints or other limiting chokepoints is difficult. Increasing the interrogating radiation intensity of an EDS system is costly and a safety issue for operators; longer interrogations times decrease throughput, which creates schedule risk to passengers and creates additional manpower costs to the TSA.

Improvements to current checked baggage screening capabilities are needed to provide an acceptable level of detection on all threats, significantly reduce primary screening false alarms, and improve overall screening throughput. Enhancing the ability to reduce/resolve aviation security screening alarms is identified in the TSA Strategy Plan (2018-2026) and by the Aviation Security Integrated Product Team as a priority capability gap. TSA's Electronic Baggage Screening Program has established an operational performance objective to require checked baggage primary automated screening performance to demonstrate a net false alarm rate of less than 10%. To reach this goal, DHS S&T has a need to identify advanced technologies that can increase the discrimination between explosives and stream-of-commerce clutter in checked baggage.

S&T is seeking sensing modalities using the passenger luggage itself as the sensor or as host for a sensor to scan for threat exposure over time before a passenger arrives at an airport. Such an in-luggage sensing capability would be greatly able to increase sensor time with the luggage and be queried at the airport by a TSO. It would also enable a concept of operations wherein luggage was screened somewhere other than the airport check-in, utilizing time before a passenger needs to arrive at an airport, and sealed—using the luggage sensor as a protection against tampering. TSA has expressed interest in developing a PreCheck-like or PreCheck compatible option for a reduced checked baggage screening methodology. The use of such baggage by passengers would enable more efficient screening such as quick readouts of the scanner instead of x-ray/CT scans, and later check-ins for bags. Additional benefits of this solution include an expansion to detecting

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components of gas forming reactions, a recent area of TSA concern, and expansion to law enforcement concerns such as opioid detection.

S&T is seeking development of innovative, low-cost (\$5-10/sensor in production), internally powered, durable, tamper-proof sensors using any relevant methodology. Such sensors should not significantly impact the weight of a typical passenger checked bag (typical 50 lbs. before being considered overweight by airlines) Considerations for such sensors will include high sensitivity, low power operation, and potential for eventual manufacturability.

PHASE I: Identify and define a sensing mechanism suitable for installation in passenger luggage, with a feasible development path to appropriate sensitivity, durability, and cost. The offeror shall produce a final technical report and a roadmap for future development of the technology.

PHASE II: Develop, test and demonstrate a prototype of the novel sensing mechanism, to include life cycle testing and demonstration. The offeror shall also develop and deliver a cost model for at-scale commercial deployment of sensors in luggage to the travelling public.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: The eventual homeland security application would be the enabling of luggage with sensors that would provide augmented screening, or be eligible for lighter screening, if CONOPS developments permit. This luggage would trigger fewer false alarms and fewer occurrences of manual inspections, greatly reducing the need for TSO deployment in the checked baggage area and freeing up TSA resources. Potential commercial applications of the technology include long-term environmental and chemical monitoring.

REFERENCES:

Ricci, Peter & Gregory, Otto. (2020). [Continuous Monitoring of TATP Using Ultrasensitive, Low-Power Sensors](#). IEEE Sensors Journal. PP. 1-1. 10.1109/JSEN.2020.3008254.

Gao, T.; Woodka, M. D.; Brunschwig, B. S.; Lewis, N. S., [Chemiresistors for array-based vapor sensing using composites of carbon black with low volatility organic molecules](#). *Chem. Mater.* **2006**, 18 (22), 5193-5202.

McCaig, H. C.; Myers, E.; Lewis, N. S.; Roukes, M. L., [Vapor sensing characteristics of nanoelectromechanical chemical sensors functionalized using surface-initiated polymerization](#). *Nano Lett.* **2014**, 14 (7), 3728-3732.

Askim, J. R.; Li, Z.; LaGasse, M. K.; Rankin, J. M.; Suslick, K. S. "An optoelectronic nose for identification of explosives" [Chem. Sci., 2016, 7, 199-206](#). DOI: 10.1039/c5sc02632f

KEY WORDS: Sensors, explosives detection, checked baggage, chemical sensing

TECHNICAL POINT OF CONTACT:

Dashunda McDonley, dashunda.mcdonley@hq.dhs.gov

SBIR Topic Number DHS211-011

TITLE: Fieldable multiplex detection of Biothreats

TECHNOLOGY AREAS: Bio detection, Biothreats, Bio surveillance

OBJECTIVE: Develop advanced bio detection technology which will be used to detect multiple biothreats within a sample in the field.

DESCRIPTION: The government is seeking an innovative bio detection technology that would be used to detect biothreats, such as toxins, bacteria and viruses, in the field. This bio detection technology would be used to detect multiple biothreats within a sample at a time. There are currently very limited, reliable, fieldable multiplex biothreat detectors available. As a result, if a biothreat is suspected, there is very limited fieldable technology available to determine whether there is a biothreat present. Typically, if a biothreat is suspected, a sample is collected and sent to a laboratory for testing to determine if and what biothreat is present. This can take hours to days to properly rule out if a biothreat is present which essentially halts response and freezes access to a location until it is ruled free from a given biothreat. Many of the current fieldable biothreat technologies have limited panels of biothreats for detection, are time consuming because a sample needs to be tested individually for each biothreat of interest and have major issues with false negative/positive results.

The proposed technology must meet the following performance objectives;

- The ability to detect multiple biothreats in each sample.
- Precision and accuracy of detection of at least 90%.
- Has the ability to add biothreats of interest to multiplex panel to account for new biothreats of interest.
- The ability to operate at various outdoor temperatures.
- Be portable and easily accessible.
- Produces results within 1 hours.

PHASE I: Develop the initial bio detector design which includes: size, weight, battery life, sample collection method, method of detection, how results will be analyzed, how results will be displayed, stability of reagents, maintenance requirements, planned costs, proposed multiplex panel(s), and testing plan. Offeror must demonstrate the ability to obtain, design, and develop a bio detector that will meet the performance objectives. Offeror must demonstrate the ability to obtain biothreat (toxins, bacterial, viruses) pathogens needed to test fieldable bio detection. Offeror must demonstrate the ability of multiplex detection of at least 3 biothreats within a given sample during one detection run.

PHASE II: Develop four bio detector prototypes and demonstrate their performance capabilities as outlined in the description of the topic. This will be done in two iterations. During the first, finalize an initial prototype bio detector, and develop a multiplex panel for at least 3 biothreats, and characterize results and analysis.

Following testing of the first unit, the offeror must develop at least three units for testing based on the results and analysis of the first prototype and successfully complete multiplex runs for at least 3 biothreats at a given time (multiple multiplex panels can be developed to detect more biothreats).

Pre-Solicitation

In addition to prototype development and analysis, a cost schedule for reagents, materials and maintenance must be established. Plans to transition the prototype system as a commercial product, with identification of a transition partner must also be developed.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: Provide the final design and evaluation of the prototype system and transition of the prototype system as a commercial product for integration into detector systems. The resulting material should be able to be integrated into passive and active detection equipment used for assessing situations in which biological threats is suspected. Further uses may include use in other bio detection programs & used by first responders. This technology could be further developed to look for novel bio threats by developing a library for future detection. This technology could also be used to detect soil pathogens as it relates to bio surveillance in agricultural setting.

Potential end users for this technology are; first responders such as FBI (Federal Bureau Investigation), CBP (Custom Border Patrol), TSA (Transportation Security Administration), Military entities and federal & state stakeholders.

REFERENCES:

1. George M. Dougherty, David S. Clague, and Robin R. Miles "Field-capable biodetection devices for homeland security missions", Proc. SPIE 6540, Optics and Photonics in Global Homeland Security III, 654016 (4 May 2007); <https://doi.org/10.1117/12.719841>
2. Mariella R Jr. Sample preparation: the weak link in microfluidics-based biodetection. *Biomed Microdevices*. 2008;10(6):777. <https://doi.org/10.1007/s10544-008-9190-7>
3. Arif M, Fletcher J, Marek SM, Melcher U, Ochoa-Corona FM. Development of a rapid, sensitive, and field-deployable razor ex BioDetection system and quantitative PCR assay for detection of *Phymatotrichopsis omnivora* using multiple gene targets. *Appl Environ Microbiol*. 2013;79(7):2312-2320. <https://doi.org/10.1128/AEM.03239-12>

KEY WORDS: biodetection, field biodetection, bioterrorism, rapid biodetection, biothreats, multiplex detection.

TECHNICAL POINT OF CONTACT: Rakeiya A. McKnight, Rakeiya.Mcknight@hq.dhs.gov,

SBIR Topic Number DHS211-012

TITLE: Diagnostic tools for detection of African Swine Fever (ASF) virus

TECHNOLOGY AREAS: Food, Agriculture, Veterinary, Threat Detection, Biological

OBJECTIVE: Develop a rapid laboratory diagnostic test and field screening tools for detection of African Swine Fever virus.

DESCRIPTION: Currently the United States lacks a rapid laboratory diagnostic test for detection of African Swine Fever virus (ASFV). ASFV is the causative agent of African Swine Fever (ASF), a hemorrhagic fever affecting domestic pigs. This disease can cause rapid-onset (as little as one week), high mortality rates in swine. While ASFV does not infect humans, this disease poses a significant threat to US food security and the food supply chain and could cause devastating economic losses.

Currently, the US, Japan, China, the European Union, and Mexico represent the leading exporters of pork. However, the US also imported approximately \$1.1 billion of pigs and pork products in 2019. Outbreaks of ASF are ongoing in China, eastern Europe, SE Asia, and sub-saharan Africa. While the US currently remains ASF-free, and importation from ASF-affected countries is illegal, shipments to the US from these countries do still occur. This is evidenced by a Customs and Border Patrol effort to intercept and seize a large illegal pork shipment from China in March 2019. The importation of ASF via infected swine or via ASF-infected *Ornithodoros* ticks, could spread throughout the US and have a devastating impact.

There is currently no effective treatment for affected pigs, a reliable vaccine to protect against the virus, nor a rapid diagnostic test or field screening tools for identification of infected animals. Development of a novel, rapid laboratory diagnostic test would greatly improve on-site inspection capabilities and better secure the US and its allies against this disease. Additionally, development of a field screening tool to detect infected swine that have not yet developed signs and symptoms of the disease would enable inspection teams to better detect potential outbreaks and isolate/quarantine animals before an outbreak could occur. This effort should enable screening teams to collect samples at points of entry for transfer and analysis via a rapid diagnostic test as well as development of a field screening tool for use during site visits.

PHASE I: Determine technical feasibility of a target for use in rapid laboratory diagnostic screens and field screening equipment with proof of concept preliminary test results. Identify potential realistic targets and show potential for use in laboratory-based diagnostic tests and field deployable screening tools. Determine cost model for tools to work in the field.

PHASE II: Development of a rapid diagnostic laboratory test for detection of ASFV. Additionally, the team should produce a prototype of a field screening tool for on-site inspection uses, including a cost analysis.

PHASE III: COMMERCIAL OR GOVERNMENT APPLICATIONS: The rapid laboratory diagnostic assay as well as field screening prototypes could be used at port of entry sites for inspection of imported swine to ensure security of the US food chain. The laboratory diagnostic assay and field screening tool could become commercial products for use throughout the US as

well as by US allies around the world.

Potential end users for this technology are; first responders such as FBI (Federal Bureau Investigation), CBP (Custom Border Patrol), TSA (Transportation Security Administration), Military entities and federal & state stakeholders.

REFERENCES:

1. OIE World Animal Health Information System (2013, December 30) (information for 2020).
https://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseaseoutbreakmaps
2. Central Intelligence Agency, The World Factbook *Field Listing: Imports – Commodities*. <https://www.cia.gov/library/publications/the-world-factbook/geos/us.html>
3. The Ohio State University College of Food, Agricultural, and Environmental Sciences. *US Customs Seizes Illegal Chinese Pork Shipment* <https://ocj.com/2019/03/u-s-customs-seizes-illegal-chinese-pork-shipment/>

KEY WORDS: African swine fever virus, ASF, diagnostics, food security

TECHNICAL POINT OF CONTACT: Jarrad M. Marles, PhD, jarrad.marles@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 the 21.1 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 the 21.1 Solicitation are encouraged to submit SAFETY Act applications on their applicable 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 (VCOs), 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>	

ATTACHMENT 4: SAMPLE NON-DISCLOSURE AGREEMENT

**NON-DISCLOSURE AGREEMENT
SOLICITATION :TBD**

The Parties to this Agreement agree that (a yet to be determined company) and its supporting consultants and subcontractors also under non-disclosure agreement, may have access to proprietary information of Offeror contained within the technical and cost proposals, solely to perform technical advisory services for the Government, in evaluating proposals submitted in response to this Solicitation.

The Parties agree to protect the proprietary information from unauthorized use or disclosure for as long as it remains proprietary, and to refrain from using the information for any purpose other than that for which it was furnished.

Company Name (Offeror)

Name of Company Official, Printed

Signed

Dated

Name of Company Official, Printed
Company to be Determined

Signed

Dated