

Defense Threat Reduction Agency (DTRA)
DoD 2023.4 Small Business Innovation Research (SBIR) Program
Proposal Submission Instructions

August 23, 2023: Topics issued for pre-release

September 20, 2023: DTRA begins accepting proposals

October 11, 2023: DSIP Topic Q&A closes to new questions at 12:00 p.m. ET

October 18, 2023: Deadline for receipt of proposals/whitepapers no later than **12:00 p.m. ET**

INTRODUCTION

The Defense Threat Reduction Agency (DTRA) mission is to enable the DoD, the U.S. Government, and International Partners to counter and deter Weapons of Mass Destruction (WMD) Chemical Biological, Radiological, Nuclear) and Improvised Threat Networks. The DTRA SBIR program is consistent with the purpose of the Federal SBIR/STTR Program, i.e., to stimulate a partnership of ideas and technologies between innovative small business concerns and through Federal-funded research or research and development (R/R&D).

The approved FY23.4 topics solicited for the Defense Threat Reduction Agency (DTRA) Small Business Innovation Research (SBIR) Program are included in these instructions followed by the full topic description. Offerors responding to this Broad Agency Announcement (BAA) must follow all general instructions provided in the related Department of Defense Annual Program BAA and submit proposals by the date and time listed in this release. Specific DTRA requirements that add to or deviate from the DoD Annual Program BAA instructions are provided below with references to the appropriate section of the DoD document.

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

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

The DTRA Small Business Innovation Research (SBIR) Program is implemented, administered, and managed by the DTRA SBIR/STTR Program Office. Specific questions pertaining to the administration of the DTRA SBIR program and these proposal preparation instructions should be directed to:

Mr. Mark D. Flohr
DTRA SBIR/STTR Program Manager
Mark.D.Flohr.civ@mail.mil
Tel: (571) 616-6066

Defense Threat Reduction Agency
8725 John J. Kingman Road
Stop 6201
Ft. Belvoir, VA 22060-6201

For technical questions about specific topic requirements during the pre-release period, contact the DTRA Technical Point of Contact (TPOC) for that specific topic. To obtain answers to technical questions during the formal BAA open period, visit: <https://www.dodsbirsttr.mil/submissions/login>. For questions regarding the Defense SBIR/STTR Innovation Portal, contact DSIP Support at: dodsbirsupport@reisystems.com.

Proposals not conforming to the terms of this announcement will not be considered. DTRA reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality as determined by DTRA will be funded. DTRA reserves the right to withdraw from negotiations at any time prior to contract award. The Government may withdraw from negotiations at any time for any reason to include matters of national security (foreign persons, foreign influence or ownership, inability to clear the firm or personnel for security clearances, or other related issues).

Please read the entire DoD announcement and DTRA instructions carefully prior to submitting your proposal as there have been significant updates to the requirements.

This release contains an open topic. As outlined in section 7 of the SBIR and STTR Extension Act of 2022, innovation open topic activities—

- (A) Increase the transition of commercial technology to the Department of Defense;
- (B) Expand the small business nontraditional industrial base;
- (C) Increase commercialization derived from investments of the Department of Defense; and
- (D) Expand the ability for qualifying small business concerns to propose technology solutions to meet the needs of the Department of Defense.

Unlike conventional topics, which specify the desired technical objective and output, open topics can use generalized mission requirements or specific technology areas to adapt commercial products or solutions to close capability gaps, improve performance, or provide technological advancements in existing capabilities.

A small business concern may only submit one (1) proposal to each open topic. If more than one proposal from a small business concern is received for a single open topic, only the most recent proposal to be certified and submitted prior to the submission deadline will receive an evaluation. All prior proposals submitted by the small business concern for the same open topic will be marked as nonresponsive and will not receive an evaluation.

OPEN TOPIC GUIDELINES

DTRA will have one Open Topic (DTRA234-P01) for the SBIR 2023.4 Broad Agency Announcement and will incorporate a two-step Whitepaper process using a Technical Feasibility review approach providing a formal review of the proposed technical merit and feasibility. **This two-step process is applicable to topic DTRA234-P01 ONLY.** For those firms wishing to submit a proposal to the Open Topic please follow the instructions below. Firms must clearly identify the unique topic number in their proposal. Additionally, please follow carefully the requirements of Volume 5 as stated in the DoD Annual SBIR Program BAA.

OPEN TOPIC STEP ONE: Proposing small business concerns must certify and submit, by the deadline stated in the DoD BAA, the following proposal volumes in DSIP:

1. All Firm-level Forms. On the Defense SBIR/STTR Innovation Portal (DSIP) at <https://www.dodsbirsttr.mil/submissions/>, prepare the Firm-level Forms – Firm Certifications, Audit Information, and Company Commercialization Report (CCR).
2. Supporting Documents (Volume 5). All proposing small business concerns are REQUIRED to submit the following documents to Volume 5:
 - a. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment

- b. Disclosures of Foreign Affiliations or Relationships to Foreign Countries
- c. Disclosure of Funding Sources

In addition, a white paper outlining the proposed effort must be uploaded to Volume 5.

- a. White paper format:
 - 3-5 pages/1,000-1,200 words in length;
 - Single-column, single spaced typed lines format on the standard 8 1/2" x 11" paper with 1-inch margins. The header on each page of the whitepaper should contain your company name, topic number, and proposal number assigned by DSIP when the proposal was created. The header may be included in the one-inch margin.
- b. The paper should be a formalized focus on technical merits and feasibility of the project, which defines the specific technical problem and includes the research and development effort to determine the feasibility of the proposed approach to a solution. Any related significant activities by the offeror that relate directly to the proposed effort should be included.

Upon the deadline listed, subject matter experts in the technical field will review the white papers to determine suitability for full proposal submission. DTRA will review the technical merit of the whitepaper considering the Principal Investigator's assumptions, the technical approach, analysis, proposed results/conclusions and potential for commercialization. The DTRA SBIR/STTR Selection Authority will review and approve those white papers selected to move forward.

OPEN TOPIC STEP TWO: Offerors whose White Paper were favorably reviewed and selected for proposal submittal will receive, within 20 days, notification from DTRA with instructions for submitting a full proposal following guidelines provided in the DoD Annual Program BAA and the DTRA 2023.4 SBIR Instructions. Proposals that are submitted without prior notification from DTRA will not receive an evaluation.

Technical Volume (Volume 2)

The technical volume is not to exceed a twenty (20) pages and must follow the formatting requirements provided in the DoD Annual SBIR Program BAA. Any pages in the technical volume over 20 pages will not be considered in proposal evaluations.

Content of the Technical Volume

Please review the DoD Annual Program BAA and the DTRA 2023.4 SBIR Phase I Proposal Guidelines below for further details.

Cost Volume (Volume 3)

The Phase I Base amount must not exceed \$167,500. For the Cost Volume, The Defense Threat Reduction Agency requires the use of a Microsoft excel spread sheet which is available on the DSIP portal. Note: The DTRA Cost Volume template and instructions will be accessible once the Cost Volume is initiated.

At least 2/3 (66 2/3 %) of the research and/or analytical work in Phase I must be conducted by the proposing firm. The percentage of work is measured by both direct and indirect costs as a percentage of the total contract cost.

Company Commercialization Report (CCR) (Volume 4)

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

Supporting Documents (Volume 5)

All proposing small business concerns are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment
2. Disclosures of Foreign Affiliations or Relationships to Foreign Countries
3. Disclosure of Funding Sources

Please refer to the DoD Annual Program BAA for more information.

In addition to mandatory/required supporting documents as outlined in the DoD Annual Program BAA, proposers must include the original whitepaper **and** the notification to submit a full proposal within Volume 5. Additional supporting documents can be included in this Volume as well.

Fraud, Waste and Abuse Training (Volume 6)

Fraud, Waste and Abuse (FWA) training is required for all proposals. Please refer to the DoD Annual Program BAA instructions for full details.

PHASE I PROPOSAL GUIDELINES

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

Technical Volume (Volume 2)

The technical volume is not to exceed 20 pages and must follow the formatting requirements provided in the DoD SBIR Annual Program BAA. Any pages in the technical volume over 20 pages will not be considered in proposal evaluations.

Content of the Technical Volume

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

(a) Identification and Significance of the Problem or Opportunity.

Define the specific technical problem or opportunity addressed and its importance.

(b) Phase I Technical Objectives.

Enumerate the specific objectives of the Phase I work, including the questions the research and development effort will try to answer to determine the feasibility of the proposed approach.

(c) Phase I Statement of Work (including Subcontractors' Efforts)

- (1) Provide an explicit, detailed description of the Phase I approach. The Statement of Work should indicate what tasks are planned, how and where the work will be conducted, a schedule of major events, and the final product(s) to be delivered. The Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the Technical Volume section.
- (2) This BAA may contain topics that have been identified by the Program Manager as research or activities involving Human/Animal Subjects and/or Recombinant DNA. In the event that Phase I performance includes performance of these kinds of research or activities, please identify the applicable protocols and how those protocols will be followed during Phase I. Please note that funds cannot be released or used on any portion of the project involving human/animal subjects or recombinant DNA research or activities until all of the proper approvals have been obtained. **Submitters proposing research involving human and/or animal use are encouraged to separate these tasks in the technical proposal and cost proposal in order to avoid potential delay of contract award.**

(d) Related Work.

Describe significant activities directly related to the proposed effort, including any conducted by the principal investigator, the proposing firm, consultants, or others. Describe how these activities interface with the proposed project and discuss any planned coordination with outside sources. The technical volume must persuade reviewers of the proposer's awareness of the state-of-the-art in the specific topic. Describe previous work not directly related to the proposed effort but similar. Provide the following:

- (1) Short description,
- (2) Client for which work was performed (including individual to be contacted and phone number), and
- (3) Date of completion.

(e) Relationship with Future Research or Research and Development

- (1) State the anticipated results of the proposed approach if the project is successful.
- (2) Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort.
- (3) Identify the applicable clearances, certifications and approvals required to conduct Phase II testing and outline the plan for ensuring timely completion of said authorizations in support of Phase II research or research and development effort.

(f) Commercialization Strategy. Describe in approximately one page your company's strategy for commercializing this technology in DoD (such as a formal DoD Program), other Federal Agencies, and/or private sector markets. Provide specific information on the market need the technology will address and the size of the market. Also include a schedule showing the quantitative commercialization results from this SBIR project that your company expects to achieve.

- (g) Key Personnel.** Identify key personnel who will be involved in the Phase I effort including information on directly related education and experience. A concise technical resume of the principal investigator, including a list of relevant publications (if any), must be included (Please do not include Privacy Act Information). All resumes will count toward the page limitations for Volume 2.
- (h) Foreign Citizens.** Identify any foreign citizens or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For these individuals, please specify their country of origin, the type of visa or work permit under which they are performing and an explanation of their anticipated level of involvement on this project. Proposers frequently assume that individuals with dual citizenship or a work permit will be permitted to work on an SBIR project and do not report them. This is not necessarily the case and a proposal will be rejected if the requested information is not provided. Therefore, firms should report any and all individuals expected to be involved on this project that are considered a foreign national as defined in the BAA. You may be asked to provide additional information (e.g., copy of valid passport, visa, work permit, etc.) during negotiations in order to verify the foreign citizen's eligibility to participate on an SBIR contract. Supplemental information provided in response to this paragraph will be protected in accordance with the Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)).
- (i) Facilities/Equipment.** Describe available instrumentation and physical facilities necessary to carry out the Phase I effort. Justify equipment purchases in this section and include detailed pricing information in the Cost Volume. State whether or not the facilities where the proposed work will be performed meet environmental laws and regulations of federal, state (name), and local Governments for, but not limited to, the following groupings: airborne emissions, waterborne effluents, external radiation levels, outdoor noise, solid and bulk waste disposal practices, and handling and storage of toxic and hazardous materials.
- (j) Subcontractors/Consultants.** Involvement of a university or other subcontractors or consultants in the project may be appropriate. If such involvement is intended, it should be identified and described to the same level of detail as the prime contractor costs. A minimum of two-thirds (66%) of the research and/or analytical work in Phase I, as measured by direct and indirect costs, must be conducted by the proposing firm, unless otherwise approved in writing by the Contracting Officer. For Phase II, a minimum of one-half (50%) of the research and/or analytical work must be performed by the proposing firm. The percentage of work is measured by both direct and indirect costs. SBIR efforts may include subcontracts with Federal Laboratories and Federally Funded Research and Development Centers (FFRDCs). A waiver is no longer required for the use of federal laboratories and FFRDCs; however, proposer must certify their use of such facilities on the Cover Sheet of the proposal.

For both Phase I and II, the primary employment of the principal investigator must be with the small business firm at the time of the award and during the conduct of the proposed effort. Primary employment means that more than one-half of the principal investigator's time is spent

with the small business. Primary employment with a small business concern precludes full-time employment at another organization.

(k) Prior, Current, or Pending Support of Similar Proposals or Awards. If a proposal submitted in response to this BAA is substantially the same as another proposal that was funded, is now being funded, or is pending with another Federal Agency, or another or the same DoD Component, you must reveal this on the Proposal Cover Sheet and provide the following information. Refer to the instructions provided in the DoD SBIR BAA for this requirement.

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

Cost Volume (Volume 3)

The Phase I Base amount must not exceed \$167,500. For the Cost Volume, The Defense Threat Reduction Agency requires the use of a Microsoft excel spread sheet which is available on the DSIP portal. Note: The DTRA Cost Volume template will be accessible once the Cost Volume is initiated.

Important: when completing the cost volume, enough information should be provided to allow the agency to understand how you plan to use the requested funds if a contract is awarded. Itemized costs of any subcontract or consultant should be provided to the same level as for the prime small business. If an unsanitized version of costs cannot be provided with the proposal, the Government may request it during negotiations if selected. Refer to the instruction provided in the DoD Annual SBIR program BAA for additional details on the content of the Cost Volume.

Note: Cost for travel funds must be justified and related to the needs of the project. DTRA does not include any fee on travel costs, so proposal should exclude fee on any travel costs proposed. Please review the updated Percentage of Work (POW) calculation details included in the DoD Annual Program BAA. DTRA will not accept any deviation to the POW requirements.

Company Commercialization Report (CCR) (Volume 4)

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

Supporting Documents (Volume 5)

Volume 5 is provided for proposers to submit additional documentation to support the Coversheet (Volume 1), Technical Volume (Volume 2), and the Cost Volume (Volume 3). Further, the SBIR and STTR Extension Act of 2022 mandated several new and important requirements that must be included in the Supporting Documents (Volume 5).

All proposing small business concerns are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment
2. Disclosures of Foreign Affiliations or Relationships to Foreign Countries
3. Disclosure of Funding Sources

Please refer to the DoD Annual Program BAA for more information. Proposals that do not include the above documents will be deemed noncompliant and will not receive an evaluation.

Any of the following documents may be included in Volume 5 if applicable to the proposal.

1. Letters of Support
2. Additional Cost Information
3. Funding Agreement Certification
4. Technical Data Rights (Assertions)
5. Lifecycle Certification
6. Allocation of Rights

Fraud, Waste, and Abuse Training (Volume 6)

Fraud, Waste and Abuse (FWA) training is required for all proposals. Please refer to the DoD Annual SBIR Program BAA instructions for full details.

PHASE II PROPOSAL GUIDELINES

Phase II proposals may only be submitted by Phase I awardees.

The Phase II proposals are best submitted no later than (NLT) 30 days AFTER the end of the 7 month Phase I period of performance.

All SBIR Phase II awards made on topics from solicitations prior to FY13 will be conducted in accordance with the procedures specified in those solicitations.

DTRA is not responsible for any money expended by the proposer prior to contract award.

DTRA has established a **40-page limitation** for the Technical Volume submitted in response to its topics. This does not include the Proposal Cover Sheets (pages 1 and 2, added electronically by the DoD submission site), or the Cost Volume, or the Company Commercialization Report. The Technical Volume includes, but is not limited to: table of contents, pages left blank, references and letters of support, appendices, key personnel biographical information, and all attachments.

Further details on the due date, content, and submission requirements of the Phase II proposal will be provided either in the Phase I award or by subsequent notification.

Phase II Proposal Instructions

Each Phase II proposal must be submitted through the Defense SBIR/STTR Innovation Portal by the deadline as specified in the Phase II Proposal Guidelines, or in the Phase I award or subsequent notification. **The format should be similar to Phase I proposal except the Phase II Technical Proposal is limited to 40 pages.** Each proposal submission must contain a Proposal Cover Sheet, Technical Volume, Cost Volume, a Company Commercialization Report (see the appropriate section of the BAA Announcement) and Volume 5 with mandatory documents as stated in the DoD Annual SBIR Program BAA. The Commercialization Strategy Volume should be more specific than was required for Phase I.

As indicated in the DoD Annual STTR Program BAA, the CCR is generated by the submission website based on information provided by you through the "Company Commercialization Report" tool.

Commercialization Strategy

See the appropriate section of the DoD Annual SBIR 23.4 BAA.

Phase II Evaluation Criteria

Phase II proposals will be reviewed for overall merit based upon the criteria specified in this Broad Agency Announcement and will be similar to the Phase I process.

Public Release of Award Information

If your proposal is selected for award, the technical abstract and discussion of anticipated benefits will be publicly released via the Internet. Therefore, do not include proprietary or classified information in these sections. For examples of past publicly released DoD SBIR/STTR Phase I and II awards, visit <https://www.dodsbirsttr.mil/submissions/login>.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

In accordance with the Small Business Act (15 U.S.C. 632), DTRA will authorize the recipient of a Phase I or Phase II STTR award to purchase Discretionary Technical & Business Assistance services, such as access to a network of scientists and engineers engaged in a wide range of technologies, or access to technical and business literature available through on-line data bases, for the purpose of assisting in areas such as:

- making better technical decisions concerning such projects;
- solving technical problems which arise during the conduct of such projects;
- minimizing technical risks associated with such projects;
- developing/ commercializing new commercial products/processes resulting from such projects; and,
- meeting cyber security requirements.

If you are proposing use of Discretionary Technical and Business Assistance (TABA), you must provide a cost breakdown in the Cost Volume under "Other Direct Costs (ODCs)" and provide a one-page description of the vendor you will use and the Technical and Business Assistance you will receive. For the Phase I project, the amount for TABA may not exceed \$6,500 per award. For the Phase II project, the TABA amount may be less than, equal to, but not more than \$50,000 per project. The description should be included in Volume 5 of the proposal.

Approval of Discretionary Technical and Business Assistance is not guaranteed and is subject to review of the contracting officer.

For Discretionary Technical and Business Assistance, small business concerns may propose one or more vendors. Additionally, business-related services aimed at improving the commercialization success of a small business concern may be obtained from an entity, such as a public or private organization or an agency or other entity established or funded by a State that facilitates or accelerates the commercialization of technologies or assists in the creation and growth of private enterprises that are commercializing technology.

EVALUATION AND SELECTION

All proposals will be evaluated in accordance with the evaluation criteria listed in the BAA.

Proposing firms will be notified of selection or non-selection status for a Phase I award within 90 days of the closing date of the BAA. DTRA has a single Evaluation Authority (EA) for all proposals received under this solicitation. The EA either selects or rejects Phase I and Phase II proposals based upon the results of the review and evaluation process plus other considerations including limitation of funds, and investment balance across all the DTRA topics in the solicitation. To provide this balance, a lower rated

proposal in one topic could be selected over a higher rated proposal in a different topic. DTRA reserves the right to select all, some, or none of the proposals in a particular topic.

Notifications. Following the EA decision, the DTRA SBIR/STTR office will release notification e-mails of selection or non-selection status for a Phase I award within 90 days of the closing date of the BAA. The E-mails will be sent to the addresses provided for the Principal Investigator and Corporate Official. Offerors may request a debriefing of the evaluation of their not selected proposal and should submit this request via email to: dtra.belvoir.RD.mbx.sbir@mail.mil and include "SBIR 23.4 / Topic XX Debriefing Request" in the subject line. Debriefings are provided to help improve the offeror's potential response to future solicitations. Debriefings do not represent an opportunity to revise or rebut the EA decision.

For selected offers, DTRA will initiate contracting actions which, if successfully completed, will result in contract award. DTRA Phase I awards are issued as fixed-price purchase orders with a maximum period of performance of seven-months. DTRA may complete Phase I awards without additional negotiations by the contracting officer or without opportunity for revision for proposals that are reasonable and complete.

DTRA Support Contractors

Select DTRA-employed support contractors may have access to contractor information, technical data or computer software that may be marked as proprietary or otherwise marked with restrictive legends. Each DTRA support contractor performs under a contract that contains organizational conflict of interest provisions and/or includes contractual requirements for nondisclosure of proprietary contractor information or data/software marked with restrictive legends. These contractors require access while providing DTRA such support as advisory and assistance services, contract specialist support, and support of the Defense Threat Reduction Information Analysis Center (DTRIAC). The contractor, by submitting a proposal or entering into this contract, is deemed to have consented to the disclosure of its information to DTRA's support contractors.

The following are, at present, the prime contractors anticipated to access such documentation: ASRC Federal (contract specialist support); Kent, Campa and Kate, Inc. (contract closeout support), ARServices (Program Management Advisory and Assistance Services--A&AS), Systems Planning and Analysis, Inc. (Subject Matter Expertise A&AS), Amentum (A&AS), Polaris Consulting (Small Business Program Support), Seventh Sense Consulting, LLC (Acquisition Support), Savantage Solutions (Accounting and Financial Systems Support); TekSynap Corporation and Kapili Services, LLC (DTRIAC).. This list is not all inclusive (e.g., subcontractors) and is subject to change.

Protests.

Refer to the DoD Annual SBIR Program BAA for procedures to protest the Announcement.

As further prescribed in FAR 33.106(b), FAR 52.233-3, Protests after Award should be submitted to:

- (a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed to Mr. Herbert Thompson, Contracting Officer, as follows) by obtaining written and dated acknowledgment of receipt from (if mailed letter) Defense Threat Reduction Agency, ATTN: AL-ACQ (Mr. Herbert Thompson), 1680 Texas Street, Kirtland AFB, NM 87117. If Federal Express is used for the transmittal, the appropriate address is: Defense Threat Reduction Agency, ATTN: AL-ACQ (Mr. Herbert Thompson), 8151 Griffin Avenue SE, Building 20414, Kirtland AFB, NM 87117-5669.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

AWARD AND CONTRACT INFORMATION

DTRA plans on Phase I projects for a seven (7) month period of performance with six months devoted to the research and the final month for the final report. The award size of the Phase I contract is no more than \$167,500.00 not withstanding a maximum of \$6,500.00 for Discretionary Technical and Business Allowance (TABAs). For a Phase II project, DTRA plans on a 24 month period of performance. The award size of a Phase II contract is no more than \$1,100,000.00 not withstanding a maximum of \$50,000.00 for Discretionary Technical and Business Allowance (TABAs) for the entire project.

ADDITIONAL INFORMATION

Export Control Restrictions

The International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, will apply to all projects with military or dual-use applications that develop beyond fundamental research, which is basic and applied research ordinarily published and shared broadly within the scientific community. More information is available at https://www.pmdtc.state.gov/ddtc_public.

The technology within some DTRA topics is restricted under export control regulations including the International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). ITAR controls the export and import of listed defense-related material, technical data and services that provide the United States with a critical military advantage. EAR controls military, dual-use and commercial items not listed on the United States Munitions List or any other export control lists. EAR regulates export-controlled items based on user, country, and purpose. **The offeror must ensure that their firm complies with all applicable export control regulations.**

NOTE: Export control compliance statements found in these proposal instructions are not meant to be all inclusive. They do not remove any liability from the submitter to comply with applicable ITAR or EAR export control restrictions or from informing the Government of any potential export restriction as fundamental research and development efforts proceed.

Cyber Security

Any Small Business Concern receiving an SBIR award is required to provide adequate security on all covered contractor information systems. Specific security requirements are listed in DFARS 252.204.7012, and compliance is mandatory.

Feedback

In an effort to encourage participation in, and improve the overall SBIR award process, offerors may submit feedback on the SBIR solicitation and award process to: dtra.belvoir.RD.mbx.sbir@mail.mil for consideration for future SBIR BAAs.

DTRA SBIR 23.4 Topic Index
Release 1

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DTRA234-001 TITLE: Portable Automated Solution for the Library Preparation for Sequencing

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

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: DTRA seeks to develop a portable tool capable of preparing DNA and RNA libraries for sequencing utilizing a minION in a tactical environment. Further automatization is envisioned to extract, purify, and isolate the genomic library for use in sequencing using the minION. Successful development of this tool will provide benefits to both government and commercial users of the minION sequencing capability by decreasing both the operator load and potential error in the preparation of biological samples.

DESCRIPTION: Biological Warfare Agent (BWA) detection and identification options for tactical users are limited in both the available technologies and scope of the ID capability. Lab-based theater confirmatory DNA and RNA sequencing are possible, but are not technically or tactically feasible for operators at the current time. Additionally, the methods employed by operators, Hand Held Assay (HHA) and Polymerase Chain Reaction-based (PCR) tools, are definitively limited to known and specifically targeted BWAs. Sequencing, however, is capable of having a BWA library that is only limited by available processing power and available genomic data. The specific need for these users is a tool that can streamline the library preparation of low complexity, high biomass BWA samples for use in a minION in a time-constrained tactical environment. BWA library preparation includes the extraction and purification of the genomic sequence along with the fragmentation of the DNA and attachment of the adaptor protein. When combined with the Oxford Nanopores minION, on-target sequencing results will be viewable in real-time by CONUS/OCONUS laboratories, and decision-makers at the Joint Operations Center (JOC). Applying automated library preparation will prevent potential errors by employed operators, while minimizing the overall time commitment.

Requirements for this development are as follows:

- Tool Capabilities :
 - o Isolate DNA/RNA from low complexity, high biomass BWA sample
 - o Isolation of DNA/RNA must work on all types (i.e. bacteria, viruses, etc.) of BWA samples
 - o All steps must be automated, with the exception of the insertion of the raw sample.
 - o Production of DNA/RNA library must be compatible with Oxford Nanopores minION
- Tool Design
 - o Approximate Run Time (from insertion of raw sample): <= 10 minutes
 - o Approximate Overall Dimensions: 6" x 6" x 3"
 - o Weight = <5.0 lbs.
 - o Capable of running isolated or using a windows laptop with GUI software

PHASE I: Begin with a market research study of potential COTS hardware solutions that meet tool requirements. Demonstrate the feasibility of automated DNA/RNA library preparations and confirm the compatibility of the prepared library with the Nanopore Technologies (NPT) minION. Conduct successful benchtop functionality testing consisting of library preparation for a pre-determined raw sample followed

by accurate identification utilizing the minION and related software. Culminate Phase I with a conceptual flow chart and system design to demonstrate that for Phase II an initial development path from start to finish has been given adequate consideration, risk and their mitigation have been investigated, and a development plan that provides confidence in the outcome has been established.

PHASE II: Focus on building, testing, and refining with an integrated initial prototype. After full functionality is achieved with the prototype, conduct successful benchtop functionality testing consisting of library preparation for multiple pre-determined raw samples followed by accurate identification using the minION and related software. Pending a successful functionality test, a minimum of two fully functional units will be fabricated with packaging that meets all of the final tool's requirements. Discussion will occur with the DTRA program team about future integration into a fully equipped sequencing kit. DTRA seeks an end state that results in a single device that can prepare the library from a variety of biological raw samples while being run on the minION.

PHASE III DUAL USE APPLICATIONS: This phase will further develop the capability developed in Phase II by improving robustness and user application. Although additional funding may be provided through DoD sources, the awardee should look to other public or private sector funding sources for assistance with transition and commercialization.

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KEYWORDS: Biosequencing; Portable Genomic Sequencing; Sample Preparation

DTRA234-002 TITLE: Capability to Determine the Effect of Dust and Debris on the Chemistry Environment post CWMD Weapons Strike

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), 22 CFR Parts 120-130, which controls the export and import of defense-related material and services, including export of sensitive technical data, or the Export Administration Regulation (EAR), 15 CFR Parts 730-774, which controls dual use items. Offerors must disclose any proposed use of foreign nationals (FNs), their country(ies) of origin, the type of visa or work permit possessed, and the statement of work (SOW) tasks intended for accomplishment by the FN(s) in accordance with the Announcement. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws.

OBJECTIVE: Develop the diagnostics, experimentation processes, and the modeling and simulation (M&S) needed to determine the effects of dust and debris on agents after weapons detonating in structures.

DESCRIPTION: Real world CWMD strike kinetic weapons often encounter responding structures. Weapon strikes on targets generate significant dust and debris, e.g. fragment striking of walls and floors, building collapse, ground based debris.

Particulates in the environment have been shown to affect the late time chemical combustion of non-ideal explosives such as the metals found in many weapon systems and the late time combustion of biological and chemical agents. This reduces weapon effectiveness. Currently, we lack the ability to measure and model the effect of dust and debris on agent defeat.

Development of well-characterized experiments and accompanying M&S are needed for this critical effort. These experiments and M&S can be utilized outside of the DoD to understand the effects on environments from industrial pollution, forest fires, and other particulates in the air that would change natural and industrial occurring chemistry within buildings or in open air.

This SBIR looks at for a well entwined the experimental and M&S effort. This should include develop diagnostics, experimentation processes, and the M&S needed to determine the effects of dust and debris on agents and in general late-time chemistry. This effort pairs with other efforts at DTRA and elsewhere aimed at understanding the amount of dust and debris generated from weapons detonating in structures. It also ties into a separate ongoing DTRA effort aimed at generating a well-characterized amount of dust and debris in laboratory and field settings.

This SBIR has as an end goal of taking dust and debris generated as a function of time to determine effects on the chemistry throughout the process (not just end states). Effects to explore include mixing, pressure, and temperature, size of fireball and late-time combustion of agent, metals and other species. The work from this effort can incorporated into mission planning software for DoD/DOE programs and be utilized commercially in the modeling of environmental effects from pollutions and forest fires.

PHASE I: Phase I: Initial experimentation and modeling of effect of dust and debris

- Develop M&S, diagnostics, and testing for effects at the laboratory scale
- M&S code should be able to accept outside data on dust generation efforts

PHASE II: Phase 2: Prototype M&S and experimental techniques

- Develop M&S capability to determine effect of dust and debris on chemistry towards use in full scale application
- Perform experiments to examine scale-up effects of dust and late-time chemistry
- Utilize data, obtained through this SBIR, past efforts, and from concurrent DTRA projects to refine theory & models
- Develop experimental hardware/techniques for full scale applications towards model validation

PHASE III DUAL USE APPLICATIONS: Phase 3: Full-weapon and target efforts

- Model and participate in testing of full-scale weapons
- Refine techniques based on full-scale results
- Tie in with Agent Defeat mission planning codes such as IMEA
- Market capabilities to larger DoD/DOE and industrial/environmental community

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2. "A multiphase shock tube for shock wave interactions with dense particle fields" Justin L. Wagner et al. Exp Fluids
3. "On the passage of a shock wave through a dusty-gas layer" Miura H, Glass II Proc R Soc 385:85-105
4. "Dust Deflagration Extinction" Kris Chatrathi and John Going Process Safety Progress (Vo1.19, No.3)

KEYWORDS: CWMD; Kinetic; Chemistry; Dust; Debris; Effects; Weapons; Temperature; Pressure; Planning

DTRA234-003 TITLE: Deep Learning and Extraction of Chemical Synthesis or Biosynthetic Pathways from Scientific Literature

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software; Biotechnology

OBJECTIVE: Conduct proof-of-concept studies to enable automated knowledge extraction and Natural Language Processing (NLP) approaches in machine learning (ML) for chemical synthesis or biosynthetic pathways of publicly available scientific publications that may pose dual-use research of concern (DURC). This topic seeks development of (1) computational methods for employing large language models (LLMs) for automated production of knowledge ontologies from scientific literature and (2) a scalable system with automated annotation capability.

DESCRIPTION: Scientific research of dual use concern includes research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, materiel, national security, among other sectors. Automated, large-scale extraction of procedures for chemical synthesis or biosynthesis will increase the efficiency and effectiveness of analysts seeking to provide timely courses of action (COA) for relevant decision makers concerning biological or chemical synthesis information of interest to the Defense Threat Reduction Agency (DTRA) and end users. An ideal system shall require minimal human-in-the-loop, enabling a subject matter expert (SME) to supplement the model with ad hoc data.

The development of open-source semantic systems have expanded beyond manually curated, commercial databases such as Reaxys (Reference 1). One recent effort, SynKB, has applied methods to automatically extract data from organic chemistry reactions described in United States (U.S.) and European commercial patents (Reference 2). The SynKB system enables chemists to perform structured queries over large corpora of synthesis procedures. Other research groups have applied language models for molecular design, whereby the model implicitly learns the “vocabulary” and composition of valid molecules and provides the ability to survey optimized molecular properties (Reference 3). Text-like representations of chemical reactions (SMILES) and Natural Language Processing (NLP) neural network Transformer architectures have been applied to retrosynthesis prediction problems (Reference 4). Another research team has developed the AiZynthTrain package for training synthesis models on USPTO patent data with the intent to integrate into retrosynthesis software (Reference 5). This topic seeks to build upon these and similar NLP-based approaches for knowledge extraction that may be broadly applied to chemical or biological scientific domains, improve system scalability, and automate data annotation capabilities. DTRA’s areas of interest include, but are not limited to: (1) understanding viable synthesis routes to a chemical compound from precursor molecules or substrates, and other starting materials, and (2) retrosynthesis prediction, which may be used to identify possible routes of synthesis and determine the most effective route for the synthesis process.

PHASE I: Leverage an LLM-based ontology system that uses textual knowledge of ontologies to extract information about biosynthetic or chemical synthetic procedure details from open source literature. The proof-of-concept system shall provide information about viable routes to a chemical compound and possible retrosynthesis analysis. Performers shall utilize visual analytical methods that enable users to browse and search for chemical-related data. Performers are encouraged to represent findings to a user with chemical-pathway association graphs, knowledge graphs, or by other means. The architecture shall be scalable, and shall leverage automated annotation capabilities in lieu of human annotation.

The devised solution shall capture relationships between concepts that indicate possible DURC. The performers will develop quantitative metrics to evaluate the LLM neural network classification performance by way of statistical approaches.

Phase I deliverables will include (1) a final report and (2) demonstration of the preliminary architecture. The report should provide results on architecture performance using unambiguous statistical methods, describe training and development, and identify advantages, limitations, and weaknesses. The architecture shall be described, including operating system, other software requirements (if applicable), and data sources.

PHASE II: Phase II efforts will focus on refinement of the approach developed during Phase I and prototype demonstration. The Phase II deliverables will be a prototype demonstration of the LLM neural network architecture and a report detailing: (1) a description of the approach, optimization techniques, and performance outcomes; (2) training, testing and validation methods; (3) a real world evaluation of the approach with a use case of mutual interest with DTRA; and (4) advantages, disadvantages, and limitations of the approach. The performer will identify weaknesses of the approach, and identify methods that may improve performance in the classifier and aspects of the overall architecture. The performer will provide details about user interfaces (if applicable) and any associated executables.

PHASE III DUAL USE APPLICATIONS: The performer will identify and employ features that have the potential for use in commercial applications.

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KEYWORDS: Biosynthetic Pathways, Chemical Synthesis, Deep Learning, Extraction

DTRA234-004 TITLE: Remote Through-Container Identification of CBRNE materials

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Computing and Software

OBJECTIVE: Conduct a proof of concept study to develop a rapid, remote, handheld, ruggedized, all-weather, self-powered, user-friendly device to be used by first responders to quickly and accurately identify the contents within opaque, sealed containers at a stand-off distance.

DESCRIPTION: The aim of this effort is to conduct a proof of concept study to develop a remote, light-weight handheld, ruggedized, self-powered, device to identify the contents of opaque sealed containers at various stand-off distances. The solution should provide a user friendly interface and be accessible while wearing protective clothing for chemical or biological hazards. Additionally, the device should also have the capability to interpret and learn new materials as they are encountered. A similar topic was released in 2012 under DTRA122-012 which ran through a Phase I effort. However, the emphasis here is placed on designing a handheld solution rather than man-portable, ensuring it can be operated with the latest issue of CBRNE protective clothing, ensuring rapid results, and taking advantage of the latest machine learning algorithms to improve the identification of unknown materials encountered in the field. Currently available sensors fall short of meeting all of these requirements. The outcome of this effort shall improve upon current methods of identifying and characterizing CWAs in a tactical setting while streamlining and simplifying testing process for end users.

PHASE I: The performer must demonstrate in a laboratory environment the capability of sensing through opaque containers of varying thickness to detect and identify CBRNE contents such as chemical, biological, radiological materials with a high degree of confidence while minimizing physical contact with CWAs inside chemical munitions or improvised devices. The performer shall explore the tradeoff space related to the performance objectives and metrics. Additionally, the performer shall provide a design concept for a prototype related to form factors to include the device being handheld, ruggedized, providing rapid results, accessible while wearing CBRNE protective clothing, and providing a mechanism to discover new previously unknown materials in the field.

PHASE II: Phase II must develop a prototype device to meet the form factor requirements to include being lightweight, handheld, battery operated, and accessible while wearing protective clothing. The prototype must have a field upgradable library to learn new materials as they are encountered. The Phase II final report should include a development plan for follow-on production and a Phase III roadmap. Phase II demonstrations should be provided for the DoD community and clearly demonstrate successful and accurate detection and identification of unknown substances in sealed containers.

PHASE III DUAL USE APPLICATIONS: Phase III must include identification of support for commercialization of the device to include other government and commercial entities. Although additional funding may be provided through DoD sources, the awardee should look to other public or private sector funding sources for assistance with transition and commercialization.

REFERENCES:

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3. Phillip G. Wilcox, Phillip G. Wilcox, Jason A. Guicheteau, Jason A. Guicheteau, "Comparison of handheld Raman sensors through opaque containers", Proc. SPIE 10629, Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XIX, 106290M (16 May 2018); doi: 10.1117/12.2303968

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KEYWORDS: stand-off, opaque, remote identification

DTRA234-005 TITLE: Signature Detection and Training via Application of Digital Product-Insertion Technologies

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy

OBJECTIVE: To investigate and demonstrate a proof-of-concept to explore the applicability of emerging digital product-insertion technologies to the detection of and changes in signatures of interest and to the 3-D rendering of real-world objects and settings in synthetic VR/AR/XR training environments for operators and inspectors.

DESCRIPTION: Advances in commercial technologies and AI have led to the development of unique capabilities that can have direct application to DoD and national security requirements. For example, digital product insertion and related AI capabilities for seamlessly emplacing 2-D and 3-D products in media have demonstrated significant advancements that have direct application to technologies relevant to national security. These advances in AI can support requirements such as rendering 3-D environments in near-real-time and the development of models and signature identification capabilities that require limited or no training data. Areas of interest for Over-the-Horizon Arms Control and potential applications include:

- Identification of novel signatures of interest within the nuclear pathway
- Rapid generation of AR/VR/XR-enabled synthetic training environments from images, videos, CAD/CAM drawings
- Detecting evidence of alterations, including image and video authentication and DeepFake detection
- Enhancing capabilities of DTRA inspection teams and counterproliferation practitioners via VR/AR/XR technologies, including the real-time insertion of threat objects.

PHASE I: Design and execute a technical feasibility study to examine the application of novel artificial intelligence digital product-insertion capabilities in three priority areas:

Priority Area 1: Detection

1. Identification of abnormal seismic signatures in video footage.
2. Identification of other insights from video footage such as power fluctuations, equipment operating status, etc.

Priority Area 2: Training

1. 3-D rendering of objects and settings into synthetic VR/AR/XR training environments.

Priority Area 3: Image/Video Interpretation

1. Detection of indicators of alterations in images and video.
2. Identification of environmental change (e.g., equipment layout) in images and security camera footage.
3. Detection of image or video alteration.
4. Identification, extraction, and 3-D rendering of unfamiliar objects.
5. 2-D to 3-D rendering into CAD or comparable/relevant formats
6. Reduction or elimination for the need of training data to classify images/video or classify objects within images/video.

PHASE II: Design and execute a test plan to validate application of novel artificial intelligence digital product placement capabilities against one (threshold) or two (objective) priority areas determined to be feasible by the Phase I feasibility study. Tests will be conducted in laboratory (threshold) or field (objective) environments and place an emphasis on potential applications to nuclear pathway signature detection and the nuclear treaty verification space, such as remote monitoring, exercises, and training.

Test plans will include documentation on methodology to be employed and adhere to best experimental design practices.

The Phase II efforts will address research questions to include:

- The potential to transform a single 2-D image of an object into a 3-D object and place it into an interactive VR/AR/XR scenario
- The potential for a non-expert user with minimal knowledge of video editing or VR/AR/XR to insert objects into scenes after a short training course.
- An assessment of the additional value that can be extracted from still and motion video with limited to no training data and/or model iteration required
- The potential to integrate digital product placement and similar capabilities be integrated with Unreal Engine, Unity, or comparable capabilities

PHASE III DUAL USE APPLICATIONS: Phase III will consist of a demonstration of a fully capable and packaged artificial intelligence capabilities that address specific end-user requirements associated with Priority Areas 1-3.

Phase III for feasible Priority Area 1 use-cases will demonstrate a repeatable and accurate means of extracting established signatures from motion video (e.g., security camera footage). Data ingest and processing pipelines will be automated to the greatest extent feasible and leverage low-code, no-code interfaces where possible to allow for utility by users with varying ranges of technical expertise.

Phase III for feasible Priority Area 2 use-cases will demonstrate effective integration of VR/AR/XR and digital product insertion technologies. These integrations will validate enhancements to user experience and training quality. Technology integrations should also demonstrate a reduction in time associated with setting and scenario development associated with use for training, planning, and operational execution.

Phase III for feasible Priority Area 3 use-cases will demonstrate an ability to detect previously imperceptible signatures in still images and/or motion images. Phase II experiments should also demonstrate where savings were achieved (e.g., required volume of training data) in the development of models.

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KEYWORDS: 2-D to 3-D rendering; image and video exploitation; object detection; image and video authentication, synthetic training environments; virtual, augmented, and mixed reality; deep-fake detection

DTRA234-006 TITLE: Acoustic Agglomeration to aid fine aerosol particulate collection

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Integrated Sensing and Cyber

OBJECTIVE: Organically develop or modify commercially available electroacoustic agglomerator for air pretreatment in an aerosol collection system similar to the Radionuclide Airborne Particulate Sampler Analyzer (RASA).

DESCRIPTION: DTRA supports the Comprehensive Nuclear Test Ban Treaty (CTBT) via the Nuclear Arms Control Technologies Program (NACT). The CTBT is strategically important to the United States (US) by banning nuclear testing for participating countries and allowing US access to 337 stations and laboratories worldwide. The NACT supports the US contribution to the CTBT with 37 stations and laboratories. Part of the CTBT monitoring regimen is radionuclide aerosol (RN) monitoring. The US accomplishes its CTBT RN monitoring via a system called the RASA. The required collection efficiency and Minimum Detectable Concentration (MDC) for RN collection as specified in the CTBT operational manuals are:

For filter: $\geq 80\%$ at $\varnothing = 0.2 \mu\text{m}$

Global^d: $\geq 60\%$ at $\varnothing = 10 \mu\text{m}$

MDC ≤ 10 to 30 Bq/m^3 for Ba-140

The current RASA system minimally meets these requirements.

The efficiency of particle capture on a filter is related to the intake air velocity, particle size, filter pore size and other variables such as humidity, wind speed, duct shape, etc.. A filter's efficiency is rated as a Minimum Efficiency Reporting Value (MERV), which measures a filter's ability to capture particles between 0.3 and 10 microns (μm). Most Penetrating Particle Size (MPPS) refers to the size of the particles that most easily pass through a filter. A high-efficiency particulate air (HEPA) filter can remove 99.97% of particles down to 0.3 Micron. An MPPS of 0.2 to 0.3 microns is difficult; many filters are effective at capturing particles smaller or larger than this, but 0.2 to 0.3 micron particles regularly gets by basic filtration. Using 0.3 microns as the MPPS measures the worst-case efficacy of the filter.

The fact that collection efficiency of 0.2 to 0.3 microns particles is worse than for smaller particles might seem counterintuitive, however the combined effect of the various filter collection mechanisms (interception, inertial effect, diffusion effect, gravitational effect, and electrostatic effect) as they relate to particles size causes a dip in the collection efficiency in the 0.2 to 0.3 micron

Ultrasonic sound can cause submicron particles to agglomerate and larger particles to disassociate. Literature varies with respect to the effectiveness; one study showed that mean particle size increased from sub-micron to five micron, and another study reduced the number concentration of micron & sub-micron by seventy and thirty percent respectively. Ultrasonic agglomeration studies, might not be comparable as the number and positioning of sound transducers, sound energy and frequency, shape and turbulence of the collection piping and chamber, humidity, etc./, varied from study to study. These variables have an effect on agglomeration effectiveness, however, in every study ultrasonic agglomeration increases particle size distribution from sub-micron to micron or greater. Collection efficiency greatly increases when particle size becomes 3 micron or greater. Furthermore, when combined with other collection mechanisms such as electrostatic charging or the addition of humidity or water droplets the collection efficiency may be substantially increased from any mechanisms acting alone. Successful application of this technology to the future RASA 2.0 system would allow for greater collection efficiency, reducing the Minimum Detectable Concentration (MDC) of targeted Radionuclides and improving the detection likelihood of a clandestine nuclear test.

PHASE I: Conduct extensive document research to determine state of the art with respect to aerosol collection via acoustic agglomeration aided with electrostatic charging and agglomerates such as water droplets. Design and model a system that could interface with the RASA 2.0 intake system for particle collection. Conduct trade-off studies for the system.

PHASE II: Based on the knowledge and determination of feasibility obtained in Phase I, construct a working prototype of the system designed in Phase I.

PHASE III DUAL USE APPLICATIONS: Provision of an aerosol agglomeration system that could interface with other aerosol collection or air purification systems such as the Senya Snow White.

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KEYWORDS: particulate, aerosol, radionuclide, agglomeration

DTRA234-P01 TITLE: OPEN TOPIC: Replacing User Name/Password Defaults - Alternative User Authentication Methods

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Human-Machine Interfaces

OBJECTIVE: DTRA seeks technologies to replace the user name/password default for authenticating users in various applications and services. The alternative proposed should be compatible with existing and emerging cloud/cloud-capable architectures, reduce the operational overhead for support, increase security over username/password defaults, and be 'user-friendly' to employ at the user interface application.

DESCRIPTION: While the principal user authentication used is the Public Key Encryption (PKI) used in tokens (Common Access Cards (CACs), Personal Identity Verification (PIV) cards, etc.), the continued support of username/password authentication in some use cases poses an unwelcome burden to the services provided. Current password implementations require (increasingly longer) passwords containing mixes of upper case, lower case, numerical and special characters, which must be changed every 60 – 90 days without repeating passwords maintained on lists for the previous 10-24 valid passwords. Brute force password cracking approaches have improved success rates employing parallelization of GPU and specialized hardware such as floating-point gate arrays (FPGAs) over the previous attempts using high-powered CPUs. A class of cryptologic techniques called 'memory hard' make these approaches ineffective, and form one of the key specific objectives for evaluation in this proposal. While commercial tokens (e.g. RSA and ORC PKI) are available to the public, they are not suitable for the first responders and foreign partners this topic supports due to various reasons (cost, availability, operational support and management, etc.) While token-based approaches are allowed for consideration, token-less approaches are preferred given the previously stated concerns. The World Wide Web Consortium (W3C) and the Fast Identity Online (FIDO) Alliance are the principal bodies establishing standards, which various government agencies accept as governing standards. However, the new password-less standard known as FIDO2, endorsed formally by Apple, Google, and Microsoft, suffer from two issues in this initial implementation: The three major companies adopting this standard are deploying three incompatible proprietary systems, subjecting users to maintaining multiple credentials per supported website to accommodate devices in each ecosystem. That imposes a burden on users for not only certificate maintenance per site and device, but also for transporting and maintaining that certificate cache securely across their individual devices and platforms. That limitation is not as important a concern for this topic and our use cases, but is critical for future commercial interests. The second current FIDO2 implementation problem is that each user's PKI certificate for each website must be stored in the cache (again multiplied per vendor). Caching of the certificate is a departure from the FIDO token PKI implementation that supports existing CAC/PIV architectures used by government agencies and is a principal requirement for this proposal topic. In summary, the attributes desired for any proposed solutions for this topic are:

- Solution must be a dramatic improvement in security, operation support and/or user experience for authenticating and managing disadvantaged users to replace username/password baseline
- Encryption method must be a proven 'memory hard' approach and implementation to counter parallelized GPU/FPGA brute force or intelligent guessing to spoof authentication communications
- System must be immune (or highly resistant) to common security compromise strategies; for example, such as 'man in the middle' or intercepted data replay attacks.
- System must be standards compliant or compatible, e.g. compliant with or compatible to FIDO2 guidelines
- System must be a vendor independent solution; e.g. must not be constrained to a single vendor's ecosystem or platform, and not impose large overhead in storing or transferring user credentials across supported systems. This dramatically reduces any migration issues across domains.

PHASE I: Analyze alternative approaches, providing at least two options to include summaries of technical feasibility of implementation and integration with existing systems, operations and maintenance for principal alternatives. Demonstrate depth of understanding through a detailed technical report for preferred option illustrating deployment into “as is” authentication systems with PKI as principal authentication method, but using username/PW as the default targeted for replacement by this investigation. The report should include a proposal for Phase II prototype development. The prototype should be developed not only to merge into existing DoD or other government agencies’ systems, but should also be flexible enough for commercial deployment, such as small and medium businesses, local first responders, hospitals and clinics, etc.

PHASE II: Implement a fully functional prototype of the proposed solution, to include server-side added functionality to support the concept to the user side authentication application. The prototype should be amenable to functional and security testing. The prototype should be capable of being implemented in either traditional application-centric or cloud services environments. Documentation should include user, operational and testing information.

PHASE III DUAL USE APPLICATIONS: Implement further improvements that would enhance use of the developed product by the sponsoring office, identify and exploit features that would be attractive for commercial or other applications. Expand upon the documentation developed in Phase II to include improvements implemented in Phase III. Investigate commercialization avenues that could include other government agencies, national labs, research institutes, and defense contractors. Develop a plan to enable successful technology transition at the end of this phase.

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KEYWORDS: Secure authentication, PKI, Hard memory implementation, Simplified Migration