

**Defense Threat Reduction Agency
STTR 22.D Small Business Technology Transfer (STTR)
Proposal Submission Instructions**

1.0 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 STTR 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 FY22.D topics solicited for the Defense Threat Reduction Agency (DTRA) Small Business Technology Transfer (STTR) 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 Program BAA and submit proposals by the date and time listed in the DoD Annual Program BAA. 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.

The DTRA Small Business Technology Transfer (STTR) Program is implemented, administered, and managed by the DTRA SBIR/STTR Program Office. Specific questions pertaining to the administration of the DTRA STTR Program and these proposal preparation instructions should be submitted 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>. For questions regarding the Defense SBIR/STTR Innovation Portal, contact DoD SBIR/STTR Help Desk 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.

The SBIR/STTR Policy Directive is available at: [SBIR and STTR Policy Directive - October 2020](#)

2.0 SMALL BUSINESS ELIGIBILITY REQUIREMENTS

2.1 The Offeror

Each offeror must qualify as a small business at time of award per the Small Business Administration (SBA) regulations at 13 CFR 121.701-121.705 and certify to this in the Cover Sheet section of the proposal. Those small businesses selected for award will also be required to submit a Funding Agreement Certification document provided by DTRA contracts prior to award.

2.2 SBA Company Registry

Per the 2020 SBIR-STTR Policy Directive, all STTR offerors are required to register their firm at SBA's Company Registry prior to submitting a proposal. Upon registering, each firm will receive a unique control ID to be used for submissions at any of the eleven (11) participating agencies in the program. For more information, please visit the SBA's Firm Registration Page: <https://www.sbir.gov/user/login/>.

2.3 Use of Foreign Nationals, Green Card Holders and Dual Citizens

See the "Foreign Nationals" section of the DoD SBIR Broad Agency Announcement for the definition of a Foreign National (also known as Foreign Persons).

ALL offerors proposing to use foreign nationals, green-card holders, or dual citizens, MUST disclose this information regardless of whether the topic is subject to export control restrictions. Offers must identify any foreign nationals or individuals holding dual citizenship expected to be involved on this project as a direct employee, subcontractor, or consultant. For those 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. You may be asked to provide additional information during negotiations in order to verify the foreign citizen's eligibility to participate on a STTR 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)).

Proposals submitted to export control-restricted topics and/or those with foreign nationals, dual citizens or green card holders listed will be subject to security review during the contract negotiation process (if selected for award). DTRA reserves the right to vet all uncleared individuals involved in the project, regardless of citizenship, who will have access to Controlled Unclassified Information (CUI) such as export-controlled information. If the security review disqualifies a person from participating in the proposed work, the contractor may propose a suitable replacement. In the event a proposed person is found ineligible by the government to perform proposed work, the contracting officer will advise the offeror of any disqualifications but may not disclose the underlying rationale. In the event a firm is found ineligible to perform proposed work, the contracting officer will advise the offeror of any disqualifications but may not disclose the underlying rationale.

3.0 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 STTR Annual Program BAA.

3.1 Technical Volume (Volume 2)

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

3.2 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 as indicated in the DoD BAA. **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 STTR 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 a 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 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. 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.

(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 STTR BAA for this requirement.

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

3.3 Cost Volume (Volume 3)

The Phase I Base amount must not exceed \$167,500.00. DTRA provides a MExcel workbook for the Cost Volume as template for proposal use. The Cost Volume template is available in the DSIP portal.

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 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.

For more information about cost proposals and accounting standards, see <https://www.dcaa.mil/Guidance/Audit-Process-Overview/>.

3.4 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 STTR Annual Program BAA for full details on this requirement. Information contained in the CCR will not be considered by DTRA during proposal evaluations.

3.5 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).

- (a) All proposers 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 (BAA

Attachment 1) (REQUIRED)

2. Foreign Ownership or Control Disclosure (BAA Attachment 2) (Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability)

(b) 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

4.0 DIRECT TO PHASE II PROPOSAL GUIDELINES

The Defense Threat Reduction Agency does not participate in the Direct to Phase II Program.

5.0 PHASE II PROPOSAL GUIDELINES

Small business concerns awarded a Phase I contract are permitted to submit a Phase II proposal for evaluation and potential award selection. 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 STTR 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. The Commercialization Strategy Volume should be more specific than was required for Phase I.

As indicated in the DoD STTR Annual 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 DoD STTR 22.D 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>.

6.0 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 SBIR/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 such concerns 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.

7.0 EVALUATION AND SELECTION

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

7.1 DTRA Evaluation Authority. 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.

7.2 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. 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 "STTR 22.D / 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.

7.3 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: Broadleaf Inc (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), Polaris Consulting (Small Business Program Support), Seventh Sense Consulting, LLC (Acquisition Support), Kapili Services, LLC and TekSynap (DTRIAC) and Savantage Solutions (Accounting and Financial Systems Support). This list is not all inclusive (e.g., subcontractors) and is subject to change.

7.4 Protests. Refer to the DoD STTR Annual 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: Service of Protest (Sept 2006)

(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.

(End of provision)

8.0 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).

9.0 ADDITIONAL INFORMATION

9.1 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.pmddtc.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.

9.2 Cyber Security

Any Small Business Concern receiving an STTR 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.

9.3 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 STTR 22.D Topic Index
Release 1

DTRA22D-001 TITLE: Generative Modeling of Multispectral Satellite Imagery

DTRA22D-002 TITLE: Large Form-Factor Scintillators for Nuclear Battlefield Operations

DTRA22D-001 TITLE: Generative Modeling of Multispectral Satellite Imagery

OUSD (R&E) MODERNIZATION PRIORITY: Artificial Intelligence/ Machine Learning

TECHNOLOGY AREA(S): Sensors

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 a methodology for producing synthetic multi-spectral satellite sensor data for the purpose of training low-shot machine learning models.

DESCRIPTION: DTRA has the requirement to be able to quickly and efficiently identify objects of interest related to defeating improvised threat networks as well as understanding the characteristics and conditions of specific operational environments. In certain cases, objects of interest may be rare, necessitating a novel method of performing accurate object detection. For certain objects, panchromatic or 3-band imagery may be insufficient to achieve accurate object identification, thus additional bandwidths within the near and mid infrared spectrum may be needed which takes advantage of additional spectral characteristics for achieving object detection. Currently, many of the generative modeling techniques are applied solely to the visible wavelengths. A need exists to fully explore the application of generative modeling techniques to multispectral imagery datasets.

Various studies have been conducted to show how Generative Adversarial Networks (GANs) can be successful in augmenting datasets for standard RGB datasets. However, less research has focused on how GANs could reproduce multispectral imagery (MSI) within the near and mid-IR range. Given that GAN models are typically difficult to train, the additional complexities of multispectral imagery to include higher radiometric and spectral resolution, presents a challenging task. The thrust of this effort would be to create a GAN for multispectral data that could augment current training sets and still achieve the same robustness, stability, accuracy, and correlation to original bandwidths. The multispectral GAN model would need to be tested in various terrain and seasonal environments, and ensure that spectral and radiometric characteristics were retained and good visual quality was achieved. The final model would need to be adaptable to accept various formats of imagery, with varying resolutions and bands. Various quantitative metrics should be identified and explained.

PHASE I: The performer shall conduct a proof of concept study to identify the processes and algorithms most successful for performing generative modeling to recreate useful realistic synthetic multi-band imagery in the near and mid IR wavelengths. The end report and demonstration shall provide quantitative metrics which help to determine the feasibility to continue to a Phase II effort

PHASE II: The performer shall mature the algorithms to improve accuracy, robustness, and stability of the generation of the synthetic multispectral imagery. The algorithms shall be applied in multiple terrain environments with various objects of interest and differing imagery sources. The performer shall

design, develop, and deliver a prototype, to include software code. The phase II deliverable is a (1) report detailing the finalized approaches and analysis of performance, (2) proof of concept demonstration, (3) and software code.

PHASE III DUAL USE APPLICATIONS: Finalize and commercialize software for use by customers (e.g. government, satellite companies, etc.). 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:

1. Abady, L., M. Barni, A. Garzelli and B. Tondi. "GAN generation of synthetic multispectral satellite images." *Remote Sensing* (2020);
2. Jiayi Ma, Wei Yu, Pengwei Liang, Chang Li, Junjun Jiang, "FusionGAN: A generative adversarial network for infrared and visible image fusion," *Information Fusion*, Volume 48, 2019, Pages 11-26, ISSN 1566-2535;
3. Kerdegari, Hamideh & Razaak, Manzoor & Argyriou, Vasileios & Remagnino, Paolo. "Semi-supervised GAN for Classification of Multispectral Imagery ;Acquired by UAVs." (2019);
4. M. Gong, X. Niu, P. Zhang and Z. Li, ""Generative Adversarial Networks for Change Detection in Multispectral Imagery,"" in *IEEE Geoscience and Remote Sensing Letters*, vol. 14, no. 12, pp. 2310-2314, Dec. 2017, doi: 10.1109/LGRS.2017.2762694;
5. Mohandoss, Tharun, Aditya Kulkarni, Daniel Northrup, Ernest Mwebaze, Alemohammad, Hamed. "Generating Synthetic Multispectral Satellite Imagery from Sentinel-2" *arXiv*, arXiv:2012.03108;
6. Perez, Anthony, et al. ""Semi-supervised multitask learning on multispectral satellite images using wasserstein generative adversarial networks (gans) for predicting poverty."" *arXiv preprint arXiv:1902.11110* (2019);

KEYWORDS: GAN; multispectral; synthetic data

DTRA22D-002 TITLE: Large Form-Factor Scintillators for Nuclear Battlefield Operations

OUSD (R&E) MODERNIZATION PRIORITY: General Warfighting Requirements (GWR); Nuclear Modernization

TECHNOLOGY AREA(S): Nuclear; Sensors

OBJECTIVE: DTRA seeks technologies to replace large form-factor Sodium Iodide (NaI) logs to support next-generation Department of Defense (DoD) mobile radiation detection systems. Ideal systems will provide leap-ahead capability advancements over existing systems at up to 4" x 4" x 16" form factors with gamma energy resolution and cost less than or equal to NaI. Specifically, these leap-ahead capability advancements in these large form factors may include, **but are not limited to** (1) single material fast neutron and gamma detection using pulse shape discrimination (PSD), (2) improved tolerance to shock, vibration, and/or environmental conditions, such as humidity, that would be expected during DoD operations, (3) decay times less than 10 nanoseconds to enable operations in higher dose environments, (4) integrated light-guide technologies to enable source localization via occlusion and operations in higher dose environments, (5) significant reductions in cost or gamma energy resolution compared to NaI. The ability to provide incident neutron energy spectra in a single **scintillator** element (i.e. without time-of-flight) by unfolding the neutron light-output spectra is also a desired feature.

DESCRIPTION: NaI, Cesium Iodide (CsI), Polyvinyl Toluene (PVT), and other plastic scintillators have been the state-of-the-art in large form-factor radiation detection materials; however, each of these materials has significant limitations. NaI, for example, is not well-suited to exposure to DoD shock, vibration, and environmental conditions due to its proneness to fracturing and hygroscopic nature. PVT suffers from poor energy resolution, which limits isotope identification performance. For compact detection systems, elpasolites such as CLYC and CLLBC have enabled thermal neutron detection and gamma spectroscopy in a single crystal, but the crystals remain relatively small **with limited potential to scale to these form factors**.

The recent development of organic scintillating glass (OSG) materials [1] **has shown a promising glimpse into a future where is one example where** a single material may be PSD-capable, melt-cast into multiple shapes, inexpensive, and well-performing against the best scintillator materials currently available commercially [2]. **Other nascent radiation detection materials, such as Perovskites, continue to show promise as inexpensive materials with extremely good energy resolution. Desired solutions are not limited to just scintillator technologies and may include alternate approaches as long as the form factor and capability enhancement objectives of this topic are met.**

PHASE I: Demonstrate the ability to create 2" x 4" x 6" **scintillator detector material** samples exhibiting some of the desired capability enhancements listed in the objective section of this topic. Initial testing of the **scintillator material** should be conducted, compared against NaI, and results should be documented and provided in the final report. A plan should also be submitted outlining the approach for scaling the system to meeting Phase II requirements.

PHASE II: Demonstrate the ability to create samples in multiple form factors up to 4" x 4" x 16" exhibiting two or more of the desired capability enhancements listed in the objective section of this topic. The samples should then be integrated with a commercial photomultiplier tube, solid-state photomultiplier, or other electronics (for non-scintillating solutions), as appropriate, and the resulting performance compared against equivalent NaI systems. The use of actual hardware and empirical data collection is expected for the performance analysis of the system and the results should be provided in the final report. A design plan should also be submitted outlining the plans for scaling the system to meet Phase III requirements.

PHASE III DUAL USE APPLICATIONS: Phase III will demonstrate fully capable sub-systems in multiple form factors up to 4" x 4" x 16" suitable for commercialization and achieving two or more of the desired capability enhancements listed in the objective section of this topic. All data collected during the demonstration and analysis of the final system will be included in the final report along with a user's manual and a data package on all critical system components.

REFERENCES:

1. "Organic Glass for Radiation Detection", <https://ip.sandia.gov/techpdfs/Organic%20Glass%20for%20Radiation%20Detection.pdf>, 2018;
2. Clark, L.M. et al, "Investigation of Organic Glass Scintillators for Improved Energy Resolution for Radioxenon Detection", MTV Workshop, 2021, <http://mtv.engin.umich.edu/wp-content/uploads/sites/431/2021/03/20210330-0335-Clark.pdf>;

KEYWORDS: Radiation; sodium iodide; scintillator; nuclear; scintillation; transverse Anderson localization; laser induced optical barriers