DEPARTMENT OF DEFENSE
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM
STTR 21.B Program Broad Agency Announcement (BAA)

April 21, 2021: DoD BAA issued for pre-release
May 19, 2021: DoD begins accepting proposals
June 17, 2021: Deadline for receipt of proposals no later than **12:00 p.m. ET**

Participating DoD Components:

- Department of Navy
- Department of the Air Force
- Defense Threat Reduction Agency (DTRA)
- Missile Defense Agency (MDA)

IMPORTANT

Deadline for Receipt: Complete proposals must be certified in DSIP no later than **12:00 PM** ET, **June 17, 2021**. Proposals submitted after 12:00 PM. will not be evaluated. The final proposal submission includes successful completion of all firm level forms, all required volumes, and electronic corporate official certification. Please plan to submit proposals as early as possible in order to avoid unexpected delays due to high volume of traffic during the final hours before the BAA close. DoD is not responsible for missed proposal submission due to system latency.

Classified proposals will not be accepted under the DoD STTR Program.

This BAA and the Defense SBIR/STTR Innovation Portal (DSIP) sites are designed to reduce the time and cost required to prepare a formal proposal. 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. Proposers submitting through this site for the first time will be asked to register. Firms are required to register for a Login.gov account and link it to their DSIP account. See section 4.14 for more information regarding registration.

The Small Business Administration (SBA), through its SBIR/STTR Policy Directive, purposely departs from normal Government solicitation formats and requirements, thus authorizing agencies to simplify the SBIR/STTR award process and minimize the regulatory burden on small business. Therefore, consistent with the SBA SBIR/STTR Policy Directive, the Department of Defense is soliciting proposals as a Broad Agency Announcement.

SBIR/STTR Updates and Notices: To be notified of SBIR/STTR opportunities and to receive e-mail updates on the DoD SBIR and STTR Programs, you are invited to subscribe to our Listserv by visiting https://www.dodsbirsttr.mil/submissions/login and clicking "DSIP Listserv" located under Quick Links.

Questions: Visit the Learning & Support section of DSIP at https://www.dodsbirsttr.mil/submissions/learning-support/faqs for DoD SBIR or STTR program-related information. Email the DSIP Help Desk at DoDSBIRSupport@reisystems.com only for assistance with using DSIP. Questions regarding DSIP may be emailed to the DSIP Help Desk and will be addressed in the order received during normal operating hours (Monday through Friday, 9:00 a.m. to 5:00 p.m. ET). See section 4.13 for information on where to direct other BAA and topic-related questions.

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ATTACHMENTS

1.0 INTRODUCTION

Navy, Air Force, DTRA and MDA, hereafter referred to as DoD Components, invite small business firms and research institutions to jointly submit proposals under this BAA for the Small Business Technology Transfer (STTR) Program. Firms with the capability to conduct research and development (R&D) in any of the defense-related topic areas described in this BAA and to commercialize the results of that R&D are encouraged to participate.

The STTR Program, although modeled substantially after the Small Business Innovation Research (SBIR) Program, is a separate program and is separately financed. Subject to availability of funds, DoD Components will support high quality cooperative research and development proposals of innovative concepts to solve the listed defense-related scientific or engineering problems, especially those concepts that also have high potential for commercialization in the private sector. Partnerships between small businesses and Historically Black Colleges and Universities (HBCUs) or Minority Institutions (MIs) are encouraged, although no special preference will be given to STTR proposals from such proposers.

This BAA is for Phase I proposals only. A separate BAA will not be issued requesting Phase II proposals, and unsolicited proposals will not be accepted. All firms that receive a Phase I award originating from this BAA will be eligible to participate in Phases II competitions and potential Phase III awards. DoD Components will notify Phase I awardees of the Phase II proposal submission requirements. Submission of Phase II proposals will be in accordance with instructions provided by individual Components. The details on the due date, content, and submission requirements of the Phase II proposal will be provided by the awarding DoD Component either in the Phase I award or by subsequent notification. If a firm submits their Phase II proposal prior to the dates provided by the individual Components, it may be rejected without evaluation.

DoD is not obligated to make any awards under Phase I, Phase II, or Phase III, and all awards are subject to the availability of funds. DoD is not responsible for any monies expended by the proposer before the issuance of any award.

2.0 PROGRAM DESCRIPTION

2.1 Objectives

The objectives of the DoD STTR Program include stimulating technological innovation, strengthening the role of small business in meeting DoD research and development needs, fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and increasing the commercial application of DoD-supported research or research and development results.

2.2 Technology and Program Protection to Maintain Technological Advantage

In accordance with DoD Instruction 5000.83, Technology and Program Protection to Maintain Technological Advantage, dated July 20, 2020, and as a means to counter the threat from strategic competitor nations, the DoD will employ risk-based measures to protect systems and technologies from adversarial exploitation and compromise of U.S. military vulnerabilities and weaknesses in: (1) systems, (2) components, (3) software, (4) hardware, and (5) supply chains. Any offeror submitting a proposal under this BAA will be required to disclose via self-report any foreign ownership or control. Offerors shall also require any proposed subcontractors included in their proposal under this BAA to disclose via self-report any foreign ownership or control. Reporting and disclosing such information will enable the DoD to identify national security risks posed by foreign participation, through investment, ownership, or influence, in the defense industrial base. This information will be used by DoD program offices to

determine risks posed by STTR contract awardees and their subcontractors to the DoD and the defense industrial base.

OUSD(R&E) Modernization Priorities

Focus Area	Description
5G	Technologies enabling the 5G spectrum to increase speed over current networks, to be more resilient and less susceptible to attacks, and to improve military communication and situational awareness.
Artificial Intelligence (AI)/ Machine Learning (ML)	Systems that perceive, learn, decide, and act on their own. Machine-learning systems with the ability to explain their rationale, characterize their strengths and weaknesses, and convey understanding of how they will behave in the future.
Autonomy	Technology that can deliver value by mitigating operational challenges such as: rapid decision making; high heterogeneity and/or volume of data; intermittent communications; high complexity of coordinated action; danger to mission; and high persistence and endurance.
Biotechnology	Biotechnology is any technological application that harnesses cellular and biomolecular processes. Most current biotech research focuses on agent detection, vaccines, and treatment. Future advances in biotechnology will improve the protection of both the general public and military personnel from biological agents, among numerous other potential applications.
Cybersecurity	Prevention of damage to, protection of, and restoration of computers, electronic communications systems, electronic communications services, wire communication, and electronic communications, including information contained therein, to ensure its availability, integrity, authentication, confidentiality, and nonrepudiation.
Directed Energy (DE)	Technologies related to production of a beam of concentrated electromagnetic energy, atomic, or subatomic particles.
Hypersonics	Innovative concepts or technologies that enable, or directly support, weapons or aircraft that fly at or near hypersonic speeds and/or innovation that allows for enhancing defensive capability against such systems.
Microelectronics	Critical microcircuits used in covered systems, custom-designed, custom-manufactured, or tailored for specific military application, system, or environment.
Networked Command, Control, and Communications (C3)	Fully networked command control and communications including: command and control (C2) interfaces, architectures, and techniques (e.g., common software interfaces and functional architectures and improved C2 processing/decision making techniques); communications terminals (e.g, software-defined radio (SDRs)/apertures with multiple networks on the same band and multi-functional systems); and apertures and networking technologies (e.g., leveraging/managing a diverse set of links across multiple band and software defined networking/ network slicing).
Nuclear	Technologies supporting the nuclear triad-including nuclear command, control, and communications, and supporting infrastructure. Modernization of the nuclear force includes developing options to counter competitors' coercive strategies, predicated on the threatened use of nuclear or strategic non-nuclear attacks.
Quantum Science	Technologies related to matter and energy on the atomic and subatomic level. Areas of interest: clocks and sensors; networks; computing enabling technologies (e.g., low temperature amplifiers, cryogenics, superconducting circuits, photon detectors); communications (i.e., sending/receiving individual photons); and manufacturing improvements.
Space	Technologies supporting space, or applied to a space environment.

General Warfighting Requirements (GWR)	Warfighting requirements not meeting the descriptions above; may be categorized into Reliance 21 areas of interest.

The DoD SBIR/STTR Programs follow the policies and practices of the Small Business Administration (SBA) SBIR/STTR Policy Directive updated on May 2, 2019. The guidelines presented in this BAA incorporate and make use of the flexibility of the SBA SBIR/STTR Policy Directive to encourage proposals based on scientific and technical approaches most likely to yield results important to the DoD and the private sector. The SBIR/STTR Policy Directive is available at: https://www.sbir.gov/sites/default/files/SBIR-STTR_Policy_Directive_2019.pdf.

2.3 Three Phase Program

The STTR Program is a three-phase program. Phase I is to determine, to the extent possible, the scientific, technical, and commercial merit and feasibility of ideas submitted under the STTR Program. Phase I awards are made in accordance with the SBA Policy Directive guidelines, current version. The period of performance is generally between six to twelve months with twelve months being the maximum period allowable. Proposals should concentrate on research or research and development which will significantly contribute to proving the scientific and technical feasibility, and commercialization potential of the proposed effort, the successful completion of which is a prerequisite for further DoD support in Phase II. Proposers are encouraged to consider whether the research or research and development being proposed to DoD Components also has private sector potential, either for the proposed application or as a base for other applications.

Phase II awards will be made to firms on the basis of results of their Phase I effort and/or the scientific merit, technical merit, and commercialization potential of the Phase II proposal. Phase II awards are made in accordance with the SBA Policy Directive guidelines, current version. The period of performance is generally 24 months. Phase II is the principal research or research and development effort and is expected to produce a well-defined deliverable prototype. A Phase II contractor may receive up to one additional, sequential Phase II award for continued work on the project.

Under Phase III, the Proposer is required to obtain funding from either the private sector, a non-STTR Government source, or both, to develop the prototype into a viable product or non-R&D service for sale in military or private sector markets. STTR Phase III refers to work that derives from, extends, or completes an effort made under prior STTR funding agreements, but is funded by sources other than the STTR Program. Phase III work is typically oriented towards commercialization of STTR research or technology.

3.0 DEFINITIONS

The following definitions from the SBA STTR Policy Directive and the Federal Acquisition Regulation (FAR) apply for the purposes of this BAA:

Commercialization

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

Cooperative Research and Development

For the purposes of the STTR Program this means research and development conducted jointly by a small business concern and a research institution in which not less than 40% of the work is performed by the small business concern, and not less than 30% of the work is performed by the single research institution. The percentage of work is usually measured by both direct and indirect costs; however, proposers should verify how it will be measured with their DoD contracting officer during contract negotiations.

Essentially Equivalent Work

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

Export Control

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.

NOTE: Export control compliance statements found in the individual Component-specific 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.

Federal Laboratory

As defined in 15 U.S.C. §3703, means any laboratory, any federally funded research and development center (FFRDC), or any center established under 15 U.S.C. §§ 3705 & 3707 that is owned, leased, or otherwise used by a Federal agency and funded by the Federal Government, whether operated by the Government or by a contractor.

Foreign Entity

Foreign entity means any branch, partnership, group or sub-group, association, estate, trust, corporation or division of a corporation, non-profit, academic institution, research center, or organization established, directed, or controlled by foreign owners, foreign investors, foreign management, or a foreign government.

Foreign Government

Foreign government means any government or governmental body, organization, or instrumentality, including government owned-corporations, other than the United States Government or United States state, territorial, tribal, or jurisdictional governments or governmental bodies. The term includes, but is not limited to, non-United States national and subnational governments, including their respective departments, agencies, and instrumentalities.

Foreign Nationals

Foreign Nationals (also known as Foreign Persons) as defined by 22 CFR 120.16 means any natural person who is not a lawful permanent resident as defined by 8 U.S.C. § 1101(a)(20) or who is not a protected individual as defined by 8 U.S.C. § 1324b(a)(3). It also means any foreign corporation, business association, partnership, trust, society or any other entity or group that is not incorporated or organized to do business in the United States, as well as international organizations, foreign governments and any agency or subdivision of foreign governments (e.g., diplomatic missions).

"Lawfully admitted for permanent residence" means the status of having been lawfully accorded the privilege of residing permanently in the United States as an immigrant in accordance with the immigration laws, such status not having changed.

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

Fraud, Waste and Abuse

a. **Fraud** includes any false representation about a material fact or any intentional deception designed to deprive the United States unlawfully of something of value or to secure from the United States a benefit, privilege, allowance, or consideration to which an individual or business is not entitled.
b. **Waste** includes extravagant, careless or needless expenditure of Government funds, or the consumption of Government property, that results from deficient practices, systems, controls, or decisions.
c. **Abuse** includes any intentional or improper use of Government resources, such as misuse of rank, position, or authority or resources.
d. The STTR Program training related to Fraud, Waste and Abuse is available at: https://www.sbir.gov/tutorials/fraud-waste-abuse/tutorial-1. See Section 4.17 for reporting Fraud, Waste and Abuse.

Funding Agreement

Any contract, grant, or cooperative agreement entered into between any Federal Agency and any small business concern for the performance of experimental, developmental, or research work, including products or services, funded in whole or in part by the Federal Government. Only the contract method will be used by DoD Components for all STTR awards.

Historically Black Colleges and Universities and Minority Institutions (HBCU/MI)

Listings for the Historically Black Colleges and Universities (HBCU) and Minority Institutions (MI) are available through the Department of Education Web site, http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

Certified HUBZone Small Business Concern

An SBC that has been certified by SBA under the Historically Underutilized Business Zones (HUBZone) Program (13 C.F.R. § 126) as a HUBZone firm listed in the Dynamic Small Business Search (DSBS).

Performance Benchmark Requirements for Phase I

Companies with multiple SBIR/STTR awards must meet minimum performance requirements to be eligible to apply for a new Phase I or Direct-to-Phase II award. The purpose of these requirements is to ensure that Phase I applicants that have won multiple prior SBIR/STTR awards are making progress towards commercializing the work done under those awards. The Phase I to Phase II Transition Rate addresses the extent to which an awardee progresses a project from Phase I to Phase II. The Commercialization Benchmark addresses the extent to which an awardee has moved past Phase II work towards commercialization. Additional information on performance benchmarking for Phase I applicants can be found at https://www.sbir.gov/performance-benchmarks.

Principal Investigator

The principal investigator/project manager is the one individual designated by the applicant to provide the scientific and technical direction to a project supported by the funding agreement.

For both Phase I and Phase II, the primary employment of the principal investigator must be with the small business firm or research institution at the time of award and during the conduct of the proposed project. Primary employment means that more than one-half of the principal investigator's time is spent in the employ of the small business firm or research institution. This precludes full-time employment with another organization. Occasionally, deviations from this requirement may occur, and must be approved in writing by the contracting officer after consultation with the agency SBIR/STTR Program Manager/Coordinator. Further, a small business firm or research institution may replace the principal investigator on an SBIR/STTR Phase I or Phase II award, subject to approval in writing by the contracting officer.

Proprietary Information

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

Research Institution

Any organization located in the United States that is:

a. A university.
b. A nonprofit institution as defined in Section 4(5) of the Stevenson-Wydler Technology Innovation Act of 1980.
c. A contractor-operated federally funded research and development center, as identified by the National Science Foundation in accordance with the government-wide Federal Acquisition Regulation issued in accordance with Section 35(c)(1) of the Office of Federal Procurement Policy Act. A list of eligible FFRDCs is available at: https://www.nsf.gov/statistics/ffrdclist/.

Research or Research and Development

Any activity that is:

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

Research Involving Animal Subjects

All activities involving animal subjects shall be conducted in accordance with DoDI 3216.01 "Use of Animals in DoD Programs," 9 C.F.R. parts 1-4 "Animal Welfare Regulations," National Academy of Sciences Publication "Guide for the Care & Use of Laboratory Animals," as amended, and the Department of Agriculture rules implementing the Animal Welfare Act (7 U.S.C. §§ 2131-2159), as well as other applicable federal and state law and regulation and DoD instructions.

"Animal use" protocols apply to all activities that meet any of the following criteria:

a. Any research, development, test, evaluation or training, (including experimentation) involving an animal or animals.
b. An animal is defined as any living or dead, vertebrate organism (non-human) that is being used or is intended for use in research, development, test, evaluation or training.
c. A vertebrate is a member of the subphylum Vertebrata (within the phylum Chordata), including birds and cold-blooded animals.

See DoDI 3216.01 for definitions of these terms and more information about the applicability of DoDI 3216.01 to work involving animals.

Research Involving Human Subjects

All research involving human subjects shall be conducted in accordance with 32 C.F.R. § 219 "The Common Rule," 10 U.S.C. § 980 "Limitation on Use of Humans as Experimental Subjects," and DoDI 3216.02 "Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research," as well as other applicable federal and state law and regulations, and DoD component guidance. Proposers must be cognizant of and abide by the additional restrictions and limitations imposed on the DoD regarding research involving human subjects, specifically as they regard vulnerable populations (DoDI 3216.02), recruitment of military research subjects (DoDI 3216.02), and informed consent and surrogate consent (10 U.S.C. § 980) and chemical and biological agent research (DoDI 3216.02). Food and Drug Administration regulation and policies may also apply.

"Human use" protocols apply to all research that meets any of the following criteria:

a. Any research involving an intervention or an interaction with a living person that would not be occurring or would be occurring in some other fashion but for this research.
b. Any research involving identifiable private information. This may include data/information/specimens collected originally from living individuals (broadcast video, web-use logs, tissue, blood, medical or personnel records, health data repositories, etc.) in which the identity of the subject is known, or the identity may be readily ascertained by the investigator or associated with the data/information/specimens.

See DoDI 3216.02 for definitions of these terms and more information about the applicability of DoDI 3216.02 to research involving human subjects.

Research Involving Recombinant DNA Molecules

Any recipient performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with the National Institutes of Health Guidelines for Research Involving Recombinant DNA Molecules, dated January 2011, as amended. The guidelines can be found at: https://osp.od.nih.gov/wp-content/uploads/2013/06/NIH_Guidelines.pdf. Recombinant DNA is defined as (i) molecules that are constructed outside living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in living cells or (ii) molecules that result from the replication of those described in (i) above.

Service-Disabled Veteran-Owned Small Business (SDVOSB)

A small business concern owned and controlled by a Service-Disabled Veteran or Service-Disabled Veterans, as defined in Small Business Act 15 USC § 632(q)(2) and SBA's implementing SDVOSB regulations (13 CFR 125).

Small Business Concern (SBC)

A concern that meets the requirements set forth in 13 C.F.R. § 121.702 (available here).

An SBC must satisfy the following conditions on the date of award:

a. Is organized for profit, with a place of business located in the United States, which operates primarily within the United States or which makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor;
b. Is in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that if the concern is a joint venture, each entity to the venture must meet the requirements set forth in paragraph (c) below;
c. Is more than 50% directly owned and controlled by one or more individuals (who are citizens or permanent resident aliens of the United States), other small business concerns (each of which is more than 50% directly owned and controlled by individuals who are citizens or permanent resident aliens of the United States), or any combination of these; and
d. Has, including its affiliates, not more than 500 employees. (For explanation of affiliate, see www.sba.gov/size.)

Subcontract

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

Subcontractor

Subcontractor means any supplier, distributor, vendor, firm, academic institution, research center, or other person or entity that furnishes supplies or services pursuant to a subcontract, at any tier.

United States

"United States" means the fifty states, the territories and possessions of the Federal Government, the Commonwealth of Puerto Rico, the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the District of Columbia.

Women-Owned Small Business Concern

An SBC that is at least 51% owned by one or more women, or in the case of any publicly owned business, at least 51% of the stock is owned by women, and women control the management and daily business operations.

4.0 PROPOSAL FUNDAMENTALS

4.1 Introduction

The proposal must provide sufficient information to demonstrate to the evaluator(s) that the proposed work represents an innovative approach to the investigation of an important scientific or engineering problem and is worthy of support under the stated criteria. The proposed research or research and development must be responsive to the chosen topic, although it need not use the exact approach specified in the topic. Anyone contemplating a proposal for work on any specific topic should determine:

a. The technical approach has a reasonable chance of meeting the topic objective,
b. This approach is innovative, not routine, with potential for commercialization and
c. The proposing firm has the capability to implement the technical approach, i.e., has or can obtain people and equipment suitable to the task.

4.2 Proposer Eligibility and Performance Requirements

a. Each proposer must qualify as a small business concern as defined by 13 CFR §701-705 at time of award and certify to this on the Cover Sheet of the proposal. The eligibility requirements for the SBIR/STTR programs are unique and do not correspond to those of other small business programs (see Section 3 of this BAA). Proposers must meet eligibility requirements for Small Business Ownership and Control (see 13 CFR § 121.702 and Section 4.4 of this BAA).
b. A minimum of 40% of each STTR project must be conducted by the small business concern and a minimum of 30% of the effort performed by the single research institution, as defined in Section 3. The percentage of work is usually measured by both direct and indirect costs.
c. For both Phase I and II, the primary employment of the principal investigator must be with the small business firm or the research institution at the time of award and during the conduct of the proposed effort. At the time of award of a Phase I or Phase II contract, the small business concern must have at least one employee in a management position whose primary employment is with the small business and who is not also employed by the research institution. 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.
d. For both Phase I and Phase II, all research or research and development work must be performed by the small business concern and its subcontractors in the United States.
e. **Benchmarks**. Proposers with prior SBIR/STTR awards must meet two benchmark requirements for Progress towards Commercialization as determined by the Small Business Administration (SBA) on June 1 each year.

(1) Phase I to Phase II Transition Rate: For all proposers with greater than 20 Phase I awards over the past five fiscal years excluding the most recent year, the ratio of Phase II awards to Phase I awards must be at least 0.25.

(2) Commercialization Benchmark: For all proposers with greater than 15 Phase II awards over the last ten fiscal years excluding the last two years, the proposer must have received, to date, an average of at least $100,000 of sales and/or investments per Phase II award received or have received a number of patents resulting from the STTR work equal to or greater than 15% of the number of Phase II awards received during the period.

Consequence of failure to meet the benchmarks:

- SBA will identify and notify Agencies on June 1st of each year the list of companies which fail to meet minimum performance requirements. These companies will not be eligible to submit a proposal for a Phase I award for a period of one year from that date.
- Because this requirement only affects a company's eligibility for new Phase I awards, a company that fails to meet minimum performance requirements may continue working on its current ongoing SBIR/STTR awards and may apply for and receive new Phase II and Phase III awards.
- To provide companies with advance warning, SBA notifies companies on April 1st if they are failing the benchmarks. If a company believes that the information used was not complete or accurate, it may provide feedback through the SBA Company Registry at www.sbir.gov.
- In addition, SBA has posted a Guide to SBIR/STTR Program Eligibility to help small businesses understand program eligibility requirements, determine if they will be eligible at the time of award, and accurately complete necessary certifications.
- The benchmark information on the companies will not be available to the public.
- More detail is available at https://www.sbir.gov/performance-benchmarks.

f. A small business concern must negotiate a written agreement between the small business and the research institution allocating intellectual property rights and rights to carry out follow-on research, development, or commercialization (see Model Agreement for the Allocation of Rights).

4.3 Joint Ventures

Joint ventures and limited partnerships are permitted, provided that the entity created qualifies as a small business in accordance with the Small Business Act, 13 U.S.C. § 121.701. Proposers must disclose joint ventures with existing (or planned) relationships/partnerships with any foreign entity or any foreign government-controlled companies.

4.4 Majority Ownership in Part

Majority ownership in part by multiple venture capital, hedge fund, and private equity firms: Small businesses that are owned in majority part by multiple venture capital operating companies (VCOCs), hedge funds, or private equity funds are ineligible to submit applications or receive awards for opportunities in this BAA. Component instructions will specify if participation by a small business majority owned in part by VCOCs, hedge funds, or private equity funds is allowable for a specific topic in the BAA. If a Component authorizes such participation, any proposer that is owned, in whole in or in part, by any VCOC, hedge fund, and/or private equity fund must identify each foreign national, foreign entity, or foreign government holding or controlling greater than a 5% equity stake in the proposer, whether such equity stake is directly or indirectly held. The proposer must also identify any and all of its

ultimate parent owner(s) and any other entities and/or individuals owning more than a 5% equity stake in its chain of ownership.

4.5 Conflicts of Interest

Contract awards to firms owned by or employing current or previous Federal Government employees could create conflicts of interest for those employees which may be a violation of federal law.

4.6 Organizational Conflicts of Interest

FAR 9.5 Requirements

In accordance with FAR 9.5, proposers are required to identify and disclose all facts relevant to potential OCIs involving the proposer's organization and any proposed team member (subawardee, consultant). Under this Section, the proposer is responsible for providing this disclosure with each proposal submitted to the BAA. The disclosure must include the proposer's, and as applicable, proposed team member's OCI mitigation plan. The OCI mitigation plan must include a description of the actions the proposer has taken, or intends to take, to prevent the existence of conflicting roles that might bias the proposer's judgment and to prevent the proposer from having unfair competitive advantage. The OCI mitigation plan will specifically discuss the disclosed OCI in the context of each of the OCI limitations outlined in FAR 9.505-1 through FAR 9.505-4.

Agency Supplemental OCI Policy

In addition, DoD Components may have a supplemental OCI policy that prohibits contractors/performers from concurrently providing Scientific Engineering Technical Assistance (SETA), Advisory and Assistance Services (A&AS) or similar support services and being a technical performer. Therefore, as part of the FAR 9.5 disclosure requirement above, a proposer must affirm whether the proposer or any proposed team member (subawardee, consultant) is providing SETA, A&AS, or similar support to any DoD Component office(s) under: (a) a current award or subaward; or (b) a past award or subaward that ended within one calendar year prior to the proposal's submission date.

If SETA, A&AS, or similar support is being or was provided to any DoD Component office(s), the proposal must include:

- The name of the DoD Component office receiving the support;
- The prime contract number;
- Identification of proposed team member (subawardee, consultant) providing the support; and
- An OCI mitigation plan in accordance with FAR 9.5.

Government Procedures

In accordance with FAR 9.503, 9.504 and 9.506, the Government will evaluate OCI mitigation plans to avoid, neutralize or mitigate potential OCI issues before award and to determine whether it is in the Government's interest to grant a waiver. The Government will only evaluate OCI mitigation plans for proposals that are determined selectable under the BAA evaluation criteria and funding availability.

The Government may require proposers to provide additional information to assist the Government in evaluating the proposer's OCI mitigation plan.

> If the Government determines that a proposer failed to fully disclose an OCI; or failed to provide the affirmation of Government support as described above; or failed to reasonably provide additional information requested by the Government to assist in evaluating the proposer's OCI

mitigation plan, the Government may reject the proposal and withdraw it from consideration for award.

4.6 Classified Proposals

Classified proposals will not be accepted under the DoD STTR Program. If topics will require classified work during Phase II, the proposing firm must have a facility clearance in order to perform the Phase II work. For more information on facility and personnel clearance procedures and requirements, please visit the Defense Security Service Web site at: http://www.dss.mil/index.html.

4.7 Research Involving Human Subjects

All research involving human subjects, to include use of human biological specimens and human data, shall comply with the applicable federal and state laws and agency policy/guidelines for human subject protection (see Section 3).

Institutions to be awarded funding for research involving human subjects must provide documentation of a current Federal Assurance of Compliance with Federal regulations for human subject protection, for example a Department of Health and Human Services, Office for Human Research Protections Federalwide Assurance (http://www.hhs.gov/ohrp). Additional Federal Assurance documentation may also be requested by the awarding DoD Component. All institutions engaged in human subject research, to include subcontractors, must also have a valid Assurance. In addition, personnel involved in human subjects research must provide documentation of completing appropriate training for the protection of human subjects. Institutions proposing to conduct human subject research that meets one of the exemption criteria in 32 CFR 219.101 are not required to have a Federal Assurance of Compliance. Proposers should clearly segregate research activities involving human subjects from other research and development activities in their proposal.

If selected, institutions must also provide documentation of Institutional Review Board (IRB) approval or a determination from an appropriate official in the institution that the work meets one of the exemption criteria with 32 CFR 219. As part of the IRB review process, evidence of appropriate training for all investigators should accompany the protocol. The protocol, separate from the proposal, must include a detailed description of the research plan, study population, risks and benefits of study participation, recruitment and consent process, data collection and data analysis.

The amount of time required for the IRB to review and approve the protocol will vary depending on such things as the IRB's procedures, the complexity of the research, the level of risk to study participants and the responsiveness of the Investigator. The average IRB approval process can last between one and three months. Once the IRB has approved the research, the awarding DoD Component will review the protocol and the IRB's determination to ensure that the research will be conducted in compliance with DoD and DoD Component policies. The DoD review process can last between three to six months. Ample time should be allotted to complete both the IRB and DoD approval processes prior to recruiting subjects. **No funding can be used towards human subject research until ALL approvals are granted. 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.**

4.8 Research Involving Animal Subjects

All research, development, testing, experimentation, education or training involving the use of animals shall comply with the applicable federal and agency rules on animal acquisition, transport, care, handling, and use (see Section 3).

For submissions containing animal use, proposals should briefly describe plans for their Institutional Animal Care and Use Committee (IACUC) review and approval.

All Recipients must receive their IACUC's approval as well as secondary or headquarters-level approval by a DoD veterinarian who is trained or experienced in laboratory animal medicine and science. **No animal research may be conducted using DoD funding until all the appropriate DoD office(s) grant approval. 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.**

4.9 Research Involving Recombinant DNA Molecules

All research involving recombinant DNA molecules shall comply with the applicable federal and state law, regulation and any additional agency guidance. Research shall be approved by an Institutional Biosafety Committee.

4.10 Debriefing/Technical Evaluation Narrative

After final award decisions have been announced, the technical evaluations of the submitter's proposal may be provided to the submitter. Please refer to the Component-specific instructions of your topics of interest for Component debriefing processes.

4.11 Pre-Award and Post Award BAA Protests

Interested parties have the right to protest as prescribed in FAR 33.106(b) and FAR 52.233-2. For purposes of pre-award protests related to the terms of this BAA, protests should be served to the Contracting Officer (listed below).

Ms. Chrissandra Smith
DoD SBIR/STTR BAA Contracting Officer
E-mail: chrissandra.smith.civ@mail.mil

NOTE: CONTACT FOR PROTESTS ONLY. All other inquires will not be answered or considered.

Washington Headquarters Services (WHS)
Acquisition Directorate
1155 Defense Pentagon
Washington, DC 20301-1155

For the purposes of a protest related to a selection or award decision, protests should be served to the point-of-contact (POC) listed in the instructions of the DoD Component that authored the topic.

For protests filed with the Government Accountability Office (GAO), a copy of the protest shall be submitted to the Contracting Officer listed above (pre-award ONLY) or DoD Component POC (selection/award decision ONLY) within one day of filing with the GAO. Protests of small business status of a selected firm may also be made to the Small Business Administration.

4.12 Phase I Award Information

All Phase I and Direct to Phase II proposals will be evaluated and judged on a competitive basis. Proposals will be initially screened to determine responsiveness. Proposals passing this initial screening will be technically evaluated by engineers or scientists to determine the most promising technical and scientific approaches. Each proposal will be judged on its own merit. DoD is under no obligation to fund any proposal or any specific number of proposals in a given topic. It also may elect to fund several or none of the proposed approaches to the same topic.

a. **Number of Phase I Awards**. The number of Phase I awards will be consistent with the Component's RDT&E budget. No Phase I contracts will be awarded until evaluation of all qualified proposals for a specific topic is completed.

b. **Type of Funding Agreement**. Each Phase I proposal selected for award will be funded under negotiated contracts or purchase orders and will include a reasonable fee or profit consistent with normal profit margins provided to profit-making firms for R/R&D work. Firm Fixed Price, Firm-Fixed-Price Level of Effort, Labor Hour, Time & Material, or Cost-Plus-Fixed-Fee type contracts can be negotiated and are at the discretion of the Component Contracting Officer.

c. **Dollar Value**. The Phase I contract value varies among the DoD Components; it is therefore important for proposing firms to review Component-specific instructions regarding award size.

d. **Timing.** Proposing firms will be notified of selection or non-selection status for a Phase I or DP2 award by the DoD Component that originated the topic within 90 days of the closing date for this BAA. Please refer to the Component-specific instructions for details.

The SBA SBIR/STTR Policy Directive, Section 7(c)(1)(ii), states that agencies should issue the Phase I award no more than 180 days after the closing date of the BAA. However, across DoD, the median time between the date that the STTR BAA closes and the award of a Phase I contract is approximately four months.

4.13 Questions about this BAA and BAA Topics

a. **General SBIR/STTR Questions/Information**.

(1) **DSIP Help Desk**:
Email the DSIP Help Desk at DoDSBIRSupport@reisystems.com for assistance with using DSIP. Questions regarding DSIP can be emailed to the DSIP Help Desk and will be addressed in the order received, during normal operating hours (Monday through Friday, 9:00 a.m. to 5:00 p.m. ET).

The DSIP Help Desk cannot provide updates to proposal status after submission, such as proposal selection/non-selection status or contract award status. Contact the DoD Component that originated the topic in accordance with the Component-specific instructions given at the beginning of that Component's topics.

(2) **Websites**:
The Defense SBIR/STTR Innovation Portal (DSIP) at https://www.dodsbirsttr.mil/submissions/login, which provides the following resources:

- SBIR and STTR Program Opportunities
- Topics Search Engine

- Topic Q&A
- All Electronic Proposal Submission for Phase I and Phase II Proposals. Firms submitting through this site for the first time will be asked to register on https://www.dodsbirsttr.mil/submissions.

DoD SBIR/STTR website at https://rt.cto.mil/rtl-small-business-resources/sbir-sttr/, which provides the following resources:

- SBIR and STTR Program Opportunities
- Dates for Current and Upcoming Opportunities
- Past SBIR and STTR Program Opportunities

(3) **SBIR/STTR Updates and Notices:**
To be notified of SBIR/STTR opportunities and to receive e-mail updates on the DoD SBIR and STTR Programs, subscribe to the Listserv by selecting "DSIP Listserv" under Quick Links on the DSIP login page.

b. **General Questions about a DoD Component**. General questions pertaining to a particular DoD Component and the Component-specific BAA instructions should be submitted in accordance with the instructions given at the beginning of that Component's topics, in Section 12.0 of this BAA.

c. **Direct Contact with Topic Authors.** From **April 21, 2021 to May 19, 2021,** this BAA is issued for pre-release with the names of the topic authors and their phone numbers and e-mail addresses. During the pre-release period, proposing firms have an opportunity to contact topic authors by telephone or e-mail to ask technical questions about specific BAA topics. Questions should be limited to specific ginformation related to improving the understanding of a particular topic's requirements. Proposing firms may not ask for advice or guidance on solution approach and you may not submit additional material to the topic author. If information provided during an exchange with the topic author is deemed necessary for proposal preparation, that information will be made available to all parties through Topic Q&A. After this period questions must be asked through Topic Q&A as described below.

d. **Topic Q&A**. Once DoD begins accepting proposals on **May 19, 2021**, no further direct contact between proposers and topic authors is allowed, unless the Topic Author is responding to a question submitted during the pre-release period. However, proposers may submit written questions through Topic Q&A at https://www.dodsbirsttr.mil/submissions/login. In Topic Q&A, all questions and answers are posted electronically for general viewing. Identifying information for the questioner and respondent is not posted.

Questions submitted through the Topic Q&A are limited to technical information related to improving the understanding of a topic's requirements. Any other questions, such as those asking for advice or guidance on solution approach, or administrative questions, such as SBIR or STTR program eligibility, technical proposal/cost proposal structure and page count, budget and duration limitations, or proposal due date WILL NOT receive a response. Refer to the Component-specific instructions given at the beginning of that Component's topics for help with an administrative question.

Proposing firms may use the Topic Search feature on DSIP to locate a topic of interest. Then, using the form at the bottom of the topic description, enter and submit the question. Answers are generally posted within seven (7) business days of question submission (answers will also be e-mailed directly to the inquirer).

The Topic Q&A for this BAA opens on **April 21, 2021** and closes to new questions on **June 03, 2021 at 12:00 PM ET**. Once the BAA closes to proposal submission, no communication of any kind with the topic author or through Topic Q&A regarding your submitted proposal is allowed.

Proposing firms are advised to monitor Topic Q&A during the BAA period for questions and answers. Proposing firms should also frequently monitor DSIP for updates and amendments to the topics.

4.14 Registrations and Certifications

Proposing firms must be registered in the Defense SBIR/STTR Innovation Portal (DSIP) in order to prepare and submit proposals. All users will be required to register for a login.gov account and link it to their DSIP account. To register in Login.gov, click the Login/Register button in the top right corner on the DSIP Submissions homepage and follow the steps to register. If you already have a Login.gov account, you can link your existing Login.gov account with your DSIP account. Job Aids and Help Videos to walk you through the process are in the Learning & Support section of DSIP, here: https://www.dodsbirsttr.mil/submissions/learning-support/training-materials.

Please note that the email address you use for Login.gov should match the email address associated with your existing DSIP account. If you do not recall the email address associated with your DSIP account, or if you already have an existing Login.gov account using a different email address, you will need your Firm's DUNS number and your Firm PIN in order to link your Login.gov account with your DSIP account. If the email address associated with your existing DSIP account has been used for multiple DSIP accounts within your Firm, you will also need your Firm's DUNS number and your Firm PIN in order to link your Login.gov account with your DSIP account. The Firm PIN can be obtained from your Firm Admin. You can view the Firm Admin's contact information by entering your Firm's DUNS number when prompted. If you are the Firm Admin, please ensure that you contact all DSIP users in your Firm and provide them with the Firm PIN.

It is recommended that you complete your Login.gov setup as soon as possible to avoid any delays in your proposal submissions.

Before the DoD Components can award a contract, proposing firms must be registered in the System for Award Management (SAM). SAM allows firms interested in conducting business with the federal government to provide basic information on business structure and capabilities as well as financial and payment information. To register, visit www.sam.gov. It is in the firm's interest to visit SAM and ensure the firm's registration is active and representations and certifications are up-to-date to avoid delay in award.

SAM.gov will be merged into the modernized beta.SAM.gov environment on May 24, 2021. Once integrated, legacy SAM.gov will be decommissioned and the new environment will retire the "beta" and be renamed SAM.gov. Once the integration occurs, the system will provide a modern portal for entities to register, update, renew, and check the status of their registration in the rebranded SAM.gov. Core functions of SAM and core data will not change. Entities with an active registration do not need to take action and the process to register to do business with the government will not change.

Follow instructions found during SAM registration on how to obtain a Commercial and Government Entry (CAGE) code and Data Universal Numbering System (DUNS) number. Once a CAGE code and DUNS number are obtained, update the firm's profile on the Defense SBIR/STTR Innovation Portal (DSIP) at https://www.dodsbirsttr.mil/submissions/.

In addition to the standard federal and DoD procurement certifications, the SBA STTR Policy Directive requires the collection of certain information from firms at time of award and during the award life cycle. Each firm must provide this additional information at the time of the Phase I and Phase II award, prior to final payment on the Phase I award, prior to receiving 50% of the total award amount for a Phase II award, and prior to final payment on the Phase II award.

4.15 Promotional Materials

Promotional and non-project related discussion is discouraged, and additional information provided via Universal Resource Locator (URL) links or on computer disks, CDs, DVDs, video tapes or any other medium will not be accepted or considered in the proposal evaluation.

4.16 Prior, Current, or Pending Support of Similar Proposals or Awards

IMPORTANT -- While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work (see Section 3) for consideration under numerous federal program BAAs or solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning prior, current, or pending support of similar proposals or awards, it must be disclosed to the soliciting agency or agencies as early as possible. See Section 5.4.c(11).

4.17 Fraud and Fraud Reporting

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

The Department of Defense, Office of Inspector General Hotline ("Defense Hotline") is an important avenue for reporting fraud, waste, abuse, and mismanagement within the Department of Defense. The Office of Inspector General operates this hotline to receive and investigate complaints or information from contractor employees, DoD civilians, military service members and public citizens. Individuals who wish to report fraud, waste or abuse may contact the Defense Hotline at (800) 424-9098 between 8:00 a.m. and 5:00 p.m. Eastern Time or visit http://www.dodig.mil/Components/Administrative-Investigations/DoD-Hotline/Hotline-Complaint/ to submit a complaint. Mailed correspondence should be addressed to the Defense Hotline, The Pentagon, Washington, DC 20301-1900, or e-mail addressed to hotline@dodig.mil.

4.18 State and Other Assistance Available

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

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

Contact your State SBIR/STTR Support office at https://www.sbir.gov/state_services?state=105813# for further information. Small Businesses may seek general administrative guidance from small and disadvantaged business utilization specialists located in various Defense Contract Management activities throughout the continental United States.

4.19 Discretionary Technical and Business Assistance (TABA)

DoD has mandated the use of TABA pending further SBA guidance and establishment of a limit on the amount of technical and business assistance services that may be received or purchased by a small business concern that has received multiple Phase II SBIR or STTR awards for a fiscal year. However, proposers should carefully review individual component instructions to determine if TABA is being offered and follow specific proposal requirements for requesting TABA funding.

5.0 PHASE I PROPOSAL

5.1 Introduction

This BAA and the Defense SBIR/STTR Innovation Portal (DSIP) sites are designed to reduce the time and cost required to prepare a formal proposal. 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. Proposers submitting through this site for the first time will be asked to register. It is recommended that firms register as soon as possible upon identification of a proposal opportunity to avoid delays in the proposal submission process.

Guidance on allowable proposal content may vary by Component. Accordingly, it is the proposing firm's responsibility to consult the Component-specific instructions for detailed guidance, including required proposal documentation, cost and duration limitations, budget structure, TABA allowance and proposal page limits.

DSIP provides a structure for providing the following proposal volumes:

Volume 1: Proposal Cover Sheet
Volume 2: Technical Volume
Volume 3: Cost Volume
Volume 4: Company Commercialization Report (REQUIRED)
Volume 5: Supporting Documents
a. Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment (REQUIRED)
b. Foreign Ownership or Control Disclosure (Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability.)
c. Other supporting documentation (Refer to Component-specific instructions for additional Volume 5 requirements)
Volume 6: Fraud, Waste and Abuse Training (REQUIRED)

NOTE: All proposers are required to submit Volume 4: Company Commercialization Report (CCR), Volume 5(a): Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment, Volume 5(b): Foreign Ownership or Control Disclosure (Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability), and Volume 6: Fraud, Waste and Abuse training.

A Phase I Proposal Template is available to provide helpful guidelines for completing each section of your Phase I technical proposal. This can be found at https://www.dodsbirsttr.mil/submissions/learning-support/firm-templates.

Detailed guidance on registering in DSIP and using DSIP to submit a proposal can be found at https://www.dodsbirsttr.mil/submissions/learning-support/training-materials. If the proposal status is "In

Progress" or "Ready to Certify" it will NOT be considered submitted, even if all volumes are added prior to the BAA close date. The proposer may modify all proposal volumes prior to the BAA close date.

Although signatures are not required on the electronic forms at the time of submission the proposal must be certified electronically by the corporate official for it to be considered submitted. If the proposal is selected for award, the DoD Component program will contact the proposer for signatures at the time of award.

5.2 Marking Proprietary Proposal Information

Proposers that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall:

(1) Mark the first page of each Volume of the proposal submission with the following legend:

> "This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed-in whole or in part-for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this proposer as a result of – or in connection with – the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in pages [insert numbers or other identification of sheets]"; and

(2) Mark each sheet of data it wishes to restrict with the following legend:

> "Use or disclosure of data contained on this page is subject to the restriction on the first page of this volume."

The DoD assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

Restrictive notices notwithstanding, proposals and final reports submitted through the Defense SBIR/STTR Innovation Portal (DSIP) may be handled, for administrative purposes only, by support contractors. All support contractors are bound by appropriate non-disclosure agreements.

5.3 Phase I Proposal Instructions

a. **Proposal Cover Sheet (Volume 1)**

On the Defense SBIR/STTR Innovation Portal (DSIP) at https://www.dodsbirsttr.mil/submissions/, prepare the Proposal Cover Sheet.

The Cover Sheet must include a brief technical abstract of no more than 200 words that describes the proposed R&D project with a discussion of anticipated benefits and potential commercial applications. **Do not include proprietary or classified information in the Proposal Cover Sheet**. If your proposal is selected for award, the technical abstract and discussion of anticipated benefits may be publicly released on the Internet. Once the Cover Sheet is saved, the system will assign a proposal number. You may modify the cover sheet as often as necessary until the BAA closes.

b. **Format of Technical Volume (Volume 2)**

(1) **Type of file**: The Technical Volume must be a single Portable Document Format (PDF) file, including graphics. Perform a virus check before uploading the Technical Volume file. If a virus is detected, it may cause rejection of the proposal. **Do not lock or encrypt the uploaded file. Do not include or embed active graphics such as videos, moving pictures, or other similar media in the document.**

(2) **Length**: It is the proposing firm's responsibility to verify that the Technical Volume does not exceed the page limit after upload to DSIP. Please refer to Component-specific instructions for how a technical volume is handled if the stated page count is exceeded. Some Components will reject the entire technical proposal if the proposal exceeds the stated page count.

(3) **Layout**: Number all pages of your proposal consecutively. Those who wish to respond must submit a direct, concise, and informative research or research and development proposal (no type smaller than 10-point on standard 8-1/2" x 11" paper with one-inch margins). The header on each page of the Technical Volume should contain your company name, topic number, and proposal number assigned by the Defense SBIR/STTR Innovation Portal (DSIP) when the Cover Sheet was created. The header may be included in the one-inch margin.

c. **Content of the Technical Volume (Volume 2)**

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

(1) **Identification and Significance of the Problem or Opportunity.** Define the specific technical problem or opportunity addressed and its importance.

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

(3) **Phase I Statement of Work (including Subcontractors' Efforts)**

a. Provide an explicit, detailed description of the Phase I approach. If a Phase I option is required or allowed by the Component, describe appropriate research activities which would commence at the end of Phase I base period should the Component elect to exercise the option. The Statement of Work should indicate what tasks are planned, how and where the work will be conducted, a schedule of major events, and the final product(s) to be delivered. The Phase I effort should attempt to determine the technical feasibility of the proposed concept. The methods planned to achieve each objective or task should be discussed explicitly and in detail. This section should be a substantial portion of the Technical Volume section.

b. 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 (see Sections 4.7 - 4.9). **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.**

(4) **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:
   a. Short description,
   b. Client for which work was performed (including individual to be contacted and phone number), and
   c. Date of completion.

(5) **Relationship with Future Research or Research and Development**
   a. State the anticipated results of the proposed approach if the project is successful.
   b. Discuss the significance of the Phase I effort in providing a foundation for Phase II research or research and development effort.
   c. Identify the applicable clearances, certifications and approvals required to conduct Phase II testing and outline the plan for ensuring timely completion of said authorizations in support of Phase II research or research and development effort.

(6) **Commercialization Strategy.** Describe in approximately one page your company's strategy for commercializing this technology in DoD, 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.

(7) **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.

(8) **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 STTR 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 Section 3 of the BAA. 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)).

(9) **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.

(10) **Subcontractors/Consultants.** Involvement of a research institution in the project is required and the institution should be identified and described according to the Cost Breakdown Guidance. A minimum of 40% 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. STTR 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, proposers must certify their use of such facilities on the Cover Sheet of the proposal.

(11) **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:

a. Name and address of the Federal Agency(s) or DoD Component to which a proposal was submitted, will be submitted, or from which an award is expected or has been received.
b. Date of proposal submission or date of award.
c. Title of proposal.
d. Name and title of principal investigator for each proposal submitted or award received.
e. Title, number, and date of BAA(s) or solicitation(s) under which the proposal was submitted, will be submitted, or under which award is expected or has been received.
f. If award was received, state contract number.
g. Specify the applicable topics for each SBIR/STTR proposal submitted or award received.

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

d. **Content of the Cost Volume (Volume 3)**

Complete the Cost Volume by using the on-line cost volume form on the Defense SBIR/STTR Innovation Portal (DSIP). Some items in the Cost Breakdown Guidance may not apply to the proposed project. If that is the case, there is no need to provide information on each and every item. What matters is that enough information be provided to allow us to understand how you plan to use the requested funds if a contract is awarded.

(1) List all key personnel by name as well as by number of hours dedicated to the project as direct labor.

(2) While special tooling and test equipment and material cost may be included under Phases I, the inclusion of equipment and material will be carefully reviewed relative to need and appropriateness for the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Component Contracting Officer, be advantageous to the Government and should be related directly to the specific topic. These may include such items as innovative instrumentation or automatic test equipment. Title to property furnished by the Government or acquired with Government funds will be vested with the DoD Component, unless it is determined that transfer of title to the contractor would be more cost effective than recovery of the equipment by the DoD Component.

(3) Cost for travel funds must be justified and related to the needs of the project.

(4) Cost sharing is permitted for proposals under this BAA; however, cost sharing is not required nor will it be an evaluation factor in the consideration of a Phase I proposal.

(5) A Phase I Option (if applicable) should be fully costed separately from the Phase I (base) approach.

(6) All subcontractor costs and consultant costs, such as labor, travel, equipment, materials, must be detailed at the same level as prime contractor costs. Provide detailed substantiation of subcontractor costs in your cost proposal. Volume 5, Supporting Documents, may be used if additional space is needed.

When a proposal is selected for award, you must be prepared to submit further documentation to the Component Contracting Officer to substantiate costs (e.g., an explanation of cost estimates for equipment, materials, and consultants or subcontractors). For more information about cost proposals and accounting standards, see http://www.dcaa.mil. Click on "Guidance" and then click on "Audit Process Overview Information for Contractors."

e. **Company Commercialization Report (Volume 4)**

The Company Commercialization Report (CCR) allows companies to report funding outcomes resulting from prior SBIR and STTR awards. Completion of Volume 4: Company Commercialization Report in DSIP is required for all proposal submissions. During proposal submission, proposing firms with no prior DoD or non-DoD SBIR/STTR awards can select "No" for the question "Do you have a new or revised Company Commercialization Report to upload?".

Proposing firms with prior DoD and/or non-DoD Phase I and/or Phase II SBIR/STTR awards must complete the CCR, regardless of whether the project has any commercialization to date, by logging into their account at https://www.sbir.gov/. To view or print the information currently contained in the Company Registry Commercialization Report, navigate to My Dashboard > My Documents. To create or update the commercialization record, from the company dashboard, scroll to the "My Commercialization" section, and click the create/update Commercialization tab under "Current Report Version". Please refer to the "Instructions" and "Guide" documents contained in this section of the Dashboard for more detail on completing and updating the CCR.

Once the report is certified and submitted on SBIR.gov, click the "Company Commercialization Report" PDF under the My Documents section of the dashboard to download a PDF of the CCR. This PDF of the CCR must be uploaded to Volume 4: Company Commercialization Report in the Firm Information section of DSIP by the Firm Admin. All other firm users will have read-only access to the CCR from the proposal submission page, in order to confirm that the CCR has been uploaded by the Firm Admin to complete the Volume 4 requirement. The most recent version of the CCR that has been uploaded by the Firm Admin will be included in the proposal submission.

WARNING: Uploading a new Company Commercialization Report (CCR) under the Firm Information section of DSIP or clicking "Save" or "Submit" in Volume 4 of one proposal submission is considered a change for ALL proposals under any open BAAs or CSOs. If a proposing firm has previously certified and submitted any Phase I or Direct to Phase II proposals under ***any*** BAA or CSO ***that is still open***, those proposals will be automatically reopened. Proposing firms will have to recertify and resubmit such proposals. If a proposing firm does not recertify or resubmit such proposals, they will not be considered fully submitted and will not be evaluated.

f. **Supporting Documents (Volume 5)**

Volume 5 is provided for proposers to submit additional documentation to support the Technical Volume (Volume 2), and the Cost Volume (Volume 3).

Beginning with the DoD 21.B STTR BAA, all proposers are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment (REQUIRED)
2. Foreign Ownership or Control Disclosure (BAA Attachment 2) (Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability)

Any of the following documents may be included in Volume 5 if applicable to the proposal. Refer to Component-specific instructions for additional Volume 5 requirements.

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

g. **Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment**

The DoD must comply with Section 889(a)(1)(B) of the National Defense Authorization Act (NDAA) for Fiscal Year 2019, and is working to reduce or eliminate contracts with entities that use any equipment, system, or service that uses covered telecommunications equipment or services (as defined in BAA Attachment 1) as a substantial or essential component of any system, or as critical technology as part of any system.

All proposals must include certifications in Federal Acquisition Regulation clauses 52.204-24, 52-204-25, and 52-204-26, executed by the proposer's authorized company representative. These Federal Acquisition Regulation clauses may be found in BAA Attachment 1. **These certifications must be signed by the authorized company representative and uploaded as a separate PDF file in the supporting documents sections of Volume 5 for all proposal submissions.**

The effort to complete the required certification clauses includes due diligence on the part of the proposer and for any contractors that may be proposed as a part of the submission including research partners and suppliers. Therefore, proposers are strongly encouraged to review the requirements of these certifications early in the proposal development process. Failure to submit or complete the required certifications as a part of the proposal submission process may be cause for rejection of the proposal submission without evaluation.

h. Foreign Ownership or Control Disclosure

Proposers must review Attachment 2: Foreign Ownership or Control Disclosure to determine applicability. If applicable, an authorized firm representative must complete the Foreign Ownership or Control Disclosure (BAA Attachment 2). The completed and signed disclosure must be uploaded to Volume 5 of the proposal submission.

i. Fraud, Waste and Abuse Training (Volume 6)

The Fraud, Waste and Abuse (FWA) training is **required** for Phase I and Direct to Phase II proposals. FWA training provides information on what represents FWA in the SBIR/STTR program, the most common mistakes that lead to FWA, as well as the penalties and ways to prevent FWA in your firm. This training material can be found in the Volume 6 section of the proposal submission module in DSIP and must be thoroughly reviewed once per year. Plan ahead and leave ample time to complete this training based on the proposal submission deadline. FWA training must be completed by one DSIP firm user with read/write access (Proposal Owner, Corporate Official or Firm Admin) on behalf of the firm.

6.0 PHASE I EVALUATION CRITERIA

Proposals will be evaluated based on the criteria outlined below, unless otherwise specified in the Component-specific instructions. Selections will be based on best value to the Government considering the following factors which are listed in descending order of importance:

a. The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
b. The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.
c. The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Cost or budget data submitted with the proposal will be considered during evaluation.

Technical reviewers will base their conclusions only on information contained in the proposal. It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments.

Relevant supporting data such as journal articles, literature, including Government publications, etc., should be included based on requirements provided in Component-specific instructions.

7.0 PHASE II PROPOSAL INFORMATION

7.1 Introduction

Unless the Component is participating in the Direct to Phase II, Phase II proposals may only be submitted by Phase I awardees. Submission of Phase II proposals are not permitted at this time and, if submitted, may be rejected without evaluation. Phase II proposal preparation and submission instructions will be provided by the DoD Components to Phase I awardees. See Component-specific instructions for more information on Direct to Phase II Program preparation and submission instructions.

7.2 Proposal Provisions

IMPORTANT -- While it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous federal program BAAs and solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies as early as possible. If a proposal submitted for a Phase II effort 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 Cover Sheet and provide the information required in Section 5.4.c(11).

Due to specific limitations on the amount of funding and number of awards that may be awarded to a particular firm per topic using SBIR/STTR program funds, Head of Agency Determinations are now required before a different agency may make an award using another agency's topic. This limitation does not apply to Phase III funding. Please contact your original sponsoring agency before submitting a Phase II proposal to an agency other than the one who sponsored the original topic.

Section 4(b)(1)(i) of the SBIR/STTR Policy Directive provides that, at the agency's discretion, projects awarded a Phase I under a BAA or solicitation for SBIR may transition in Phase II to STTR and vice versa. A firm wishing to transfer from one program to another must contact their designated technical monitor to discuss the reasons for the request and the agency's ability to support the request. The transition may be proposed prior to award or during the performance of the Phase II effort. Agency disapproval of a request to change programs shall not be grounds for granting relief from any contractual performance requirement. All approved transitions between programs must be noted in the Phase II award or award modification signed by the contracting officer that indicates the removal or addition of the research institution and the revised percentage of work requirements.

7.3 Commercialization Strategy

At a minimum, your commercialization strategy must address the following five questions:

(1) What is the first product that this technology will go into?
(2) Who will be the customers, and what is the estimated market size?
(3) How much money will be needed to bring the technology to market, and how will that money be raised?
(4) Does the company contain marketing expertise and, if not, how will that expertise be brought into the company?

(5) Who are the proposing firm's competitors, and what is the price and/or quality advantage over those competitors?

The commercialization strategy must also include a schedule showing the anticipated quantitative commercialization results from the Phase II project at one year after the start of Phase II, at the completion of Phase II, and after the completion of Phase II (i.e., amount of additional investment, sales revenue, etc.). After Phase II award, the company is required to report actual sales and investment data in its SBA Company Commercialization Report via "My Dashboard" on SBIR.gov at least annually. For information on formatting, page count and other details, please refer to the Component-specific instructions.

7.4 Phase II Evaluation Criteria

Phase II proposals will be evaluated based on the criteria outlined above in section 6.0, unless otherwise specified in the Component-specific instructions.

7.5 Phase II Award Information

DoD Components will notify Phase I awardees of the Phase II proposal submission requirements. Submission of Phase II proposals will be in accordance with instructions provided by individual Components. The details on the due date, content, and submission requirements of the Phase II proposal will be provided by the awarding DoD Component either in the Phase I award or by subsequent notification.

7.6 Adequate Accounting System

In order to reduce risk to the small business and avoid potential contracting delays, it is suggested that companies interested in pursuing Phase II SBIR/STTR contracts and other contracts of similar size with the Department of Defense (DoD), have an adequate accounting system per General Accepted Accounting Principles (GAAP), Generally Accepted Government Auditing Standards (GAGAS), Federal Acquisition Regulation (FAR) and Cost Accounting Standards (CAS) in place. The accounting system will be audited by the Defense Contract Audit Agency (DCAA). DCAA's requirements and standards are available on their Website at: http://www.dcaa.mil and click on "Guidance" and then click on "Audit Process Overview – Information for Contractors," and also at: http://www.dcaa.mil and click on "Checklists and Tools" and then click on "Pre-award Accounting System Adequacy Checklist".

7.7 Phase II Enhancement Policy

To further encourage the transition of STTR research into DoD acquisition programs as well as the private sector, certain DoD Components have developed their own Phase II Enhancement policy. Under this policy, the Component will provide a Phase II awardee with additional Phase II STTR funding if the company can match the additional STTR funds with non-STTR funds from DoD acquisition programs or the private sector.

See component instructions for more details on Phase II Enhancement opportunities.

7.8 Commercialization Readiness Program (CRP)

The SBIR/STTR Reauthorization Act of 2011 establishes the Commercialization Pilot Program (CPP) as a long-term program titled the Commercialization Readiness Program (CRP).

Each Military Department (Army, Navy, and Air Force) has established a Commercialization Readiness Program. Please check the Component instructions for further information.

The Small Business and Technology Partnerships Office established the OSD Transitions SBIR Technology (OTST) Pilot Program. The OTST pilot program is an interim technology maturity phase (Phase II), inserted into the SBIR development.

For more information contact osd.ncr.ousd-r-e.mbx.sbir-sttr@mail.mil.

8.0 CONTRACTUAL REQUIREMENTS

8.1 Additional Contract Requirements

Small Business Concerns (SBCs) are strongly encouraged to engage with their Contracting/Agreements Office to determine what measures can be taken in the event contract performance is affected due to the COVID-19 situation. SBCs are encouraged to monitor the CDC Website, engage with your employees to share information and discuss COVID-19 concerns employees may have. Please identify to your Contracting/Agreements Officer potential impacts to the welfare and safety of your workforce and any contract/OT performance issues. Most importantly, keep in mind that only your Contracting/Agreements Officer can affect changes to your contract/OT.

Upon award of a contract, the contractor will be required to make certain legal commitments through acceptance of Government contract clauses in the Phase I contract. The outline that follows is illustrative of the types of provisions required by the Federal Acquisition Regulation that will be included in the Phase I contract. This is not a complete list of provisions to be included in Phase I contracts, nor does it contain specific wording of these clauses. Copies of complete general provisions will be made available prior to award.

Examples of general provisions:

a. **Standards of Work**. Work performed under the contract must conform to high professional standards.
b. **Inspection**. Work performed under the contract is subject to Government inspection and evaluation at all reasonable times.
c. **Examination of Records**. The Comptroller General (or a fully authorized representative) shall have the right to examine any directly pertinent records of the contractor involving transactions related to this contract.
d. **Default**. The Government may terminate the contract if the contractor fails to perform the work contracted.
e. **Termination for Convenience**. The contract may be terminated at any time by the Government if it deems termination to be in its best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.
f. **Disputes**. Any dispute concerning the contract which cannot be resolved by agreement shall be decided by the contracting officer with right of appeal.
g. **Contract Work Hours**. The contractor may not require an employee to work more than eight hours a day or forty hours a week unless the employee is compensated accordingly (that is, receives overtime pay).
h. **Equal Opportunity**. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.
i. **Affirmative Action for Veterans**. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran.

j. **Affirmative Action for Handicapped**. The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.
k. **Officials Not to Benefit**. No member of or delegate to Congress shall benefit from the contract.
l. **Covenant Against Contingent Fees**. No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bona fide employees or commercial agencies maintained by the contractor for the purpose of securing business.
m. **Gratuities**. The contract may be terminated by the Government if any gratuities have been offered to any representative of the Government to secure the contract.
n. **Patent Infringement**. The contractor shall report each notice or claim of patent infringement based on the performance of the contract.
o. **Military Security Requirements**. The contractor shall safeguard any classified information associated with the contracted work in accordance with applicable regulations.
p. **American Made Equipment and Products**. When purchasing equipment or a product under the SBIR funding agreement, purchase only American-made items whenever possible.

Applicable Federal Acquisition Regulation (FAR) and/or Defense Federal Acquisition Regulation Supplement (DFARS) Clauses:

q. **Unique Identification (UID)**. If your proposal identifies hardware that will be delivered to the government be aware of the possible requirement for unique item identification in accordance with DFARS 252.211-7003.
r. **Disclosure of Information.** In accordance with FAR 252.204-7000, Government review and approval will be required prior to any dissemination or publication, except within and between the Contractor and any subcontractors, of classified and non-fundamental information developed under this contract or contained in the reports to be furnished pursuant to this contract.
s. **Animal Welfare**. Contracts involving research, development, test, evaluation, or training on vertebrate animals will incorporate DFARS clause 252.235-7002.
t. **Protection of Human Subjects**. Effective 29 July 2009, contracts that include or may include research involving human subjects in accordance with 32 CFR Part 219, DoD Directive 3216.02 and 10 U.S.C. 980, including research that meets exemption criteria under 32 CFR 219.101(b), will incorporate DFARS clause 252.235-7004.
u. **E-Verify**. Contracts exceeding the simplified acquisition threshold may include the FAR clause 52.222-54 “Employment Eligibility Verification” unless exempted by the conditions listed at FAR 22.1803.
v. **ITAR**. In accordance with DFARS 225.7901-4, Export Control Contract Clauses, the clause found at DFARS 252.225-7048, Export-Controlled Items (June 2013), must be included in all BAAs/solicitations and contracts. Therefore, all awards resulting from this BAA will include DFARS 252.225-7048. Full text of the clause may be found at https://www.govinfo.gov/content/pkg/CFR-2013-title48-vol3/pdf/CFR-2013-title48-vol3-sec252-225-7048.pdf.
w. **Cybersecurity**. Any SBC receiving an SBIR/STTR award is required to provide adequate security on all covered contractor information systems. Specific security requirements and cyber incident reporting requirements are listed in DFARS 252.204.7012. Compliance is mandatory.
x. Safeguarding Covered Defense Information Controls. As prescribed in DFARS 252.204-7008, for covered contractor information systems that are not part of an information technology service or system operated on behalf of the Government, the SBC represents that it will implement the security requirements specified by National Institute of Standards and

Technology (NIST) Special Publication (SP) 800-171, "Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations".

y. **Limitations on the Use or Disclosure of Third- Party Contractor Reported Cyber Incident Information.** As required in DFARS 252.204-7009, the Contractor must agree that certain conditions apply to any information it receives or creates in the performance of a resulting contract that is information obtained from a third-party's reporting of a cyber incident pursuant to DFARS clause 252.204-7012, Safeguarding Covered Defense Information and Cyber Incident Reporting (or derived from such information obtained under that clause).

z. **Notice of NIST SP 800-171 DoD Assessment Requirements.** As prescribed by DFARS 252.204-7019, in order to be considered for award, the SBC is required to implement NIST SP 800-171. The SBC shall have a current assessment (see 252.204-7020) for each covered contractor information system that is relevant to the offer, contract, task order, or delivery order. The Basic, Medium, and High NIST SP 800-171 DoD Assessments are described in the NIST SP 800-171 DoD Assessment Methodology located at https://www.acq.osd.mil/dpap/pdi/cyber/strategically_assessing_contractor_implementation_of_NIST_SP_800-171.html. In accordance with DFARS 252.204-7020, the SBC shall provide access to its facilities, systems, and personnel necessary for the Government to conduct a Medium or High NIST SP 800-171 DoD Assessment, as described in NIST SP 800-171 DoD Assessment Methodology, linked above. Notification of specific requirements for NIST SP 800-171 DoD assessments and assessment level will be provided as part of the component instructions, topic, or award.

aa. **Disclosure of Ownership or Control by a Foreign Government**. DFARS 252.209-7002, Disclosure of Ownership or Control by a Foreign Government (JUN 2010), is incorporated into this solicitation. In accordance with DFARS 252.209-7002, any SBC submitting a proposal in response to this solicitation is required to disclose, by completing Attachment 2 to this solicitation, Foreign Ownership or Control Disclosure, any interest a foreign government has in the SBC when that interest constitutes control by a foreign government, as defined in DFARS provision 252.209-7002. If the SBC is a subsidiary, it is also required to disclose any reportable interest a foreign government has in any entity that owns or controls the subsidiary, including reportable interest concerning the SBC's immediate parent, intermediate parents, and the ultimate parent.

8.2 Basic Safeguarding of Covered Contractor Information Systems

FAR 52.204-21, Basic Safeguarding of Covered Contractor Information Systems, is incorporated into this solicitation. In accordance with FAR 52.204-21, the contractor shall apply basic safeguarding requirements and procedures when the contractor or a subcontractor at any tier may have Federal contract information residing in or transiting through its information system.

FAR 52.204-21 Basic Safeguarding of Covered Contractor Information Systems (JUN 2016)

(a) Definitions. As used in this clause -

Covered contractor information system means an information system that is owned or operated by a contractor that processes, stores, or transmits Federal contract information.

Federal contract information means information, not intended for public release, that is provided by or generated for the Government under a contract to develop or deliver a product or service to the Government, but not including information provided by the Government to the public (such as on public Web sites) or simple transactional information, such as necessary to process payments.

Information means any communication or representation of knowledge such as facts, data, or opinions, in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual (Committee on National Security Systems Instruction (CNSSI) 4009).

Information system means a discrete set of information resources organized for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information (44 U.S.C. 3502).

Safeguarding means measures or controls that are prescribed to protect information systems.

(b) Safeguarding requirements and procedures.

(1) The Contractor shall apply the following basic safeguarding requirements and procedures to protect covered contractor information systems. Requirements and procedures for basic safeguarding of covered contractor information systems shall include, at a minimum, the following security controls:

(i) Limit information system access to authorized users, processes acting on behalf of authorized users, or devices (including other information systems).

(ii) Limit information system access to the types of transactions and functions that authorized users are permitted to execute.

(iii) Verify and control/limit connections to and use of external information systems.

(iv) Control information posted or processed on publicly accessible information systems.

(v) Identify information system users, processes acting on behalf of users, or devices.

(vi) Authenticate (or verify) the identities of those users, processes, or devices, as a prerequisite to allowing access to organizational information systems.

(vii) Sanitize or destroy information system media containing Federal Contract Information before disposal or release for reuse.

(viii) Limit physical access to organizational information systems, equipment, and the respective operating environments to authorized individuals.

(ix) Escort visitors and monitor visitor activity; maintain audit logs of physical access; and control and manage physical access devices.

(x) Monitor, control, and protect organizational communications (i.e., information transmitted or received by organizational information systems) at the external boundaries and key internal boundaries of the information systems.

(xi) Implement subnetworks for publicly accessible system components that are physically or logically separated from internal networks.

(xii) Identify, report, and correct information and information system flaws in a timely manner.

(xiii) Provide protection from malicious code at appropriate locations within organizational information systems.

(xiv) Update malicious code protection mechanisms when new releases are available.

(xv) Perform periodic scans of the information system and real-time scans of files from external sources as files are downloaded, opened, or executed.

(2) **Other requirements**. This clause does not relieve the Contractor of any other specific safeguarding requirements specified by Federal agencies and departments relating to covered contractor information systems generally or other Federal safeguarding requirements for controlled unclassified information (CUI) as established by Executive Order 13556.

(c) ***Subcontracts***. The Contractor shall include the substance of this clause, including this paragraph (c), in subcontracts under this contract (including subcontracts for the acquisition of commercial items, other than commercially available off-the-shelf items), in which the subcontractor may have Federal contract information residing in or transiting through its information system.

8.3 Prohibition on Contracting with Persons that have Business Operations with the Maduro Regime

Section 890 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2020 prohibits entering into a contract for the procurement of products or services with any person that has business operations with an authority of the government of Venezuela that is not recognized as the legitimate government of Venezuela by the United States Government, unless an exception applies. See provision 252.225-7974 Class Deviation 2020-O0005 "Prohibition on Contracting with Persons that have Business Operations with the Maduro Regime.

8.4 Copyrights

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

8.5 Patents

Small business firms normally may retain the principal worldwide patent rights to any invention developed with Government support. The Government receives a royalty-free license for its use, reserves the right to require the patent holder to license others in certain limited circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must normally manufacture it domestically. To the extent authorized by 35 USC 205, the Government will not make public any information disclosing a Government-supported invention for a period of five years to allow the awardee to pursue a patent. See also Invention Reporting in Section 8.6.

8.6 Technical Data Rights

Rights in technical data, including software, developed under the terms of any contract resulting from proposals submitted in response to this BAA generally remain with the contractor, except that the Government obtains a royalty-free license to use such technical data only for Government purposes during the period commencing with contract award and ending five years after completion of the project under which the data were generated. This data should be marked with the restrictive legend specified in DFARS 252.227-7018. Upon expiration of the five-year restrictive license, the Government has unlimited rights in the STTR data. During the license period, the Government may not release or disclose STTR data to any person other than its support services contractors except: (1) For evaluation purposes; (2) As expressly permitted by the contractor; or (3) A use, release, or disclosure that is necessary for emergency repair or overhaul of items operated by the Government. See DFARS clause 252.227-7018, "Rights in Noncommercial Technical Data and Computer Software – Small Business Technology Transfer (STTR) Program."

If a proposer plans to submit assertions in accordance with DFARS 252.227-7017, those assertions must be identified, and assertion of use, release, or disclosure restriction MUST be included with your proposal submission. The contract cannot be awarded until assertions have been approved.

8.7 Invention Reporting

STTR awardees must report inventions to the component within two months of the inventor's report to the awardee. The reporting of inventions may be accomplished by submitting paper documentation, including fax, or through the Edison Invention Reporting System at www.iedison.gov for those agencies participating in iEdison.

8.8 Final Technical Reports - Phase I through Phase III

a. **Content**: A final report is required for each project phase. The reports must contain in detail the project objectives, work performed, results obtained, and estimates of technical feasibility. A completed SF 298, "Report Documentation Page," will be used as the first page of the report. submission resources at https://discover.dtic.mil/submit-documents/. In addition, monthly status and progress reports may be required by the DoD Component.

b. **SF 298 Form "Report Documentation Page" Preparation**:

(1) If desirable, language used by the company in its Phase II proposal to report Phase I progress may also be used in the final report.

(2) For each unclassified report, the company submitting the report should fill in Block 12 (Distribution/Availability Statement) of the SF 298, "Report Documentation Page," with the following statement: "Distribution authorized to U.S. Government only; Proprietary Information, (Date of Determination). Other requests for this document shall be referred to the Component SBIR/STTR Program Office."

Note: Data developed under an STTR contract is subject to STTR Data Rights which allow for protection under DFARS 252.227-7018 (see Section 8.5, Technical Data Rights). The sponsoring DoD activity, after reviewing the company's entry in Block 12, has final responsibility for assigning a distribution statement.

For additional information on distribution statements see the following Defense Technical Information Center (DTIC) Web site: https://discover.dtic.mil/wp-content/uploads/2018/09/distribution_statements_and_reasonsSept2018.pdf

(3) Block 14 (Abstract) of the SF 298, "Report Documentation Page" must include as the first sentence, "Report developed under STTR contract for topic [insert BAA topic number. [Follow with the topic title, if possible.]" The abstract must identify the purpose of the work and briefly describe the work conducted, the findings or results and the potential applications of the effort. **Since the abstract will be published by the DoD, it must not contain any proprietary or classified data and type "UU" in Block 17.**

(4) Block 15 (Subject Terms) of the SF 298 must include the term "STTR Report".

c. **Submission**: In accordance with DoD Directive 3200.12 and DFARS clause 252.235-7011, a copy of the final report shall be submitted (electronically or on disc) to:

Defense Technical Information Center
ATTN: DTIC-OA (SBIR/STTR)
8725 John J Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218

Delivery will normally be within 30 days after completion of the Phase I technical effort.

Other requirements regarding submission of reports and/or other deliverables will be defined in the Contract Data Requirements List (CDRL) of each contract.

Special instructions for the submission of CLASSIFIED reports will be defined in the delivery schedule of the contract.DO NOT E-MAIL Classified or controlled unclassified reports, or reports containing STTR Data Rights protected under DFARS 252.227-7018.

ATTACHMENT 1

Department of Defense (DoD)
Small Business Innovation Research (SBIR) Program
Small Business Technology Transfer (STTR) Program

CONTRACTOR CERTIFICATION REGARDING PROVISION OF PROHIBITED VIDEO SURVEILLANCE AND TELECOMMUNICATIONS SERVICES AND EQUIPMENT

Contractor's Name	
Company Name	
Office Tel #	
Mobile #	
Email	

Name of person authorized to sign: _____

Signature of person authorized: _____

Date: _____

The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

FAR CLAUSES INCORPORATED IN FULL TEXT:

52.204-24 REPRESENTATION REGARDING CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT (AUG 2020)

The Offeror shall not complete the representation at paragraph (d)(1) of this provision if the Offeror has represented that it "does not provide covered telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument" in the provision at 52.204-26, Covered Telecommunications Equipment or Services—Representation, or in paragraph (v) of the provision at 52.212-3, Offeror Representations and Certifications-Commercial Items.

(a) *Definitions.* As used in this provision-

Backhaul, covered telecommunications equipment or services, critical technology, interconnection arrangements, reasonable inquiry, roaming, and *substantial or essential component* have the meanings

provided in the clause 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment.

(b) *Prohibition.* (1) Section 889(a)(1)(A) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2019, from procuring or obtaining, or extending or renewing a contract to procure or obtain, any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. Nothing in the prohibition shall be construed to—

(i) Prohibit the head of an executive agency from procuring with an entity to provide a service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or

(ii) Cover telecommunications equipment that cannot route or redirect user data traffic or cannot permit visibility into any user data or packets that such equipment transmits or otherwise handles.

(2) Section 889(a)(1)(B) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2020, from entering into a contract or extending or renewing a contract with an entity that uses any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. This prohibition applies to the use of covered telecommunications equipment or services, regardless of whether that use is in performance of work under a Federal contract. Nothing in the prohibition shall be construed to—

(i) Prohibit the head of an executive agency from procuring with an entity to provide a service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or

(ii) Cover telecommunications equipment that cannot route or redirect user data traffic or cannot permit visibility into any user data or packets that such equipment transmits or otherwise handles.

(c) *Procedures.* The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (*https://www.sam.gov*) for entities excluded from receiving federal awards for "covered telecommunications equipment or services."

(d) *Representations.* The Offeror represents that—

(1) It [] will, [] will not provide covered telecommunications equipment or services to the Government in the performance of any contract, subcontract or other contractual instrument resulting from this solicitation. The Offeror shall provide the additional disclosure information required at paragraph (e)(1) of this section if the Offeror responds "will" in paragraph (d)(1) of this section; and

(2) After conducting a reasonable inquiry, for purposes of this representation, the Offeror represents that—

It [] does, [] does not use covered telecommunications equipment or services, or use any equipment, system, or service that uses covered telecommunications equipment or services. The Offeror shall provide the additional disclosure information required at paragraph (e)(2) of this section if the Offeror responds "does" in paragraph (d)(2) of this section.

(e) *Disclosures.* (1) Disclosure for the representation in paragraph (d)(1) of this provision. If the Offeror has responded "will" in the representation in paragraph (d)(1) of this provision, the Offeror shall provide the following information as part of the offer:

(i) For covered equipment—

(A) The entity that produced the covered telecommunications equipment (include entity name, unique entity identifier, CAGE code, and whether the entity was the original equipment manufacturer (OEM) or a distributor, if known);

(B) A description of all covered telecommunications equipment offered (include brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); and

(C) Explanation of the proposed use of covered telecommunications equipment and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(1) of this provision.

(ii) For covered services—

(A) If the service is related to item maintenance: A description of all covered telecommunications services offered (include on the item being maintained: Brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); or

(B) If not associated with maintenance, the Product Service Code (PSC) of the service being provided; and explanation of the proposed use of covered telecommunications services and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(1) of this provision.

(2) Disclosure for the representation in paragraph (d)(2) of this provision. If the Offeror has responded "does" in the representation in paragraph (d)(2) of this provision, the Offeror shall provide the following information as part of the offer:

(i) For covered equipment—

(A) The entity that produced the covered telecommunications equipment (include entity name, unique entity identifier, CAGE code, and whether the entity was the OEM or a distributor, if known);

(B) A description of all covered telecommunications equipment offered (include brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); and

(C) Explanation of the proposed use of covered telecommunications equipment and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(2) of this provision.

(ii) For covered services—

(A) If the service is related to item maintenance: A description of all covered telecommunications services offered (include on the item being maintained: Brand; model number, such as OEM number, manufacturer part number, or wholesaler number; and item description, as applicable); or

(B) If not associated with maintenance, the PSC of the service being provided; and explanation of the proposed use of covered telecommunications services and any factors relevant to determining if such use would be permissible under the prohibition in paragraph (b)(2) of this provision.

(End of provision)

52.204-25 PROHIBITION ON CONTRACTING FOR CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT (AUG 2020)

(a) *Definitions.* As used in this clause—

Backhaul means intermediate links between the core network, or backbone network, and the small subnetworks at the edge of the network (*e.g.*, connecting cell phones/towers to the core telephone network). Backhaul can be wireless (*e.g.*, microwave) or wired (*e.g.*, fiber optic, coaxial cable, Ethernet).

Covered foreign country means The People's Republic of China.

Covered telecommunications equipment or services means—

(1) Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities);

(2) For the purpose of public safety, security of Government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities);

(3) Telecommunications or video surveillance services provided by such entities or using such equipment; or

(4) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Critical technology means—

(1) Defense articles or defense services included on the United States Munitions List set forth in the International Traffic in Arms Regulations under subchapter M of chapter I of title 22, Code of Federal Regulations;

(2) Items included on the Commerce Control List set forth in Supplement No. 1 to part 774 of the Export Administration Regulations under subchapter C of chapter VII of title 15, Code of Federal Regulations, and controlled—

(i) Pursuant to multilateral regimes, including for reasons relating to national security, chemical and biological weapons proliferation, nuclear nonproliferation, or missile technology; or

(ii) For reasons relating to regional stability or surreptitious listening;

(3) Specially designed and prepared nuclear equipment, parts and components, materials, software, and technology covered by part 810 of title 10, Code of Federal Regulations (relating to assistance to foreign atomic energy activities);

(4) Nuclear facilities, equipment, and material covered by part 110 of title 10, Code of Federal Regulations (relating to export and import of nuclear equipment and material);

(5) Select agents and toxins covered by part 331 of title 7, Code of Federal Regulations, part 121 of title 9 of such Code, or part 73 of title 42 of such Code; or

(6) Emerging and foundational technologies controlled pursuant to section 1758 of the Export Control Reform Act of 2018 (50 U.S.C. 4817).

Interconnection arrangements means arrangements governing the physical connection of two or more networks to allow the use of another's network to hand off traffic where it is ultimately delivered (*e.g.,* connection of a customer of telephone provider A to a customer of telephone company B) or sharing data and other information resources.

Reasonable inquiry means an inquiry designed to uncover any information in the entity's possession about the identity of the producer or provider of covered telecommunications equipment or services used by the entity that excludes the need to include an internal or third-party audit.

Roaming means cellular communications services (*e.g.,* voice, video, data) received from a visited network when unable to connect to the facilities of the home network either because signal coverage is too weak or because traffic is too high.

Substantial or essential component means any component necessary for the proper function or performance of a piece of equipment, system, or service.

(b) *Prohibition.* (1) Section 889(a)(1)(A) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2019, from procuring or obtaining, or extending or renewing a contract to procure or obtain, any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. The Contractor is prohibited from providing to the Government any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system, unless an exception at paragraph (c) of this clause applies or the covered telecommunication equipment or services are covered by a waiver described in FAR 4.2104.

(2) Section 889(a)(1)(B) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232) prohibits the head of an executive agency on or after August 13, 2020, from entering into a contract, or extending or renewing a contract, with an entity that uses any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system, unless an exception at

paragraph (c) of this clause applies or the covered telecommunication equipment or services are covered by a waiver described in FAR 4.2104. This prohibition applies to the use of covered telecommunications equipment or services, regardless of whether that use is in performance of work under a Federal contract.

(c) *Exceptions.* This clause does not prohibit contractors from providing—

(1) A service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or

(2) Telecommunications equipment that cannot route or redirect user data traffic or permit visibility into any user data or packets that such equipment transmits or otherwise handles.

(d) *Reporting requirement.* (1) In the event the Contractor identifies covered telecommunications equipment or services used as a substantial or essential component of any system, or as critical technology as part of any system, during contract performance, or the Contractor is notified of such by a subcontractor at any tier or by any other source, the Contractor shall report the information in paragraph (d)(2) of this clause to the Contracting Officer, unless elsewhere in this contract are established procedures for reporting the information; in the case of the Department of Defense, the Contractor shall report to the website at *https://dibnet.dod.mil.* For indefinite delivery contracts, the Contractor shall report to the Contracting Officer for the indefinite delivery contract and the Contracting Officer(s) for any affected order or, in the case of the Department of Defense, identify both the indefinite delivery contract and any affected orders in the report provided at *https://dibnet.dod.mil.*

(2) The Contractor shall report the following information pursuant to paragraph (d)(1) of this clause:

(i) Within one business day from the date of such identification or notification: The contract number; the order number(s), if applicable; supplier name; supplier unique entity identifier (if known); supplier Commercial and Government Entity (CAGE) code (if known); brand; model number (original equipment manufacturer number, manufacturer part number, or wholesaler number); item description; and any readily available information about mitigation actions undertaken or recommended.

(ii) Within 10 business days of submitting the information in paragraph (d)(2)(i) of this clause: Any further available information about mitigation actions undertaken or recommended. In addition, the Contractor shall describe the efforts it undertook to prevent use or submission of covered telecommunications equipment or services, and any additional efforts that will be incorporated to prevent future use or submission of covered telecommunications equipment or services.

(e) *Subcontracts.* The Contractor shall insert the substance of this clause, including this paragraph (e), in all subcontracts and other contractual instruments, including subcontracts for the acquisition of commercial items.

(End of clause)

52.204-26 COVERED TELECOMMUNICATIONS EQUIPMENT OR SERVICES-REPRESENTATION (DEC 2019)

(a) *Definitions.* As used in this provision, "covered telecommunications equipment or services" has the meaning provided in the clause 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment.

(b) *Procedures.* The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (https://www.sam.gov) for entities excluded from receiving federal awards for "covered telecommunications equipment or services".

(c) *Representation.* The Offeror represents that it □ does, □ does not provide covered telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument.

(End of provision)

ATTACHMENT 2

OMB No. 0704-0187
OMB approval expires
August 31, 2021

Department of Defense (DoD)
Small Business Innovation Research (SBIR) Program
Small Business Technology Transfer (STTR) Program

DISCLOSURE OF OFFEROR'S OWNERSHIP OR CONTROL BY A FOREIGN GOVERNMENT

In accordance with DFARS provision 252.209-7002, an offeror is required to disclose, by completing this form (and adding additional pages, as necessary), any interest a foreign government has in the offeror when that interest constitutes control by a foreign government, as defined in DFARS provision 252.209-7002. If the offeror is a subsidiary, it is also required to disclose any reportable interest a foreign government has in any entity that owns or controls the subsidiary, including reportable interest concerning the offeror's immediate parent, intermediate parents, and the ultimate parent.

DISCLOSURE		
Offeror's Point of Contact for Questions about Disclosure	Name:	
	Phone Number:	
Offeror	Name:	
	Address:	
Entity Controlled by a Foreign Government	Name:	
	Address:	
Description of Foreign Government's Interest in the Offeror		
Foreign Government's Ownership Percentage in Offeror		
Identification of Foreign Government(s) with Ownership or Control		

DFARS 252.209-7002 Disclosure of Ownership or Control by a Foreign Government (JUN 2010)

(a) Definitions. As used in this provision—

(1) "Effectively owned or controlled" means that a foreign government or any entity controlled by a foreign government has the power, either directly or indirectly, whether exercised or exercisable, to control the election, appointment, or tenure of the Offeror's officers or a majority of the Offeror's board of directors by any means, e.g., ownership, contract, or operation of law (or equivalent power for unincorporated organizations).

(2) "Entity controlled by a foreign government"—

(i) Means—

(A) Any domestic or foreign organization or corporation that is effectively owned or controlled by a foreign government; or

(B) Any individual acting on behalf of a foreign government.

(ii) Does not include an organization or corporation that is owned, but is not controlled, either directly or indirectly, by a foreign government if the ownership of that organization or corporation by that foreign government was effective before October 23, 1992.

(3) "Foreign government" includes the state and the government of any country (other than the United States and its outlying areas) as well as any political subdivision, agency, or instrumentality thereof.

(4) "Proscribed information" means—

(i) Top Secret information;

(ii) Communications security (COMSEC) material, excluding controlled cryptographic items when unkeyed or utilized with unclassified keys;

(iii) Restricted Data as defined in the U.S. Atomic Energy Act of 1954, as amended;

(iv) Special Access Program (SAP) information; or

(v) Sensitive Compartmented Information (SCI).

(b) Prohibition on award. No contract under a national security program may be awarded to an entity controlled by a foreign government if that entity requires access to proscribed information to perform the contract, unless the Secretary of Defense or a designee has waived application of 10 U.S.C. 2536(a).

(c) Disclosure. The Offeror shall disclose any interest a foreign government has in the Offeror when that interest constitutes control by a foreign government as defined in this provision. If the Offeror is a subsidiary, it shall also disclose any reportable interest a foreign government has in any entity that owns or controls the subsidiary, including reportable interest concerning the Offeror's immediate parent, intermediate parents, and the ultimate parent. Use separate paper as needed, and provide the information in the following format:

Offeror's Point of Contact for Questions about Disclosure
(Name and Phone Number with Country Code, City Code and Area Code, as applicable)

Name and Address of Offeror

Name and Address of Entity Controlled by a Foreign Government

Description of Interest, Ownership Percentage, and Identification of Foreign Government

(End of provision)

VERSION 3

DEPARTMENT OF THE NAVY (DON)
21.B Small Business Technology Transfer (STTR)
Proposal Submission Instructions

IMPORTANT

- **The following instructions apply to STTR topics only:**
  - **N21B-T019 through N21B-T024**
- **The information provided in the DON Proposal Submission Instruction document takes precedence over the DoD Instructions posted for this Broad Agency Announcement (BAA).**
- **DON Phase I Technical Volume (Volume 2) page limit is not to exceed 10 pages.**
- A Phase I Technical Proposal (Volume 2) proposal template, specific to DON topics, is available at https://www.navysbir.com/links_forms.htm; use this template to meet Volume 2 requirements.
- The DON provides notice that Basic Ordering Agreements (BOAs) may be used for Phase I awards, and BOAs or Other Transaction Agreements (OTAs) may be used for Phase II awards.
- The Supporting Documents Volume (Volume 5) is available for the STTR 21.B BAA cycle. The Supporting Documents Volume is provided for small businesses to submit additional documentation to support the Technical Volume (Volume 2) and the Cost Volume (Volume 3). Volume 5 is available for use when submitting Phase I and Phase II proposals. DON will not be using any of the information in Volume 5 during the evaluation.

INTRODUCTION

The Program Manager of the DON STTR Program is Mr. Steve Sullivan. For questions regarding this BAA, use the following information in Table 1 to determine who to contact for what types of questions.

TABLE 1: POINTS OF CONTACT FOR QUESTIONS REGARDING THIS BAA

Type of Question	When	Contact Information
Program and administrative	Always	Program Managers list in Table 2 (below)
Topic-specific technical questions	BAA Pre-release	Technical Point of Contact (TPOC) listed in each topic. Refer to section 4.13 of the DoD BAA for details.
	BAA Open	DoD SBIR/STTR Topic Q&A platform (https://www.dodsbirsttr.mil/submissions) Refer to section 4.13 of the DoD BAA for details.
Electronic submission to the DoD SBIR/STTR Innovation Portal (DSIP)	Always	DoD Help Desk via email at dodsbirsupport@reisystems.com
Navy-specific BAA instructions and forms	Always	Navy-sbir-sttr.fct@navy.mil

VERSION 3

TABLE 21: DON SYSTEMS COMMAND (SYSCOM) STTR PROGRAM MANAGER

Topic Numbers	Point of Contact	SYSCOM	Email
N21B-T019 to N21B-T024	Ms. Donna Attick	Naval Air Systems Command (NAVAIR)	navair.sbir@navy.mil

The DON SBIR/STTR Programs are mission-oriented programs that integrate the needs and requirements of the DON's Fleet through research and development (R&D) topics that have dual-use potential, but primarily address the needs of the DON. More information on the program can be found on the DON SBIR/STTR website at www.navysbir.com. Additional information pertaining to the DON's mission can be obtained from the DON website at www.navy.mil**.**

PHASE I GUIDELINES

Follow the instructions in the DoD SBIR/STTR Program BAA at the DoD SBIR/STTR Innovation Portal (DSIP), https://www.dodsbirsttr.mil/submissions, for requirements and proposal submission guidelines. Please keep in mind that Phase I must address the feasibility of a solution to the topic. It is highly recommended that proposers use the Phase I proposal template, specific to DON topics, at https://navysbir.com/links_forms.htm to meet Phase I Technical Volume (Volume 2) requirements. Inclusion of cost estimates for travel to the sponsoring SYSCOM's facility for one day of meetings is recommended for all proposals.

Proposers are required to submit proposals via DSIP; proposals submitted by any other means will be disregarded. Proposers submitting through this site for the first time will be asked to register. It is recommended that firms register as soon as possible upon identification of a proposal opportunity to avoid delays in the proposal submission process. Proposals that are not successfully certified in the Defense SBIR/STTR Innovation Portal (DSIP) prior to BAA Close will NOT be considered submitted. Please refer to section 5.1 of the DoD SBIR/STTR Program BAA for further information.

PHASE I PROPOSAL SUBMISSION REQUIREMENTS

The following SHALL BE MET or the proposal will be REJECTED for noncompliance.

- **Proposal Cover Sheet (Volume 1).** As specified in DoD SBIR/STTR BAA section 5.4(a).

- **Technical Proposal (Volume 2).** Technical Proposal (Volume 2) must meet the following requirements:
  - Content is responsive to evaluation criteria as specified in DoD SBIR/STTR Program BAA section 6.0
  - Not to exceed **10** pages, regardless of page content
  - Single column format, single-spaced typed lines
  - Standard 8 ½" x 11" paper
  - Page margins one-inch on all sides. A header and footer may be included in the one-inch margin.
  - No font size smaller than 10-point*
  - Include, within the **10-page limit of Volume 2**, an Option that furthers the effort in preparation for Phase II and will bridge the funding gap between the end of Phase I and the start of Phase II. Tasks for both the Phase I Base and the Phase I Option must be clearly identified. Phase I Options are exercise upon selection for Phase II.

*For headers, footers, and imbedded tables, figures, images, or graphics that include text, a font size smaller than 10-point is allowable; however, proposers are cautioned that if the text is too small to be legible it will not be evaluated.

Volume 2 is the technical proposal. Additional documents may be submitted to support Volume 2 in accordance with the instructions for Supporting Documents Volume (Volume 5) as detailed below.

Disclosure of Information (DFARS 252.204-7000)
In order to eliminate the requirements for prior approval of public disclosure of information (in accordance with DFARS 252.204-7000) under this or any subsequent award, the proposer shall identify and describe all fundamental research to be performed under its proposal, including subcontracted work, with sufficient specificity to demonstrate that the work qualifies as fundamental research. Fundamental research means basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons. Simply identifying fundamental research in the proposal does NOT constitute acceptance of the exclusion. All exclusions will be reviewed and noted in the award. NOTE: Fundamental research included in the technical proposal that the proposer is requesting be eliminated from the requirements for prior approval of public disclosure of information, must be uploaded in a separate document (under "Other") in the Supporting Documents Volume (Volume 5).

- **Cost Volume (Volume 3).** The Phase I Base amount must not exceed $140,000 and the Phase I Option amount must not exceed $100,000. Costs for the Base and Option must be separated and clearly identified on the Proposal Cover Sheet (Volume 1) and in Volume 3.

- **Period of Performance.** The Phase I Base Period of Performance must be exactly six (6) months and the Phase I Option Period of Performance must be exactly six (6) months.

- **Company Commercialization Report (Volume 4)**. DoD requires Volume 4 for submission to the 21.B Phase I BAA. Please refer to instructions provided in section 5.4.e of the DoD SBIR/STTR Program BAA.

- **Supporting Documents (Volume 5)**. Volume 5 is available for use when submitting Phase I and Phase II proposals.

  The DoD must comply with Section 889(a)(1)(B) of the FY2019 National Defense Authorization Act (NDAA) and is working to reduce or eliminate contracts, or extending or renewing a contract with an entity that uses any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. **As such, all proposals must include as a part of their submission a written certification in response to the NDAA clauses (Federal Acquisition Regulation clauses 52.204-24, 52-204-25 and 52-204-26).** The written certification can be found in Attachment 1 of the DoD SBIR/STTR Program BAA. This certification must be signed by the authorized company representative and is to be uploaded as a separate PDF file in Volume 5. Failure to submit the required certification as a part of the proposal submission process will be cause for rejection of the proposal submission without evaluation. Please refer to instructions provided in section 5.4.g of the DoD SBIR/STTR Program BAA.

In accordance with DFARS provision 252.209-7002, a proposer is required to disclose any interest a foreign government has in the proposer when that interest constitutes control by foreign government. Proposers must review the Foreign Ownership or Control Disclosure information to determine applicability. If applicable, an authorized firm representative must complete the Disclosure of Offeror's Ownership or Control by a Foreign Government (found in Attachment 2 of the DoD SBIR/STTR Program BAA) and upload as a separate PDF file in Volume 5. Please refer to instructions provided in section 5.4.h of the DoD SBIR/STTR Program BAA.

Volume 5 is available for small businesses to submit additional documentation to support the Technical Proposal (Volume 2) and the Cost Volume (Volume 3). A template is available on https://navysbir.com/links_forms.htm. DON will not be using any of the information in Volume 5 during the evaluation.

- Additional Cost Information
- SBIR/STTR Funding Agreement Certification
- Data Rights
- Allocation of Rights between Prime and Subcontractor
- Disclosure of Information (DFARS 252.204-7000)
- Prior, Current, or Pending Support of Similar Proposals or Awards
- Foreign Citizens
- Majority-Owned VCOC, HF, and PEF Certification, if applicable (SBIR Only)

NOTE: The inclusion of documents or information other than that listed above (e.g., resumes, test data, technical reports, publications) may result in the proposal being deemed "Non-compliant" and REJECTED.

A font size smaller than 10-point is allowable for documents in Volume 5; however, proposers are cautioned that the text may be unreadable.

- **Fraud, Waste and Abuse Training Certification (Volume 6)**. DoD requires Volume 6 for submission to the 21.B Phase I BAA. Please refer to instructions provided in section 5.4.i of the DoD SBIR/STTR Program BAA.

DON STTR PHASE I PROPOSAL SUBMISSION CHECKLIST

- **Subcontractor, Material, and Travel Cost Detail.** In the Cost Volume (Volume 3), proposers must provide sufficient detail for subcontractor, material, and travel costs. Subcontractor costs must be detailed to the same level as the prime contractor. Material costs must include a listing of items and cost per item. Travel costs must include the purpose of the trip, number of trips, location, length of trip, and number of personnel. The "Additional Cost Information" of Volume 5 may be used if additional space is needed to detail these costs. When a proposal is selected for award, be prepared to submit further documentation to the SYSCOM Contracting Officer to substantiate costs (e.g., an explanation of cost estimates for equipment, materials, and consultants or subcontractors).

  For Phase I a minimum of 40% of the work is performed by the proposing firm, and a minimum of 30% of the work is performed by the single research institution. The percentage of work is measured by both direct and indirect costs.

  To calculate the minimum percentage of effort for the proposing firm the sum of all direct and indirect costs attributable to the proposing firm represent the numerator and the total proposals costs (i.e. costs before profit or fee) is the denominator. The single research institution percentage

is calculated by taking the sum of all costs attributable to the single research institution as the numerator and the total proposal costs (i.e. costs before profit or fee) as the denominator.

- **Performance Benchmarks.** Proposers must meet the two benchmark requirements for progress toward Commercialization as determined by the Small Business Administration (SBA) on June 1 each year. Please note that the DON applies performance benchmarks at time of proposal submission, not at time of contract award.

- **Discretionary Technical and Business Assistance (TABA).** If TABA is proposed, the information required to support TABA (as specified in the TABA section below) must be included in Volume 5 as "Additional Cost Information". Failure to include the required information in Volume 5 will result in the denial of TABA. The total value of TABA must not exceed $6,500 in Phase I.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

The SBIR and STTR Policy Directive section 9(b) allows the DON to provide TABA (formerly referred to as DTA) to its awardees. The purpose of TABA is to assist awardees in making better technical decisions on SBIR/STTR projects; solving technical problems that arise during SBIR/STTR projects; minimizing the technical risks associated with SBIR/STTR projects; and commercializing the SBIR/STTR product or process, including intellectual property protections. Firms may request, in their Phase I Cost Volume (Volume 3) and Phase II Cost Volume, to contract these services themselves through one or more TABA providers in an amount not to exceed the values specified below. The Phase I TABA amount is up to $6,500 and is in addition to the award amount. The Phase II TABA amount is up to $25,000 per award. The TABA amount, of up to $25,000, is to be included as part of the award amount and is limited by the established award values for Phase II by the SYSCOM (i.e. within the $1,700,000 or lower limit specified by the SYSCOM). As with Phase I, the amount proposed for TABA cannot include any profit/fee application by the SBIR/STTR awardee and must be inclusive of the applicable indirect costs. A Phase II project may receive up to an additional $25,000 for TABA as part of one additional (sequential) Phase II award under the project for a total TABA award of up to $50,000 per project. A TABA Report, detailing the results and benefits of the service received, will be required annually by October 30.

Approval of direct funding for TABA will be evaluated by the DON SBIR/STTR Program Office. If the TABA request does not include the following items the TABA request will be denied.

- TABA provider(s) (firm name)
- TABA provider(s) point of contact, email address, and phone number
- An explanation of why the TABA provider(s) is uniquely qualified to provide the service
- Tasks the TABA provider(s) will perform
- Total TABA provider(s) cost, number of hours, and labor rates (average/blended rate is acceptable)

TABA must NOT:

- Be subject to any profit or fee by the STTR applicant
- Propose a TABA provider that is the STTR applicant
- Propose a TABA provider that is an affiliate of the STTR applicant
- Propose a TABA provider that is an investor of the STTR applicant
- Propose a TABA provider that is a subcontractor or consultant of the requesting firm otherwise required as part of the paid portion of the research effort (e.g., research partner, consultant, tester, or administrative service provider).

TABA requests must be included as follows:

- Phase I:

- Online DoD Cost Volume (Volume 3) - the value of the TABA request.
- Supporting Documents Volume (Volume 5) – a detailed request for TABA (as specified above) specifically identified as "Discretionary Technical and Business Assistance".

- Phase II:
  - DON Phase II Cost Volume (provided by the DON SYSCOM) - the value of the TABA request.
  - Volume 5 – a detailed request for TABA (as specified above) specifically identified as "Discretionary Technical and Business Assistance".

Proposed values for TABA must NOT exceed:

- Phase I: A total of $6,500
- Phase II: A total of $25,000 per award, not to exceed $50,000 per Phase II project

If a proposer requests and is awarded TABA in a Phase II contract, the proposer will be eliminated from participating in the DON SBIR/STTR Transition Program (STP), the DON Forum for SBIR/STTR Transition (FST), and any other assistance the DON provides directly to awardees.

All Phase II awardees not receiving funds for TABA in their awards must attend a one-day DON STP meeting during the first or second year of the Phase II contract. This meeting is typically held in the spring/summer in the Washington, D.C. area. STP information can be obtained at: https://navystp.com. Phase II awardees will be contacted separately regarding this program. It is recommended that Phase II cost estimates include travel to Washington, D.C. for this event.

EVALUATION AND SELECTION

The DON will evaluate and select Phase I and Phase II proposals using the evaluation criteria in Sections 6.0 and 8.0 of the DoD SBIR/STTR Program BAA respectively, with technical merit being most important, followed by qualifications of key personnel and commercialization potential of equal importance. Due to limited funding, the DON reserves the right to limit awards under any topic.

Approximately one week after the Phase I BAA closing, e-mail notifications that proposals have been received and processed for evaluation will be sent. Consequently, the e-mail address on the proposal Cover Sheet must be correct.

Requests for a debrief must be made within 15 calendar days of select/non-select notification via email as specified in the select/non-select notification. Please note debriefs are typically provided in writing via email to the Corporate Official identified in the firm proposal within 60 days of receipt of the request. Requests for oral debriefs may not be accommodated. If contact information for the Corporate Official has changed since proposal submission, a notice of the change on company letterhead signed by the Corporate Official must accompany the debrief request.

Protests of Phase I and II selections and awards must be directed to the cognizant Contracting Officer for the DON Topic Number, or filed with the Government Accountability Office (GAO). Contact information for Contracting Officers may be obtained from the DON SYSCOM Program Managers listed in Table 2. If the protest is to be filed with the GAO, please refer to the instructions provided in section 4.11 of the DoD SBIR/STTR Program BAA.

Protests to this BAA and proposal submission must be directed to the DoD SBIR/STTR Program BAA Contracting Officer, or filed with the GAO. Contact information for the DoD SBIR/STTR Program BAA Contracting Officer can be found in section 4.11 of the DoD SBIR/STTR Program BAA.

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CONTRACT DELIVERABLES

Contract deliverables for Phase I are typically a kick-off brief, progress reports, and a final report. Required contract deliverables must be uploaded to https://www.navysbirprogram.com/navydeliverables/.

AWARD AND FUNDING LIMITATIONS

Awards. The DON typically awards a Firm Fixed Price (FFP) contract or a small purchase agreement for Phase I. In addition to the negotiated contract award types listed in Section 4.14.b of the DoD SBIR/STTR Program BAA for Phase II awards, the DON may (under appropriate circumstances) propose the use of an Other Transaction Agreement (OTA) as specified in 10 U.S.C. 2371/10 U.S.C. 2371b and related implementing policies and regulations. The DON may choose to use a Basic Ordering Agreement (BOA) for Phase I and Phase II awards.

Funding Limitations. In accordance with the SBIR and STTR Policy Directive section 4(b)(5), there is a limit of one sequential Phase II award per firm per topic. Additionally, to adjust for inflation DON has raised Phase I and Phase II award amounts. The maximum Phase I proposal/award amount including all options (less TABA) is $240,000. The Phase I Base amount must not exceed $140,000 and the Phase I Option amount must not exceed $100,000. The maximum Phase II proposal/award amount including all options (including TABA) is $1,700,000 (unless non-SBIR/STTR funding is being added). Individual SYSCOMs may award amounts, including Base and all Options, of less than $1,700,000 based on available funding. The structure of the Phase II proposal/award, including maximum amounts as well as breakdown between Base and Option amounts will be provided to all Phase I awardees either in their Phase I award or in a minimum of 30 days prior to the due date for submission of their Initial Phase II proposal.

PAYMENTS

The DON makes three payments from the start of the Phase I Base period, and from the start of the Phase I Option period, if exercised. Payment amounts represent a set percentage of the Base or Option value as follows:

Days From Start of Base Award or Option	Payment Amount
15 Days	50% of Total Base or Option
90 Days	35% of Total Base or Option
180 Days	15% of Total Base or Option

TRANSFER BETWEEN SBIR AND STTR PROGRAMS

Section 4(b)(1)(i) of the SBIR and STTR Policy Directive provides that, at the agency's discretion, projects awarded a Phase I under a BAA for STTR may transition in Phase II to SBIR and vice versa. Please refer to instructions provided in section 7.2 of the DoD SBIR/STTR Program BAA.

ADDITIONAL NOTES

System for Award Management (SAM). It is strongly encouraged that proposers register in SAM, https://beta.sam.gov, by the Close date of this BAA, or verify their registrations are still active and will not expire within 60 days of BAA Close. Additionally, proposers should confirm that they are registered to receive contracts (not just grants) and the address in SAM matches the address on the proposal.

Human Subjects, Animal Testing, and Recombinant DNA. Due to the short timeframe associated with Phase I of the SBIR/STTR process, the DON does not recommend the submission of Phase I proposals that require the use of Human Subjects, Animal Testing, or Recombinant DNA. For example, the ability to obtain Institutional Review Board (IRB) approval for proposals that involve human subjects can take 6-12 months, and that lengthy process can be at odds with the Phase I goal for time-to-award. Before the DON

makes any award that involves an IRB or similar approval requirement, the proposer must demonstrate compliance with relevant regulatory approval requirements that pertain to proposals involving human, animal, or recombinant DNA protocols. It will not impact the DON's evaluation, but requiring IRB approval may delay the start time of the Phase I award and if approvals are not obtained within two months of notification of selection, the decision to award may be terminated. If the use of human, animal, and recombinant DNA is included under a Phase I or Phase II proposal, please carefully review the requirements at http://www.onr.navy.mil/About-ONR/compliance-protections/Research-Protections/Human-Subject-Research.aspx**.** This webpage provides guidance and lists approvals that may be required before contract/work can begin.

Government Furnished Equipment (GFE). Due to the typical lengthy time for approval to obtain GFE, it is recommended that GFE is not proposed as part of the Phase I proposal. If GFE is proposed and it is determined during the proposal evaluation process to be unavailable, proposed GFE may be considered a weakness in the proposal.

International Traffic in Arms Regulation (ITAR). For topics indicating ITAR restrictions or the potential for classified work, limitations are generally placed on disclosure of information involving topics of a classified nature or those involving export control restrictions, which may curtail or preclude the involvement of universities and certain non-profit institutions beyond the basic research level. Small businesses must structure their proposals to clearly identify the work that will be performed that is of a basic research nature and how it can be segregated from work that falls under the classification and export control restrictions. As a result, information must also be provided on how efforts can be performed in later phases if the university/research institution is the source of critical knowledge, effort, or infrastructure (facilities and equipment).

Support Contract Personnel for Administrative Functions. Proposers are advised that support contract personnel will be used to carry out administrative functions and may have access to proposals, contract award documents, contract deliverables, and reports. All support contract personnel are bound by appropriate non-disclosure agreements.

Partnering Research Institutions. The Naval Academy, the Naval Postgraduate School, and other military academies are Government organizations but qualify as partnering research institutions. However, DON laboratories DO NOT qualify as research partners. DON laboratories may be proposed only IN ADDITION TO the partnering research institution.

PHASE II GUIDELINES

All Phase I awardees can submit an **Initial** Phase II proposal for evaluation and selection. The Phase I Final Report, Initial Phase II Proposal, and Transition Outbrief (as applicable) will be used to evaluate the proposer's potential to progress to a workable prototype in Phase II and transition technology to Phase III. Details on the due date, content, and submission requirements of the Initial Phase II Proposal will be provided by the awarding SYSCOM either in the Phase I contract or by subsequent notification.

NOTE: All SBIR/STTR Phase II awards made on topics from solicitations prior to FY13 will be conducted in accordance with the procedures specified in those solicitations (for all DON topics, this means by invitation only).

The DON typically awards a Cost Plus Fixed Fee contract for Phase II; but, may consider other types of agreement vehicles. Phase II awards can be structured in a way that allows for increased funding levels based on the project's transition potential. To accelerate the transition of SBIR/STTR-funded technologies to Phase III, especially those that lead to Programs of Record and fielded systems, the Commercialization

Readiness Program was authorized and created as part of section 5122 of the National Defense Authorization Act of Fiscal Year 2012. The statute set-aside is 1% of the available SBIR/STTR funding to be used for administrative support to accelerate transition of SBIR/STTR-developed technologies and provide non-financial resources for the firms (e.g., the DON STP).

PHASE III GUIDELINES

A Phase III SBIR/STTR award is any work that derives from, extends, or completes effort(s) performed under prior SBIR/STTR funding agreements, but is funded by sources other than the SBIR/STTR programs. This covers any contract, grant, or agreement issued as a follow-on Phase III award or any contract, grant, or agreement award issued as a result of a competitive process where the awardee was an SBIR/STTR firm that developed the technology as a result of a Phase I or Phase II award. The DON will give Phase III status to any award that falls within the above-mentioned description, which includes assigning SBIR/STTR Data Rights to any noncommercial technical data and/or noncommercial computer software delivered in Phase III that was developed under SBIR/STTR Phase I/II effort(s). Government prime contractors and/or their subcontractors must follow the same guidelines as above and ensure that companies operating on behalf of the DON protect the rights of the SBIR/STTR firm.

VERSION 3

NAVY 21.B STTR PHASE I TOPIC INDEX

VERSION 3

N21B-T019 TITLE: Tunable Wideband Differential Interferometer for Radio Frequency Photonic Links

RT&L FOCUS AREA(S): Autonomy;General Warfighting Requirements (GWR);Networked C3

TECHNOLOGY AREA(S): Air Platforms

OBJECTIVE: Develop a tunable differential interferometer for wideband phase-to-amplitude conversion to enable wide-dynamic-range radio frequency (RF) photonic links.

DESCRIPTION: Many defense applications require the remoting of antennas at a significant distance from the receiver. At high frequencies, coaxial cables losses are consequential for many applications and require the use of distributed low-noise amplifiers to prevent impacts to receiver performance. In certain applications, the antenna aperture is highly size, weight, and power (SWaP)-constrained, and the implementation of any electronics at the antenna aperture is problematic. Recent advances in RF photonic components show promise in realizing high-frequency antenna remoting with low-noise figure and high-dynamic range. However, most broadband link architectures utilize amplitude modulators at the encoding point that require active bias compensation to ensure linear operation, which can be problematic in SWaP-constrained environments. Many attempts to develop a bias-free modulator have met with limited success [Refs 1, 2], particularly in the harsh environments dictated by most military applications. An alternative amplitude modulation link architecture utilizes phase-to-amplitude conversion devices, such as a differential Mach-Zehnder interferometer (DMZI) to convert a phase-modulated link signal to an amplitude-modulated link signal directly prior to photo detection, thereby removing the need for any bias electronics at the RF encoding point [Refs 3, 4]. Unfortunately, this conversion process results in links limited in bandwidth on the order of one octave due to the details of the conversion process, even though the phase modulators can encode much wider bands. This STTR topic seeks the development of tunable phase-to-amplitude conversion elements, which can take advantage of wideband, bias-free modulation at the remote RF encoding point.

The goals of this effort are to develop a fiber-pigtailed phase-to-amplitude conversion device with a tunable operating frequency range that is compatible with both single and balanced photodiodes. The device must have sufficiently high-optical power handling (> 300 mW) and low loss (< 3 dB excess optical loss) to ensure the creation of low-noise figure, high-dynamic range RF-over-fiber links. The device should operate over a -40°C to +85°C operational temperature range, and be tunable to cover phase-to-amplitude conversion from 1 GHz on the low end to 45 GHz on the high end, with an instantaneous operational bandwidth of at least one octave [Ref 6]. The device should have dimensions no greater than 1 cm height, 10 cm long, and 3 cm wide. Individual devices should be designed to operate in 1 µm wavelength and 1550 nm wavelength RF over fiber links. Tuning speeds over this range on the order of < 10 ms are desired. It is expected that bias control of the device will be necessary to ensure linear operation, but this bias control is performed at the receiver where SWaP constraints are less burdensome. The proposed techniques must provide for closed-loop bias control. Dual-output devices that would be compatible with differential balanced photodiodes are also desirable. Highly accelerated life testing will provide initial device reliability performance [Refs 5, 6].

PHASE I: Develop and analyze a new design. Demonstrate key performance parameters of the proposed phase-to-amplitude conversion approach and simulate component performance. Develop a fabrication process, packaging approach, and test plan. Demonstrate the feasibility that the wideband differential interferometer can achieve the desired RF performance specifications with a proof of principle bench top experiment or preferably in an initial prototype. The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Optimize the Phase I design and create a functioning tunable phase-to-amplitude conversion prototype device. Demonstrate prototype operation in an RF photonic link. Show compliance of the prototype with the objective power levels, optical losses, tuning range, tuning speed, and temperature performance reached. Demonstrate a packaged, fiber-pigtailed prototype for direct insertion into single-ended and balanced-photonic links.

PHASE III DUAL USE APPLICATIONS: The proposed phase-to-amplitude conversion devices also function for digital-link applications and can be used as quadrature phase-shift keying (QPSK) demodulators for optical communications links. Such a tunable device would enable tunable bit-rate digital demodulators for reconfigurable communications links and would provide a direct dual-use application for telecommunications.

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KEYWORDS: RF-over-fiber; balanced link; phase modulation; differential interferometer; fiber optic; quadrature phase-shift keying; phase-to-amplitude

VERSION 3

N21B-T020 TITLE: Compact, Hatchable Transformer Rectifier

RT&L FOCUS AREA(S): General Warfighting Requirements (GWR)

TECHNOLOGY AREA(S): Electronics

OBJECTIVE: Improve transformer rectifier (T/R) maintainability via modular, portable design and/or introduction of technologies to significantly decrease footprint, volume, and weight.

DESCRIPTION: An existing transformer/rectifier (T/R) is approximately 450 ft^3 (12.75 m^3) in volume and weighs nearly 40,000 lbs (18,144 kg). The transformer accounts for approximately 25% of the volume and 45% of the weight of the T/R. If the transformer fails, the entire T/R must be removed, which is a complex, expensive, and time-consuming process with a lengthy mean time to repair (MTTR).

The Navy requires a transformer/rectifier that receives 13.8 kVAC RMS, three-phase, 60 Hz power, and outputs ±850 VDC nominal. The T/R must be capable of providing output power in the single-digit megawatt (MW) range continuously for tens of minutes. It must also output less than 0.5 MW for greater than one hour. It receives single-digit MW input power.

The T/R should be hatchable, that is, T/R components or line replaceable units (LRUs) must be smaller than 26” x 66” x 33” (66 x 167 x 83 cm) in order to fit through hatches. Therefore, solutions should focus on decreasing T/R size and weight and improving supportability by making components removable/replaceable/repairable within the space constraints. A hatchable T/R will improve maintainability and decrease MTTR.

LRUs, or other removable subassemblies or parts, should be of reasonable weight so that they can be lifted and carried over moderate distances through passageways, doors, and hatches. For reference, existing LRUs are 31.5” H x 9.5” W x 22” D (80 cm H x 24 cm W x 56 cm D) and weigh approximately 150 lbs (68 kg). Technologies that minimize LRU weight are encouraged and preferred as heavier loads increase injury risk and require additional personnel. MIL-STD-1472G, TABLE XXXIX [Ref 5] and similar tables may be used as a guide for one-person, two-person, and more than two-person lifting/carrying limits. Other military standards should be referenced for shock (MIL-DTL-901E [Grade A]) [Ref 2], vibration (MIL-STD-167-1A [Type 1]) [Ref 3], electromagnetic interference (MIL-STD-461G) [Ref 4], and environmental factors (MIL-STD-810H) [Ref 1] since the system must be rugged to be viable. The ability to regulate T/R temperature (i.e., thermal management) should also be considered. The T/R should remove self-generated heat to maintain acceptable component temperatures. The maximum thermal load from the transformer should be 77.5 kW at 212 °F (100 °C), and the maximum thermal load from the rectifier should be 2.0 kW. At the ambient temperature of 77 °F (25 °C), the operating temperature of control panels and controls should not exceed 120 °F (49 °C). Surface hot spots on accessible equipment exteriors should not exceed 140 °F (60 °C). The temperature of all other exposed surfaces should not be greater than 158 °F (70 °C).

Designs that achieve both transformation and rectification in a more reliable, maintainable (modular/portable/hatchable), and compact package are ideal as they will increase operational availability (Ao). However, solutions cannot sacrifice performance as nominal output voltages/currents must meet certain tolerances as defined by requirements in an existing specification. For example, transformer output (rectifier input) shall have a nominal output voltage of hundreds of volts RMS, +/-2%. Further information on this and other requirements will be identified to the Phase I performers.

Advances in silicon carbide (SiC) and high-frequency transformer technology, or other related innovations associated with miniaturization of power electronics, may be leveraged to achieve the goals as outlined.

VERSION 3

PHASE I: Develop a concept for a compact and maintainable transformer/rectifier, which may consist of modular, portable, electronic building blocks, also known as LRUs. Demonstrate feasibility using modeling and power simulation tools, or other applicable design methodologies. Subscale designs are allowable at this preliminary design stage assuming the concepts are scalable. Supporting documentation that shows how a subscale system might be scaled-up to meet full power requirements will help determine if the solution will be effective, suitable, and sustainable for this application. For example, a subscale T/R that meets input/output voltage requirements but not full-scale power requirements may still be practical if it can be shown that multiple subscale T/Rs can be connected together to achieve full-scale power. The same can be said of modules that do not meet full voltage/current requirements but can be connected in series/parallel. Evaluate thermal/cooling requirements to prepare for construction of a physical prototype. The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Design and build a prototype based on Phase I work. Demonstrate the technology and utilize Hardware-in-the-Loop (HIL) simulations, including Controller Hardware-in-the-Loop (CHIL) and Power Hardware-in-the-Loop (PHIL), to test and characterize performance. Validate and verify operation of the system against electrical, mechanical, and thermal requirements. If the prototype is subscale and intended for partial power, plans for how to achieve scalability and test at full rated power should be well documented.

Assuming iterative design is utilized and a larger and more capable system is developed gradually throughout this phase, consideration must be given to packaging, thermal/cooling requirements, communications, controls, and user interfaces as the effort progresses.

PHASE III DUAL USE APPLICATIONS: Design and construct a full-scale T/R based on work completed during earlier phases. Perform final testing at full-scale power via T/R test procedures and fault scenarios as defined by existing specifications and test plans. Validate and verify T/R performance. Transition after successful testing.

Transformers increase or decrease AC (alternating current) voltage, and rectifiers convert AC to DC (direct current).

Transformers and rectifiers are increasingly vital as the energy sector moves towards renewables, such as wind and solar, and the transportation industry moves towards electric vehicles (EVs). This is because T/Rs are useful for energy transmission, storage, and charging applications.

For example, to transmit energy over long distances, transformers are used to increase voltage since high-voltage energy transmission decreases energy losses over long cable runs. In addition, more so than fossil fuels, renewables utilize energy storage so that power remains available even if the sun is not shining or the wind is not blowing. Many energy storage technologies, such as batteries, accept DC voltage; however, energy is often generated as AC, so it needs to be converted by a rectifier prior to storage.

Conversion from AC to DC is also required to charge everything from cellphones to electric vehicle batteries. Therefore, for those who own an electric vehicle (EV), the AC power available in their houses must be converted to DC to charge their EVs. This functionality is often incorporated into power supplies themselves. For example, the “brick” on a phone or laptop charger converts AC power from a wall outlet to DC to charge/power the device.

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KEYWORDS: Transformer; rectifier; T/R; power; portable-electronic-building-blocks; silicon-carbide; high-frequency-transformer

VERSION 3

N21B-T021 TITLE: Artificial Intelligence and Machine Learning-Based Autonomous Mission Planning for Intelligence, Surveillance, and Reconnaissance (ISR) Missions

RT&L FOCUS AREA(S): Artificial Intelligence (AI)/Machine Learning (ML);Autonomy

TECHNOLOGY AREA(S): Air Platforms;Battlespace Environments;Information Systems

OBJECTIVE: Develop a capability to autonomously generate mission plans for onboard Unmanned Aerial Systems (UAS) in support of Intelligence, Surveillance, and Reconnaissance (ISR) missions by applying artificial intelligence (AI) and machine learning (ML) techniques.

DESCRIPTION: With today's advances in software and hardware, autonomous operation is a capability, even if still somewhat disruptive, that is fully realizable as highlighted in references 1–6. In fact, autonomous operation is becoming a critical capability in order to stay ahead of our adversaries. But there are other reasons for autonomous systems [Ref 2], such as "when the world can't be sufficiently specified a priori" and "when adaptation must occur at machine speed". It also makes a good case for AI, which enables significant autonomy and includes learning, reasoning, introspection, decision making, and much more. Exploiting unmanned systems autonomous mission planning is the next stage in enhancing the capabilities of these systems in the operational environments.

This project's success relies on utilizing sophisticated software solutions including machine intelligence/learning and modern computer hardware or graphics processing units (CPUs/GPUs – a scaled version of a workload-optimized massively parallelized computer). It should be evident that the size of unmanned aerial vehicles (UAVs) (Groups 1-5) and the types of missions will impact the overall mission planning requirements and complexity.

The goal is to be entirely autonomous; however, in particular with Group 4-5 systems, embedding trust/risk capabilities and detailed contingency plans in autonomous operation—if unacceptable behavior is detected—is as critical as meeting mission success. Even within autonomous operations, there will still be means to alert the Common Control System operator via the envisioned tool that monitors trust embedded on the platform. With these risk mitigations capabilities, the goal of this project will focus on ISR collection – a more simplistic mission when compared to a strike execution mission, which would in the future add considerable levels of mission complexities.

All UAVs will have the necessary sensors and flight control systems to embed the software to generate autonomous missions from takeoff (flight plan and mission plan) to landing, while completing missions including collection and dissemination of ISR data, i.e., when connectivity is available. It is anticipated that activity-based intelligence and/or other relevant information will start the components-based planning process to determine a suitable platform; route planning, types of sensors in support of ISR collection and sensor collection requirements to generate an entire flight plan with associated requirements; and when to disseminate data. Note that many route planning and resource management algorithms exist, thus any solution should include the ability to adaptively change a particular part of the overall planning process. It should also include consideration for automated contingency plans and dynamic replanning capabilities due to various unexpected factors, such as weather, change in mission requirements, etc. These fully autonomous, mission planning service capabilities must be able to be integrated into the Next-Gen Navy Mission Planning System (NGNMPS) and be shared with the Common Control Systems operator with any available communication system with the ability to be modified if necessary, and more importantly, to actually realize the autonomous behavior be embedded on board the platform. Due to the autonomous plan to be initially shared NGNMPS and CCS operator, it will be necessary to define how the plan is presented to the operators.

Finally, in order to meet mission requirements, the solution needs to specify CPU/GPU requirements to achieve as close to real-time performance as possible; and to paraphrase the Heilmeier Catechism exams for success [Ref 11], it will be essential to understand "how to eventually test, verify and evaluate the overall accuracy and performance of the autonomous mission planning process" that need to be addressed as part of this development effort.

PHASE I: Generate a concept of autonomous mission planning from launch to execution of mission specific requirements (ISR as specified in a tasking order and other data such as activity based intelligence data) to data dissemination, and finally, to return to base. This mission plan may also be an airborne modification (dynamic replanning) to the current mission, applying artificial intelligence techniques. Mission plans will take into consideration threat and friendly disposition, weather, terrain, and any onboard sensor (collection) requirements and limitations. In addition the concept needs to outline required hardware to achieve real-time or near real-time processing capabilities. The Phase I effort will include prototype plans to be developed under Phase II. The overall solution should outline data sources and information that will be required to successfully generate mission plans. It is also required to take into account STANAG processes and procedures to minimize proprietary solutions.

PHASE II: Develop a prototype software solution that can be tested in a simulated mission environment.

In Phase II, the program office will provide additional details about the platforms and sensors characteristics and other vital data critical in support of a realistic prototype development.

PHASE III DUAL USE APPLICATIONS: Finalize the prototype version. Perform final testing and verification in a simulated environment and potentially in a real environment using a surrogate vehicle. Transition to naval platform.

Companies such as Amazon, and similar delivery companies that have already started drone-based package delivery, would benefit from this development. FEDEX and UPS would benefit in terms of using large UAVs for package deliveries from large collection centers to smaller distribution centers.

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KEYWORDS: Mission Planning; Unmanned Aerial Vehicle; UAV; Intelligence, Surveillance and Reconnaissance; ISR; Artificial Intelligence; Autonomous; Machine Learning

VERSION 3

N21B-T022 TITLE: Integrated Computational Materials Engineering (ICME) Modeling Tool for Optimum Gas Flow in Metal Additive Manufacturing Processes

RT&L FOCUS AREA(S): General Warfighting Requirements (GWR);Hypersonics;Space

TECHNOLOGY AREA(S): Air Platforms;Materials / Processes;Weapons

OBJECTIVE: Develop an Integrated Computational Materials Engineering (ICME) modeling tool to predict the effect of gas flow on metal additive manufacturing processes for improvement in the quality of the parts.

DESCRIPTION: Additive manufacturing (AM) processes, such as powder bed fusion (PBF) and directed energy deposition (DED), have the potential to revolutionize the manufacturing and repairing of complex metal components in aerospace, medical, and automotive industries. Current processes are not yet fully matured. There is a great need for the processes to produce parts that are free from defects, such as pores, lack of fusion, metal oxidation, and fusion of splattered condensate.

To prevent the parts from oxidizing, AM processes blow inert gases - such as argon and nitrogen - to shield the fusion zone from oxygen. In PBF processes, the shielding gas flow is directed over the build layer to remove metal condensate and spatter from the fusion zone and then is pulled out of the chamber through filters to remove the splattered particle. Improper shielding and removal of spatter particles lead to defects in a PBF process. For example, it has been shown that:

a) the condensed metal vapor particles could attenuate the laser beam up to 10%,
b) spatter falling back on the powder bed could locally increase the layer thickness, and
c) spatter falling onto the consolidated surface could fuse resulting in poor surface finish [Ref 1].

The direction of the flow relative to the laser scanning direction plays a significant role in the quality of the product [Ref 2]. Similarly, the DED processes are also strongly dependent on the flow rates of carrying and shielding gases. Higher flow rates could result in higher cooling rates and reduced heat-affected zone, but could also cause discontinuities and gaps in the deposition. Microhardness could vary with the changes in flow rates [Ref 3]. Current literature surveys show limitations in the modeling efforts. Adam Philo et al. (2017) have developed a computational model of gas-flow effects in the inlet design for the Renishaw AM250 to predict spatter particulate accumulation [Refs 4]. Florian Wirth et al. (2017) have shown the interaction of powder jet and laser beam in a powder-blown machine and cases for laser beam attenuation [Ref 5]. Praveen BidareI et al. (2017) use Schlieren imaging and multiphysics modeling to investigate the inert atmosphere and laser plume in PBF [Ref 6]. References 7 through 14 provide additional experimental and computational efforts. However, a comprehensive modeling tool for gas flow interacting with all major AM process parameters is not available for designing and developing better AM processes.

An ICME framework is needed to represent the process-structure-property-performance relationship in metallic AM. The tool sought in this STTR topic will be part of the framework. It should integrate critical fundamental physics, such as mass, fluid and heat transport, phase transition, surface tension, Marangoni stress, recoil pressure, and melt pool fluid dynamics, into one comprehensive framework. With manufacturing parameters and material properties as the inputs, the framework should quantify the effect of gas flow on melt pool dimension, surface morphology, temperature profile, solidification rate, powder spattering, and pore formation/propagation. The framework should provide mitigation strategies for the gas-induced powder spattering and pore formation, which degrade the property of the fabricated metallic part.

Overall, the model should enable optimizing the gas flow including improvement in nozzle designs; gas circulation to match the design of the AM machine offering optimum shielding of the fusion area and the

melt pool; and the efficient removal of the gas and debris from the chamber. The model should provide ways to set print parameters for optimum part performance for the raw material used and the scan patterns for the part.

PHASE I: Demonstrate the feasibility of a multiphysics model gas flow interaction with metal fusion in the PBF or DED additive manufacturing process. Show that the model works efficiently within the ICME framework to enable proper design and control of gas flow for producing defect-free AM products. Carry out experiments for the chosen AM process to validate the simulated results. Evaluate the model based on the AM products, such as surface finish, defects (size, density, and distribution), and/or microhardness. Demonstrate the potential for this prototype to address factors additional to the subset chosen above for a fully developed modeling system in the ICME framework in Phase II.

PHASE II: Based on the prototype modeling tool developed in Phase I, fully develop and validate the predictive modeling tool to fine-tune the gas flow and the associated process parameters to improve AM part quality, such as fewer defects, better surface finish, and desirable microhardness. Demonstrate its capability of additive manufacturing of aircraft components with complex geometry and tailored performance.

PHASE III DUAL USE APPLICATIONS: Mature the modeling tool further by extending the capability for common airframe metal alloys, such as aluminum, steel, and titanium. Demonstrate the capability to optimize the AM process for multiple metals. Validate the tool in final testing of the capability by printing parts of more than one metal alloy and carrying out component tests demonstrating strength and durability.

AM in the commercial sector is progressing with individual companies developing limited capabilities using ICME tools. The commercial sector broadly treats material qualification and part certification for AM as separate processes, one followed by the other. ICME tools integrate them to have a seamless process. Hence, this tool will open the possibilities for the commercial sector to take advantage of developing quality products for their customers.

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KEYWORDS: Additive Manufacturing; AM; Laser Powder Bed Fusion; Directed Energy Deposition; Inert Gas Shield; multiphysics model gas flow; powder splatter

VERSION 3

N21B-T023 TITLE: High Specific Energy Lithium-Ion Battery with Carbon-Based Nanostructures

RT&L FOCUS AREA(S): General Warfighting Requirements (GWR);Microelectronics;Quantum Science

TECHNOLOGY AREA(S): Electronics

OBJECTIVE: Develop and demonstrate a novel high-energy (> 600 Whr/kg) rechargeable lithium-ion battery technology to provide high-quality enduring power for Navy hand-held portable electronics and small unmanned aerial system (UAS) applications.

DESCRIPTION: Rechargeable Lithium-ion (Li-ion) batteries [Ref 1] are widely used for a wide variety of commercial and naval electronics and electrical applications. The weight of the naval power battery system can be a significant portion of the overall weight of the portable electrical device on board a ground or aerial vehicle. Furthermore, the energy capacity of existing Li-ion batteries is not adequate to support prolonged operating times of current and future naval platforms, such as unmanned aerial systems (UASs) and portable communication and surveillance systems, for extended mission endurance. Moreover, the current batteries necessitate frequent recharging and the times for full recharging are in the range of hours.

In order to increase the energy capacity, reduce the weight, and shorten the recharging time of next-generation rechargeable batteries for future naval missions, high-performance rechargeable batteries with higher specific energy and much shorter recharging cycle times are needed. Current state-of-the art Li-ion batteries use graphite as an anode. Research has shown that the use of carbon-based nanomaterials, such as graphene, carbon nanotubes, carbon nanofibers, etc., as potential anode materials for Li-ion batteries enhancements to replace graphite, shows great promise in providing high-galvanometric capacity while also maintaining reasonable cycling stability [Refs 2, 3].

The objective of this STTR topic is to develop and demonstrate a novel rechargeable Li-ion battery enhanced by using carbon-based nanostructures with a specific energy > 600 Whr/kg at 0.5C discharge rate, and specific capacity of > 600 Ahr/kg. The battery is also expected to exhibit an excellent cycle stability and maintain 85% capacity after 1000 cycles and operate over a wide temperature range of -30°C to +55°C. The high-energy cell should have the ability to operate up to a 3C continuous discharge rate at the stated operational conditions, as well as to be stored over a wide temperature range (-40°C to +70°C). Proposed innovative approaches may include improvements to cell components, novel materials or processes, or other innovative ideas.

PHASE I: Develop, design, and demonstrate the feasibility of an innovative Li-ion battery using the most promising carbon-based nanomaterials as the anode material. Perform analysis and initial testing to determine the ability of the proposed battery with the chosen anode, cathode, and electrolyte material combination in terms of the performance metrics, including specific energy, specific capacity, reliable charge/discharge capabilities, and cycle life as stated in the Description. Project the overall performance improvements of the proposed battery configuration to be fabricated in Phase II compared to a common lithium ion battery. The Phase I effort will include prototype plans to be developed under Phase II.

PHASE II: Fabricate and demonstrate a complete cell, based on the down-selected design in Phase I. Demonstrate and validate the performance of the novel Li-ion battery to meet stated design metrics listed in the Description. Perform laboratory testing to confirm performance. Assess the risks associated with the storage and operation of the battery and propose viable risk mitigation solutions. Deliver a prototype to NAVAIR for further field testing and evaluation.

PHASE III DUAL USE APPLICATIONS: Fully develop and transition the Lithium ion Battery based on the final design from Phase II for naval applications in various UAV platforms.

The commercial sectors such as electrical vehicles and other commercial electronic devices, would significantly benefit from this research and development in high-performance, lightweight batteries.

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KEYWORDS: Specific-Energy; Lithium-Ion; Li-ion; Battery; Carbon-Based Nanostructures; Graphene; Carbon nano-tubes

VERSION 3

N21B-T024 TITLE: Predictive Data Analytics to Refine Aircrew Training and Operations

RT&L FOCUS AREA(S): Artificial Intelligence (AI)/Machine Learning (ML);Autonomy;General Warfighting Requirements (GWR)

TECHNOLOGY AREA(S): Air Platforms;Human Systems

OBJECTIVE: Research and develop a technology that supports ingesting large and disparate data sets from naval aviation aircraft and uses data science to provide outputs that increase enterprise level knowledge of aviator performance, safety, and effectiveness through data-driven predictive analytics to influence training and operations.

DESCRIPTION: The success of military operations significantly depends on the level of quality training, safety, and operational effectiveness demonstrated by its personnel. This is especially true for naval aviation operations. There are a large set of factors that affect the successful employment of naval aircraft during peacetime and wartime. These factors can change with time and with the situation and are articulated in vast and disparate data sets. These data sets, when captured, traditionally provide immediate evaluation and aircrew debrief. Generally, a vast amount of data that affects and describes crew performance is discarded or stored with no long-term data analytics processing conducted that could provide valuable trend and predictive insight.

The ability to identify performance trends is a key factor today in the effectiveness of any enterprise. This is especially true in aviation and military operations. The capability to capture large sets of performance/attribute data, and analyze the data to establish baseline and standard performance levels, enables the identification of performance anomalies, trends, and predictive outcomes. This capability has become a standard in commercial aviation and has the same applicability to military operations. The implementation of this capability to the highly complex naval aviation operations would provide great benefit from the comprehensive analysis aircrew performance to gain greater insight into areas including aircraft flight path management, procedural compliance, stores deployment, situational awareness, threat/error management, distraction management, environmental effects, aircraft envelope management, and many other performance areas. However, solutions must address both the opportunities and the challenges associated with data analytic solutions [Ref 1].

The Navy requires a technology that supports ingesting large and disparate data sets from naval aviation aircraft, supporting required parsing, sorting, and fusion to manage relevant data. Development efforts should focus on providing data analytic functionality that results in outputs that increase enterprise-level knowledge of aviator performance, safety, and effectiveness. Further, the technology functionality should extend traditional data science solutions to include capabilities for data-driven predictive analytics to influence training and operations [Ref 2]. The research and development effort should provide focus on the visualization capabilities to increase end user understanding of data analysis processes and outputs, in addition to an underlying data analytic architecture. The technology developed must meet the system DoD accreditation and certification requirements to support processing approvals for use through Risk Management Framework [Refs 4, 5, and 7] and any use of artificial intelligence (AI) as part of defined solutions should understand ethical use recommendations [Ref 6]. The policy cited in Department of Defense Instruction (DoDI) 8510.01, Risk Management Framework (RMF) for DoD Information Technology (IT) [Ref 3] and compliance with appropriate DoDI 8500.01, Cybersecurity [Ref 8] are necessary to support future transition needs.

Work produced in Phase II may become classified. Note: The prospective contractor(s) must be U.S. owned and operated with no foreign influence as defined by DoD 5220.22-M, National Industrial Security Program Operating Manual, unless acceptable mitigating procedures can and have been implemented and approved

by the Defense Counterintelligence Security Agency (DCSA). The selected contractor and/or subcontractor must be able to acquire and maintain a secret level facility and Personnel Security Clearances, in order to perform on advanced phases of this project as set forth by DCSA and NAVAIR in order to gain access to classified information pertaining to the national defense of the United States and its allies; this will be an inherent requirement. The selected company will be required to safeguard classified material IAW DoD 5220.22-M during the advanced phases of this contract.

PHASE I: Develop, design, and demonstrate a strategy, taking into consideration the feasibility, suitability, and acceptability, to leverage all available aircraft and related crew performance data. Identify potential roadblocks likely to be encountered and formulate approaches to overcome them. Design an architecture and implementation plan illustrating the benefits of training analytics through training use cases to demonstrate benefits of predictive analytics. The Phase I effort will include prototype plans to be developed under Phase II, with consideration for options on system architecture (e.g., Navy Marine Corps Intranet (NMCI), standalone system).

PHASE II: Develop a working prototype of the selected concept to include high-level requirements, design, initial testing, and demonstration. Demonstrate the prototype in a lab or live environment. Planning and consideration for information assurance compliance and certification for an authority to operate, including updates to support installation on Navy Marine Corps Intranet (NMCI) systems or other DoD hardware.

Work in Phase II may become classified. Please see note in the Description section.

PHASE III DUAL USE APPLICATIONS: Extend the baseline functionality to include advanced or more robust data analytic techniques, and/or integrate developed capability with existing database and analysis systems. Implement Risk Management Framework guidelines [Refs 3, 4, 5, 6, and 7] to support information assurance compliance and certification for an authority to operate, including updates to support installation on NMCI systems or other DoD hardware.

Data analytics are relevant to a range of other domains such as athletics and medical communities. For medical communications, rapidly evolving situations with minimal established information is a critical and timely use case given novel infectious diseases; in addition to traditional data analytics for trends, understanding potential predictive analytics will inform decisions at various levels of leadership based on expected trends. Further, domains with quickly advancing technology due to the rapid pace of innovation and advances will benefit from similar technology solutions as a means to provide unique insights based on data analytics and predictive analyses.

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KEYWORDS: Qualitative analysis; data analytics; human performance assessment; data trends; statistical analysis; predictive analytics; predictive analysis

AIR FORCE (AF)
21.B SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)
PROPOSAL PREPARATION INSTRUCTIONS
Amendment 3 – 19 May 2021

The AF 21.B STTR Proposal Preparation Instructions, as previously amended, are hereby further amended as follows:

Topic AF21B-T002, "Establishing Common Ground between Humans & Machines Pitch Day for Trusted AI", OBJECTIVE Section is hereby deleted in its entirely and replaced with the following, "The objective of this topic is to explore and develop approaches to the establishment and maintenance of task-related shared beliefs and knowledge (i.e., common ground) between humans and machines in support of the Autonomy and Artificial Intelligence & Machine Learning DoD Technology areas. This topic will reach companies and universities that can complete research of the foregoing concepts in Phase I schedules. This topic is specifically aimed at the earlier stage basic science and research. There is no requirement of use of government material, data, or facilities."

All other content remains unchanged and in full effect.

AIR FORCE (AF)
21.B SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)
PROPOSAL PREPARATION INSTRUCTIONS
Amendment 2 – 6 May 2021

The AF 21.B STTR Proposal Preparation Instructions are hereby amended as follows:

Topic AF21B-T003, "Restricted SWAP-C Air Direction Sensing to Enable Single Vehicle Chemical Reactive Tracking", Technical Point of Contact, Ms. Jennifer Talley's, phone number is changed to **(850) 502-9339**.

All other content remains unchanged and in full effect.

AIR FORCE (AF)
21.B SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)
PROPOSAL PREPARATION INSTRUCTIONS
Amendment 1 – 26 April 2021

The AF 21.B STTR Proposal Preparation Instructions are hereby amended as follows:

Page AF-3 (below), section entitled "Technical Volume", first paragraph, second sentence, is changed to read, "The Phase I proposals shall include a technical volume (uploaded in Volume 2) prepared in accordance with CHART 1: Air Force 21.B STTR Phase I Topics Information at a Glance, found on page AF-2 (below)."

The third and fourth sentences are changed to read, "There are no set format requirements for white papers and/or pitch decks, as required by the specific topic(s). For topics requiring a white paper and a pitch deck, it is recommended more detailed information be included in the technical volume while higher level information is included in the pitch deck."

All other content remains unchanged and in full effect.

AIR FORCE
21.B SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)
PROPOSAL PREPARATION INSTRUCTIONS

The Air Force (AF) proposal submission instructions are intended to clarify the Department of Defense (DoD) instructions as they apply to AF specific requirements. **Firms must ensure their proposal meets all requirements of the Broad Agency Announcement (BAA) currently posted on the DoD website at the time the solicitation closes.**

All STTR Phase I proposals under this solicitation must be submitted through the DoD SBIR/STTR Innovation Portal (DSIP), https://www.dodsbirsttr.mil/submissions/login no later than the date and time published in the DoD 21.B STTR BAA.

Questions pertaining to the AF SBIR/STTR program and these proposal preparation instructions should be directed to the AF SBIR/STTR Program Office at usaf.team@afsbirsttr.us. For questions regarding DSIP, contact the DoD SBIR/STTR Help Desk at dodsbirsupport@reisystems.com. For technical questions about the topics during the pre-release period, contact the Topic Authors listed for each topic. To obtain answers to technical questions during the formal announcement open period, visit the Topic Q&A on DSIP at https://www.dodsbirsttr.mil/submissions/login.

General information related to the AF Small Business Program can be found at the AF Small Business website, http://www.airforcesmallbiz.af.mil/. The site contains information related to contracting opportunities within the AF, as well as business information and upcoming outreach/conference events. Other informative sites include those for the Small Business Administration (SBA), www.sba.gov, and the Procurement Technical Assistance Centers, http://www.aptacus.us.org. These centers provide Government contracting assistance and guidance to small businesses, generally at no cost.

CHART 1: Air Force 21.B STTR Phase I Topics Information at a Glance

Topic Number	Performance Period	Max SBIR Funding	Technical Volume Contents
AF21B-T001	5 months	$156,500	White paper NTE 25 pages; pitch deck NTE 15 pages
AF21B-T002	5 months	$156,500	White paper NTE 25 pages; pitch deck NTE 15 pages
AF21B-T003	9 months	$100,000	White paper NTE 20 pages
AF21B-T004	12 months	$150,000	White paper NTE 25 pages
AF21B-T005	12 months	$150,000	White paper NTE 25 pages

PHASE I PROPOSAL SUBMISSION

Read the DoD program announcement https://www.dodsbirsttr.mil/submissions/login for program requirements. When you prepare your proposal, keep in mind that Phase I should address the feasibility of a solution to the topic. See Chart 1 (above) for proposal dollar values, periods of performance, and technical volume content. Only one Cost Volume per proposal will be accepted; it must address the entire performance period.

Limitations on Length of Proposal

The Phase I Technical Volume content is listed by topic above. All page/slide counts do not include the Cover Sheet, Cost Volume, and Cost Volume Itemized Listing (a-j). The Technical Volume must be in type no smaller than 10-point on standard 8-1/2" x 11" paper with one (1) inch margins. Only the Technical Volume and any enclosures or attachments count toward the 5-page limit. In the interest of equity, pages in excess of the 5-page limitation will not be considered for review or award. The documents required for upload into Volume 5 using "Other" category do not count towards the page/slide limits either.

NOTE: The Fraud, Waste and Abuse Certificate of Training Completion (Volume 6) is required to be completed prior to proposal submission. More information concerning this requirement is provided below under "**PHASE I PROPOSAL SUBMISSION CHECKLIST"**.

Phase I Proposal Format

Proposal Cover Sheet: For proposals selected for award, the technical abstract and anticipated benefits discussion will be publicly released. Therefore, **DO NOT** include proprietary information in these sections.

Technical Volume: The Technical Volume should include all graphics and attachments but should not include the Cover Sheet, as it is completed separately. The Phase I proposals shall include a technical volume (uploaded in Volume 2) that shall not exceed 5 pages and a pitch/slide deck not to exceed 15 slides (uploaded in Volume 5). The technical volume and slide deck will be reviewed holistically and there is no set format requirements for the two documents. It is recommended (but not required) that more detailed information is included in the technical volume and higher level information is included in the pitch deck. Most proposals will be printed out on black and white printers so make sure all graphics are distinguishable in black and white.

To verify submission completion in DSIP, you will receive an automated message providing the date and time of completed upload. The proposals are virus checked and converted to a .pdf document, typically within the hour. If it does not appear after an hour, please contact the DoD SBIR/STTR Help Desk via email at DoDSBIRSupport@reisystems.com.

Key Personnel: Identify in the Technical Volume all key personnel who will be involved in this project; include information on directly related education, experience, and citizenship. A technical resume of the principal investigator, including a list of publications, if any, must be part of that information. Concise technical resumes for subcontractors and consultants, if any, are also useful. You must identify all U.S. permanent residents to be involved in the project as direct employees, subcontractors, or consultants. You must also identify all non-U.S. citizens expected to be involved in the project as direct employees, subcontractors, or consultants. For all non-U.S. citizens, in addition to technical resumes, please provide countries 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, as appropriate. Offerors may be asked to provide

additional information during negotiations in order to verify the foreign citizen's eligibility to participate on a contract issued as a result of this announcement.

Phase I Work Plan Outline

NOTE: THE AF USES THE WORK PLAN OUTLINE AS THE INITIAL DRAFT OF THE PHASE I STATEMENT OF WORK (SOW). THEREFORE, DO NOT INCLUDE PROPRIETARY INFORMATION IN THE WORK PLAN OUTLINE. TO DO SO WILL NECESSITATE A REQUEST FOR REVISION AND MAY DELAY CONTRACT AWARD.

At the beginning of the proposal work plan section, include an outline of the work plan in the following format:

1) Scope: List the major requirements and specifications of the effort.
2) Task Outline: Provide a brief outline of the work to be accomplished over the span of the Phase I effort.
3) Milestone Schedule
4) Deliverables
    a. Kickoff meeting within 30 days of contract start
    b. Progress reports
    c. Technical review within 6 months
    d. Final report with SF 298

Cost Volume

Cost Volume information should be provided by completing the online Cost Volume and including the Cost Volume Itemized Listing (a-j) specified below. The Cost Volume information must be at a level of detail that would enable Air Force personnel to determine the purpose, necessity and reasonability of each cost element. Provide sufficient information on how funds will be used if the contract is awarded. The online Cost Volume and Itemized Cost Volume Information will not count against the 5-page limit. The itemized listing may be submitted in Volume 5 under the "Other" dropdown option.

a. Special Tooling and Test Equipment and Material: The inclusion of equipment and materials will be carefully reviewed relative to need and appropriateness of the work proposed. The purchase of special tooling and test equipment must, in the opinion of the Contracting Officer, be advantageous to the government and relate directly to the specific effort. They may include such items as innovative instrumentation and/or automatic test equipment.

b. Direct Cost Materials: Justify costs for materials, parts, and supplies with an itemized list containing types, quantities, and price and where appropriate, purposes.

c. Other Direct Costs: This category of costs includes specialized services such as machining or milling, special testing or analysis, costs incurred in obtaining temporary use of specialized equipment. Proposals which include leased hardware, must provide an adequate lease vs. purchase justification or rational.

d. Direct Labor: Identify key personnel by name, if possible, or by labor category if specific names are not available. The number of hours, labor overhead and/or fringe benefits and actual hourly rates for each individual are also necessary.

e. Travel: Travel costs must relate to the needs of the project. Break out travel cost by trip, with the number of travelers, airfare, per diem, lodging, etc. The number of trips required, as well as the

destination and purpose of each trip should be reflected. Recommend budgeting at least one (1) trip to the Air Force location managing the contract.

f. Cost Sharing: If proposing cost share arrangements, please note each Phase I contract total value may not exceed $150,000 total, while Phase II contracts shall have an initial Not to Exceed value of $750,000. Please note cost share contracts or portions of contracts do not allow fee. NOTE: Subcontract arrangements involving provision of Independent Research and Development (IR&D) support are prohibited in accordance with Under Secretary of Defense (USD) memorandum "Contractor Cost Share", dated 16 May 2001, as implemented by SAF/AQ memorandum, same title, dated 11 July 2001.

g. Subcontracts: Involvement of a research institution is required in the project. Involvement of other subcontractors or consultants may also be desired. Describe in detail the tasks to be performed in the Technical Volume and include information in the Cost Volume for the research institution and any other subcontractors/consultants. The proposing SBC must perform a minimum of 40% of the Phase I R/R&D and the research institution must perform a minimum of 30% of the Phase I R/R&D. Work allocation is measured by direct and indirect costs AFTER REMOVAL OF THE SBC's PROPOSED PROFIT. This work allocation requirement is codified in statute and the Government CO cannot waive it. STTR efforts may include subcontracts with Federal Laboratories and Federally Funded Research and Development Centers (FFRDCs). However, be mindful that not all Federal Laboratories or FFRDCs qualify as research institutions.

Support subcontract costs with copies of the subcontract agreements. The supporting agreement documents must adequately describe the work to be performed, i.e., Cost Volume. At a minimum, an offeror must include a Statement of Work (SOW) with a corresponding detailed cost proposal for each planned subcontract.

h. Consultants: Provide a separate agreement letter for each consultant. The letter should briefly state what service or assistance will be provided, the number of hours required, and hourly rate.

i. DD Form 2345: For proposals submitted under export-controlled topics, either by International Traffic in Arms Regulations (ITAR) or Export Administration Regulations (EAR), a copy of the certified DD Form 2345, Militarily Critical Technical Data Agreement, or evidence of application submission must be included. The form, instructions, and FAQs may be found at the United States/Canada Joint Certification Program website, http://www.dla.mil/HQ/InformationOperations/Offers/Products/LogisticsApplications/JCP/DD2345Instructions.aspx. The DD Form 2345 must be approved prior to award if proposal is selected for negotiations and funding.

NOTE: Restrictive notices notwithstanding, proposals may be handled for administrative purposes only, by support contractors TEC Solutions, Inc., APEX, Oasis Systems, Riverside Research, Peerless Technologies, HPC-COM, Mile Two, Wright Brothers Institute, and MacB (an Alion Company). In addition, only Government employees and technical personnel from Federally Funded Research and Development Centers (FFRDCs) MITRE and Aerospace Corporations working under contract to provide technical support to AF Life Cycle Management Center and Space and Missiles Centers may evaluate proposals. All support contractors are bound by appropriate non-disclosure agreements. **If you have concerns about any of these contractors, you should contact the AF SBIR/STTR Contracting Officer, Kris Croake at kristina.croake@us.af.mil.**

k. The Air Force does not participate in the Discretionary Technical and Business Assistance (TABA) program. Proposals in response to Air Force topics should not include TABA.

PHASE I PROPOSAL SUBMISSION CHECKLIST

NOTE: Companies not registered in the System for Award Management, https://www.sam.gov/ at the time of proposal submission will not be eligible for award. Firms shall also verify "Purpose of Registration" is set to "I want to be able to bid on federal contracts or other procurement opportunities. I also want to be able to apply for grants, loans, and other financial assistance programs", NOT "I only want to apply for federal assistance opportunities like grants, loans, and other financial assistance programs." Firms registered to compete for grants only at the time of proposal submission will not be considered for award. Addresses must be consistent between the proposal and SAM.gov at award.

1) The Air Force Phase I proposal shall follow the topic-specific information in Chart 1.

2) It is mandatory complete proposal submission -- DoD Proposal Cover Sheet, Technical Volume with any appendices, Cost Volume, Itemized Cost Volume Information, Company Commercialization Report, and Fraud, Waste and Abuse Certificate of Training Completion -- be executed electronically through the DoD SBIR website at https://www.dodsbirsttr.mil/submissions/login. Each of these documents is to be submitted through the Website.

Please note the Fraud, Waste and Abuse Training shall be completed prior to submission of your proposal. This is accomplished under Volume 6 of the DoD SBIR Website (https://www.dodsbirsttr.mil/submissions/login). When the training has been completed and certified, the DoD Submission Website will indicate this in the proposal which will complete the Volume 6 requirement. Your proposal cannot be submitted until this training has been completed. The complete proposal **must** be submitted via DSIP on or before **the due date published in the DoD 21.B STTR BAA.** A hardcopy **will not** be accepted.

The AF recommends completing submission early, as computer traffic is heavy prior to solicitation close, causing system lag. **Do not wait until the last minute.** The AF will not be responsible for proposals not completely submitted prior to the deadline due to system inaccessibility unless advised by DoD.

Please ensure the e-mail addresses listed in the proposal is current and accurate. The AF is not responsible for ensuring notifications are received by firms changing mailing address/e-mail address/company points of contact after proposal submission without proper notification to the AF. If changes occur to the company mail or email addresses or points of contact after proposal submission, the information must be provided to the AF at usaf.team@afsbirsttr.us. The message shall include the subject line, "21.B Address Change".

AIR FORCE PROPOSAL EVALUATIONS

The AF will utilize the Phase I proposal evaluation criteria in section 6.0 of the DoD 21.B STTR BAA with the factors in descending order of importance.

The AF will utilize Phase II evaluation criteria in section 8.0 of the DoD 21.B STTR BAA with the factors in descending order of importance.

The proposer's record of commercializing its prior SBIR and STTR projects will be used as a portion of the Commercialization Plan evaluation. Only firms with four or more Phase II projects that were awarded at least two years prior to a SBIR solicitation will receive a CAI score. If the "Commercialization Achievement Index (CAI)" shown on the first page of the report is at the 20th percentile or below, the proposer will receive no more than half of the evaluation points available under evaluation criterion (c) in

Section 6 of the DoD 21.B STTR instructions. This information supersedes Paragraph 4, Section 5.4.e of the DoD 21.B STTR BAA.

Proposal Status and Feedback

The Principal Investigator (PI) and Corporate Official (CO) indicated on the Proposal Cover Sheet will be notified by e-mail regarding proposal selection or non-selection. Small businesses will receive a notification for each proposal submitted. Please read each notification carefully and note the Proposal Number and Topic Number referenced. **If changes occur to the company mail or email addresses or company points of contact after proposal submission, the information shall be provided to the AF at usaf.team@afsbirsttr.us. The message shall include the subject line, "21.B Address Change".**

Feedback will not be provided for Phase I proposals determined Not Selectable. Feedback will be provided only for Phase II proposals determined Not Selectable.

IMPORTANT: Proposals submitted to the AF are received and evaluated by different organizations, handled topic by topic. Each organization operates within its own schedule for proposal evaluation and selection**.** Updates and notification timeframes will vary. If contacted regarding a proposal submission, it is not necessary to request information regarding additional submissions. Separate notifications are provided for each proposal.

It is anticipated all the proposals will be evaluated and selections finalized within approximately 180 calendar days of solicitation close. Please refrain from contacting the BAA Contracting Officer for proposal status before that time.

PHASE II PROPOSAL SUBMISSIONS

AF organizations may request Phase II proposals while technical performance is on-going. This decision will be based on the contractor's technical progress, as determined by an AF TPOC's review using the DoD 21.B STTR BAA Section 8.0 Phase I review criteria. All Phase I awardees will be provided an opportunity to submit a Phase II proposal unless the Phase I purchase order has been terminated for default or due to non-performance by the Phase I company.

Phase II is the demonstration of the technology found feasible in Phase I. Only Phase I awardees are eligible to submit a Phase II proposal. All Phase I awardees will be sent a notification with the Phase II proposal submittal date and a link to detailed Phase II proposal preparation instructions. If the mail or email addresses or firm points of contact have changed since submission of the Phase I proposal, correct information shall be sent to the AF at usaf.team@afsbirsttr.us. Phase II dollar values, performance periods, and proposal content will be specified in the Phase II request for proposal.

NOTE: Air Force primarily awards Phase I and II contracts as Firm Fixed Price. However, Phase II awardees are strongly urged to work toward a Defense Contract Audit Agency (DCAA) approved accounting system. If the company intends to continue work with the DoD, an approved accounting system will allow for competition in a broader array of acquisition opportunities. Please address questions to the Phase II Contracting Officer, if selected for award.

All proposals must be submitted electronically at https://www.dodsbirsttr.mil/submissions/login by the date indicated in the Phase II request for proposal. Note: Only ONE Phase II proposal may be submitted for each Phase I award. **AIR FORCE STTR PROGRAM MANAGEMENT IMPROVEMENTS**

The Air Force reserves the right to modify the Phase II submission requirements. Should the requirements change, all Phase I awardees will be notified. The Air Force also reserves the right to change any administrative procedures at any time to improve management of the Air Force STTR Program.

AIR FORCE SUBMISSION OF FINAL REPORTS

All final reports will be submitted to the awarding AF organization in accordance with the purchase order or contract. Companies will not submit Final Reports directly to the Defense Technical Information Center (DTIC).

AIR FORCE STTR 21.B Topic Index

AF21B-T001 Hierarchical Heterogeneous Planning and Scheduling Pitch Day for Trusted AI

TECH FOCUS AREAS: Autonomy; Artificial Intelligence/Machine Learning

TECHNOLOGY AREAS: Information Systems

OBJECTIVE: The objective of this topic is to explore the development of a theoretical foundation or model for hierarchical heterogeneous planning and scheduling by which we can reason about autonomous/automated decision-making in multiple different domains while accounting for the hierarchical structure of each domain. This topic will reach companies and universities that can complete research of the foregoing concepts in Phase I schedules. This topic is specifically aimed at the earlier stage basic science and research.

DESCRIPTION: The current modus operandi for generating courses of action in military operational scenarios is largely human-derived. An increasingly heterogeneous all-domain (e.g., air, land, sea, cyber, space, electronic warfare) battle space and the resulting warfare complexity presents human decision-makers with an overwhelming amount of data and potential plans. Add to this the inherently hierarchical nature of each domain (e.g. for the air domain, there are wings composed of groups, that are composed of squadrons, that are composed of units) and this gives rise to a unique type of planning and scheduling problem. Indeed, this multi-domain hierarchical planning and scheduling would benefit greatly from automated or autonomous approaches which can model the heterogeneity of the various domains, establish a hierarchical decision-making pipeline within each domain, and explore and optimize over many potential plans and schedules in a short span of time. However, we currently have no means by which to formally reason about such hierarchical heterogeneous planning and scheduling settings.

The mathematical modeling of various operational problems lend credence to some theoretical foundation and mathematical model by which to accomplish this. Examples include the Maximum-on-Ground (MOG) parking problem of assigning a set of aircraft to various airfields so as to maximize the packing density of the airfields and how this can be formalized as a Bin Packing problem [1]. This bin packing formulation immediately lets us reason about the complexity of the MOG problem, exact solutions, approximate efficient solutions, heuristics, and interesting extensions to the problem. Similarly, we have seen the problem of air asset scheduling for Air Tasking Orders (ATOs) being modeled using integer programming [2].

Drawing inspiration from such approaches, we seek the development of a theoretical foundation or model for hierarchical heterogeneous planning and scheduling by which we can reason about autonomous/ automated decision-making in multiple different domains while accounting for the hierarchical structure of each domain. Success can be evaluated by comparing the proposed model and solution to the baseline of reasoning over each domain separately and by using naive planning approaches. The heterogeneity of the various domains may be formalized by some abstraction that accounts for domain-specific effects, such as range, mobility, impact, latency, etc.

The hierarchical nature of the solution may encapsulate the granularity and delegation of desired effects for a given domain. For example, at the wing level, potential enemy targets may be identified; this information is passed down to the group level, where squadrons are assigned to the different targets; this, in turn, is used to determine the routes and schedules of aircraft at the unit level. The underlying environment within which the agent interacts can take many forms, including purely theoretical models such as Markov Decision Processes (MDPs), performer-developed environments and academic tools like OpenAI Gym and PySC2. The developed concepts need not be specific to military operations.

PHASE I: Validate the product-market fit between the proposed solution and the proposed topic and define a clear and immediately actionable plan for running a trial with the proposed solution and the proposed AF customer. This feasibility study should directly address:

1. Clearly identify who the prime (and additional) potential AF end user(s) is and articulate how they would use your solution(s) (i.e., the one who is most likely to be an early adopter, first user, and initial transition partner).
2. Deeply explore the problem or benefit area(s), which are to be addressed by the solution(s) - specifically focusing on how this solution will impact the end user of the solution.
3. Define clear objectives and measurable key results for a potential trial of the proposed solution with the identified Air Force end user(s).
4. Clearly identify any additional specific stakeholders beyond the end user(s) who will be critical to the success of any potential trial. This includes, but is not limited to, program offices, contracting offices, finance offices, information security offices and environmental protection offices.
6. Describe if and how the demonstration can be used by other DoD or governmental customers.
7. Describe technology related development that is required to successfully field the solution.

The funds obligated on the resulting Phase I awards are to be used for the sole purpose of conducting a thorough feasibility study using mathematical models, scientific experiments, laboratory studies, commercial research and interviews.

PHASE II: Develop, install, integrate and demonstrate a prototype system determined to be the most feasible solution during the Phase I feasibility study. This demonstration should focus specifically on:

1. Evaluating the proposed solution against the objectives and measurable key results as defined in the Phase I feasibility study.
2. Describing in detail how the solution can be scaled to be adopted widely (i.e. how can it be modified for scale).
3. A clear transition path for the proposed solution that takes into account input from all affected stakeholders including but not limited to: end users, engineering, sustainment, contracting, finance, legal, and cyber security.
4. Specific details about how the solution can integrate with other current and potential future solutions.
5. How the solution can be sustainable (i.e. supportability).
6. Clearly identify other specific DoD or governmental customers who want to use the solution.

PHASE III DUAL USE APPLICATIONS: The Primary goal of STTR is Phase III. The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded mission capability to a broad range of potential government and civilian users and alternate mission applications. Direct access with end users and government customers will be provided with opportunities to receive Phase III awards for providing the government additional research & development, or direct procurement of products and services developed in coordination with the program.

PROPOSAL PREPARATION AND EVALUATION: Please follow the Air Force-specific Phase I instructions under the Department of Defense 21.2 SBIR Broad Agency Announcement and Chart 1 (above) when preparing proposals. Proposals under this topic will have a maximum value of $156,500 SBIR funding and a maximum performance period of five months, including four months technical performance and one month for reporting.

Proposals will be evaluated using a two-step process. After proposal receipt, an initial evaluation will be conducted IAW the criteria found in the AF-specific Phase I instructions as previously referenced. Based on the results of that evaluation, Selectable companies will be provided an opportunity to participate in

the Air Force Trusted AI Pitch Day, tentatively scheduled for 26-30 July 2021 (possibly virtual). Companies' pitches will be evaluated using the initial proposal evaluation criteria. Selectees will be notified after the event via email. Companies must participate in the pitch event to be considered for award.

REFERENCES:
1. De La Vega, W. Fernandez, and George S. Lueker. "Bin packing can be solved within 1+ ε in linear time." Combinatorica 1.4 (1981): 349-355
2. Rossillon, Kevin Joseph. Optimized air asset scheduling within a Joint Aerospace Operations Center (JAOC). Diss. Massachusetts Institute of Technology, 2015
3. Paquay, Célia, Michael Schyns, and Sabine Limbourg. "A mixed integer programming formulation for the three-dimensional bin packing problem deriving from an air cargo application." International Transactions in Operational Research 23.1-2 (2016): 187-213
4. Hoehn, John R. Joint All Domain Command and Control (JADC2). Congressional Research SVC Washington United States, 2020

KEYWORDS: Planning; Combinatorial Optimization; Mathematical Modeling; Integer Programming; Linear Programming; Approximation Algorithms; Complexity; Multi-Agent; Hierarchical Planning; Scheduling

AF21B-T002 Establishing Common Ground between Humans & Machines Pitch Day for Trusted AI

TECH FOCUS AREAS: Autonomy; Artificial Intelligence/Machine Learning

TECHNOLOGY AREAS: Information Systems; Air Platform

OBJECTIVE: This is a Phase I Pitch Day. Awards under this topic will include no more than $156,500 in STTR funding. Additionally, the period of performance will cover five months, including four months technical performance and one month for reporting. The objective of this topic is to explore the development of a theoretical foundation or model for hierarchical heterogeneous planning and scheduling by which we can reason about autonomous/automated decision-making in multiple different domains while accounting for the hierarchical structure of each domain. This topic seeks to reach companies and universities able to complete research into the foregoing concepts under a compressed schedule. This topic is specifically aimed at the early-stage basic science and research.

DESCRIPTION: Common ground, or the establishment of mutual knowledge, beliefs, and assumptions about a topic or task, is critical for teaming between two or more individuals. Common ground plays an important role in the development of trust, as it helps provide some transparency into processes for acquiring and providing mutually beneficial knowledge, improves communication efficiency through lexical entrainment, and flexibility to accommodate different communication styles or sudden/abrupt changes to a task at hand. The establishment, maintenance, and repair of common ground requires team members to coordinate on the content and the processes for task completion. Typically, this coordination occurs verbally through natural language; however, natural language comprehension/understanding has been an obstacle for the seamless integration of machines within human teams. The point of this topic is to solicit approaches to the establishment of common ground between humans or humans and machines using natural and/or non-natural language (e.g., brevity communication standards, controlled languages, etc.). To achieve this goal, the following are required:

• Document human approaches to the establishment of common ground for their codification;
• Develop computational models of the codified common ground processes;
• Derive or adopt a non-natural language, controlled language, etc., for testing in a human-machine context;
• Model and human training for the adopted non-natural language;
• Develop and validate objective criteria/metrics for demonstrating the establishment of common ground, with a preference for real-time assessment;
• Evaluate performance and identify improvements to the codified processes, language derivation, etc., for further potential development.

PHASE I: From a set of alternatives, perform a literature search and feasibility study to demonstrate a path forward for prototype system development, capable of establishing and maintaining common ground with humans while completing a shared task.

PHASE II: Develop and demonstrate a prototype system based on the most feasible solution during the Phase I feasibility study. This demonstration should focus specifically on:

- Evaluating the proposed solution against the objectives and measurable key results as defined in the Phase I feasibility study.
- Describing in detail how the solution can be scaled to be adopted widely (i.e. how can it be modified for scale).

- Provide a clear transition path for the proposed solution taking into account input from all affected stakeholders including but not limited to end users, engineering, sustainment, contracting, finance, legal, and cyber security.
- Provide specific details about the solution's integration with other current and potential future solutions.
- Explain how the solution can be sustainable, i.e., supportability.
- Specifically identify DoD or Governmental customers who want to use the solution.

PHASE III DUAL USE APPLICATIONS: The contractor will pursue commercialization of the various technologies developed in Phase II for transitioning expanded mission capability to a broad range of potential government and civilian users and alternate mission applications. Direct access with end users and government customers will be provided with opportunities to receive Phase III awards for providing the government additional research & development, or direct procurement of products and services developed in coordination with the program.

PROPOSAL PREPARATION AND EVALUATION: Please follow the Air Force-specific Phase I instructions under the Department of Defense 21.2 SBIR Broad Agency Announcement and Chart 1 (above) when preparing proposals. Proposals under this topic will have a maximum value of $156,500 SBIR funding and a maximum performance period of five months, including four months technical performance and one month for reporting.

Proposals will be evaluated using a two-step process. After proposal receipt, an initial evaluation will be conducted IAW the criteria found in the AF-specific Phase I instructions as previously referenced. Based on the results of that evaluation, Selectable companies will be provided an opportunity to participate in the Air Force Trusted AI Pitch Day, tentatively scheduled for 26-30 July 2021 (possibly virtual). Companies' pitches will be evaluated using the initial proposal evaluation criteria. Selectees will be notified after the event via email. Companies must participate in the pitch event to be considered for award.

REFERENCES:
1. Clark, H. H.; Brennan, S. E. (1991). Perspectives on socially shared cognition. Washington, DC: American Psychological Association. pp. 129–130
2. Clark, H. H, & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. Cognition 22(1), 1-39
3. Klein, G., Woods, D.D., Bradshaw, J.M., Hoffman, R.R., & Feltovich, P.J. (2004). Ten challenges for making automation a "team player' in joint human-agent activity. IEEE Intelligent Systems, 91-95

KEYWORDS: human-machine teaming; training; transparency; trust; Autonomy; Autonomous Agents; Autonomous Capabilities

AF21B-T003 Restricted SWAP-C Air Direction Sensing to Enable Single Vehicle Chemical Reactive Tracking

TECH FOCUS AREAS: Biotechnology Space; Autonomy

TECHNOLOGY AREAS: Sensors; Chem Bio Defense; Air Platform

OBJECTIVE: Develop methodology and hardware to sense ambient wind condition to use as a command control signal for a small autonomous flying platform. The ultimate goal is to perform anemotaxis as a key component of chemotaxis with a single vehicle.

DESCRIPTION: Animals are so successful at finding the sources of important chemical plumes by utilizing the direction of the flow around them. Active sensing of the wind direction on a small platform is not currently possible with commercial off the shelf components though some solutions are under development at the basic research level at universities. Two approaches to this problem include:

1. A physical sensor and associated software analysis dedicated to sensing and analyzing wind for control; and
2. Using existing platform commands and sensors to work out the wind for control.

Two biotechnology approaches for (1) include using antenna or whisker like structures to physically sense the wind and an observability analysis that demonstrates the theoretical possibility of using this approach. Theoretically the vehicles' own orientation and motor command responses to wind could be used for approach (2). Neither approach has been demonstrated. Passive control using fins is successful but under very limiting circumstances where the air flow is low velocity and steady.

PHASE I: Determine whether there is technical merit to the proposed approach and whether the technology can feasibly detect the wind direction and subsequent reactive command and control of a small autonomous platform.

PHASE II: Demonstrate and model in controlled conditions including wind gusts and wind direction changes wind detection and subsequent command and control of a small autonomous platform.

PHASE III DUAL USE APPLICATIONS: Demonstrate and model in uncontrolled outdoor conditions including wind gusts and wind direction changes wind detection and subsequent command and control of a small autonomous platform over a long distance upwind.

REFERENCES:
1. Anderson, Melanie J., et al. "The "Smellicopter," a bio-hybrid odor localizing nano air vehicle." 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2019.
2. Kim, Suhan, et al. "A whisker-inspired fin sensor for multi-directional airflow sensing." 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2020
3. Lopez, Austin P., Ryan Tung, and Floris van Breugel. "Upwind Detection of Ambient Wind Using Biomimetic Antenna Sensors for Aerial Vehicles through Active Sensing." AIAA AVIATION 2020 FORUM. 2020.

KEYWORDS: observability; sensor calibration; anemotaxis; UAV; MAV; ambient wind; chemotaxis; ground speed; airflow; biotechnology

AF21B-T004 Efficient Thermal Insulation System for Space Transportation

TECH FOCUS AREAS: General Warfighting Requirements (GWR)

TECHNOLOGY AREAS: Space Platform; Materials

OBJECTIVE: The objective of this solicitation is to design insulators through physics-based models, demonstrate fabrication technologies, and validate the predicted response at relevant aero-heating conditions. The insulations should be applicable at temperatures approaching 1700 °C.

DESCRIPTION: U.S. Air Force and Space Force are interested in efficient reusable thermal insulations to be used on launch and reentry vehicles. This topic concentrates on efficient reusable insulations that can sustain flight thermal and aerodynamic loads over parts of the vehicles. The reusable insulations can be either a rigid insulation directly subjected to the aerodynamic loads, or a flexible insulation located beneath an aeroshell structure. The insulation must be thermally optimized to provide optimum thermal protection with the lowest possible volume and mass. Thermal optimization can be achieved though minimizing various modes of heat transfer in insulations, such as solid and gas conduction, and radiation transport. The objective of this solicitation is to design insulators through physics-based models, demonstrate fabrication technologies, and validate the predicted response at relevant aero-heating conditions. As previously stated, the insulations should be applicable at temperatures approaching 1700 °C.

PHASE I: Phase I should determine feasibility of to-be designed/developed small-scale test articles and preliminary thermal testing to demonstrate proof of concept.

PHASE II: Focus of Phase II should be further iterations on design and development that result in functional or manufacturing scale up for larger test articles.

PHASE III DUAL USE APPLICATIONS: The fundamental nature of AFOSR programs reflect the broad opportunity to commercialize science to both commercial and defense markets. Awardees will have the opportunity to integrate with prospective follow-on transition partners. The contractor will transition the solution to provide expanded mission capability to a broad range of potential Government and civilian users and alternate mission applications.

NOTE: The technology within this topic is restricted under the International Traffic in Arms Regulations (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 proposed tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the Announcement and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the Air Force SBIR/STTR Contracting Officer, Ms. Kris Croake, kristina.croake@us.af.mil.

REFERENCES:
1. Lee, SC, and Cunnington, G.R., “Conduction and Radiation Heat Transfer in High-Porosity Fiber Thermal Insulation,” Journal of Thermophysics and Heat Transfer, Vol. 14, No. 2, April-June 2000, pp. 121-136
2. Cunnington, G.R., Lee, SC, and White, S.M. “Radiative Properties of Fiber-Reinforced Aerogel: Theory versus Experiment,” Journal of Thermophysics and Heat Transfer, Jan- March 1998, pp. 17-22

3. Veiseh, S., Hakaki-Fard, A., “Numerical Modeling of Combined Radiation and Conduction Heat Transfer in Mineral Wool Insulations,” Heat Transfer Engineering, Vol. 30, No. 6, 2009, pp. 477-486
4. Carvajal, S.A., Garboczi, E.J., and Zarr, R.R., “Comparison of Models for Heat Transfer in High-Density Fibrous Insulation,” Journal of Research of the National Institute of Standards and Technology, Vol. 124, May 2019.
5. Spagnol, S., Lartigue, B., Trombe, A., Gibiat, V., “Modeling of thermal conduction in granular silica aerogels,” Journal of Sol-Gel Science and Technology, Vol. 48, Nov. 2008, pp. 40-46

KEYWORDS: thermal protection system; reusable; optimized thermal performance

AF21B-T005 Secured and Robust Communications on Urban Air Mobility Networks (SRCUMAN)

TECH FOCUS AREAS: Cybersecurity

TECHNOLOGY AREAS: Information Systems

OBJECTIVE: Develop and implement a decentralized and distributed security solution on Urban Air Mobility (UAM) networks to enable incorruptible flight data communications and resiliency.

DESCRIPTION: The vision to revolutionize air mobility such as agility prime [1] present exciting frontiers in modern aviation. As air traffic grows, there is a need for secure Urban Air Mobility (UAM) for air passenger and cargo transportation in and among commercial, civilian, and military locations. UAM offers the potential to create a faster, cleaner, safer, and more integrated transportation system. However, recent events have shown that modern unmanned aerial vehicles (UAVs) are vulnerable to attack and subversion through buggy or sometimes malicious devices that are present on UAM communication networks, which increase the need for cyber awareness include UAVs in the airspace, development of the Automatic dependent surveillance-broadcast (ADS-B), and the risk of cyber intrusion [2].

The incident of a civilian UAV disrupting a major airport is one example of many incidents raising questions on the future of airspace security. While a civilian hobbyist might be ignorant of the impending harm, the situation could pose a threat to the air operations [3]. Therefore, a seamless trusted communication capability is important in both military and commercial operations for vehicle integrity [4].

The challenge is conventional enabling technologies mainly rely on a centralized system for data aggregation, sharing, and security policy enforcement; and it incurs critical issues related to bottleneck of data analysis, provenance, and consistency. Since air vehicles can be compromised at a single point yet effects can propagate across the entire UAM network, the Department of the Air Force (DAF) is looking for a solution to eliminate the single point of failure through a decentralized and distributed security validation to verify communications with certainty despite there being a valid node on the network acting maliciously. The DAF would like to see this technology applied on a UAV cellular intercommunication network that can perform validation of messages in a form of decentralized security distributed amongst air vehicle controllers as well as provide a sense of resiliency.

PHASE I: In the first phase of this effort, the contractor shall design a decentralized and distributed security solution performing validation of communications on UAM networks. Evaluation tradeoffs of the type and source of vulnerabilities to be exploited for a wireless UAV network, considering both accidental and malicious events, should be examined. The technology shall have a low resource consumption, minimal latency, and enhanced security on the air vehicles and networks. The proof of concept should include modeling, simulation, and mathematical description towards a prototype solution in Phase II.

PHASE II: Implement and demonstrate the concept developed in Phase I on practical wireless ad-hoc network (WANET) or mobile ad hoc network (MANET) for autonomous UAM network management and aircraft separation service of urban airspace using physical air vehicle controllers. The contractor shall test and evaluate the operation of the technology in a live air vehicle or systems integration lab (SIL) environment. The contractor shall verify the effectiveness of the technology by:

(1) Showing other controllers reject valid but malicious messages sent by another controller
(2) Performing penetration testing with an independent team to identify other attack vectors against the technology; and
(3) Evaluating the solution to refine the initial design prototype to be used in relevant and/or operational environment settings to support all domain mission requirements. Key metrics would be the confidentiality, integrity, and availability of data.

PHASE III DUAL USE APPLICATIONS: The fundamental nature of AFOSR programs reflect the broad opportunity to commercialize science to both commercial and defense markets. Awardees will have the opportunity to integrate with prospective follow-on transition partners. The contractor will transition the solution to provide expanded mission capability to a broad range of potential Government and civilian users and alternate mission applications.

NOTE: The technology within this topic is restricted under the International Traffic in Arms Regulations (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 proposed tasks intended for accomplishment by the FN(s) in accordance with section 5.4.c.(8) of the Announcement and within the AF Component-specific instructions. Offerors are advised foreign nationals proposed to perform on this topic may be restricted due to the technical data under US Export Control Laws. Please direct questions to the Air Force SBIR/STTR Contracting Officer, Ms. Kris Croake, kristina.croake@us.af.mil.

REFERENCES:
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2. E. Blasch et al., "Cyber Awareness Trends in Avionics," 2019 IEEE/AIAA 38th Digital Avionics Systems Conference (DASC), San Diego, pp. 1-8, 2019.
3. Flying Cars: Urban Air Mobility Raises Safety Concerns, 2020. Available at: https://www.nationaldefensemagazine.org/articles/2020/7/7/urban-air-mobility-raises-safety-concerns
4. J. A. Maxa, R. Blaize and S. Longuy, "Security Challenges of Vehicle Recovery for Urban Air Mobility Contexts," 2019 IEEE/AIAA 38th Digital Avionics Systems Conference (DASC), 2019.

KEYWORDS: Urban air mobility; orb; agility prime; network security; communications; data resiliency; Urban Air Mobility Networks; Decentralized Security; Communication Protocols; Information Fusion; Data Transmission System; Intrusion Detection/Prevention System; Threat; Protection; Fault Tolerance

DEFENSE THREAT REDUCTION AGENCY (DTRA)
Small Business Technology Transfer (STTR) Program
STTR 21.B Proposal Instructions

1. 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 and Nuclear) and Improvised Threat Networks. The DTRA STTR program is consistent with the purpose of the SBIR/STTR Program, i.e., to stimulate a partnership of ideas and technologies between innovative small business concerns and Research Institutions through Federal-funded research or research and development (R/R&D).

The approved FY21.B list of topics solicited for in the Defense Threat Reduction Agency (DTRA) Small Business Technology Transfer (STTR) Program are included in these instructions followed by full topic descriptions. Offerors responding to this Broad Agency Announcement 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 Program BAA. Specific DTRA requirements that add to or deviate from the DoD 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 Program Office. Specific questions pertaining to the administration of the DTRA STTR Program and these proposal preparation instructions should be submitted to:

Mr. Mark 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 which begins April 21, 2021 through May 18, 2021 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 DoD SBIR/STTR electronic submission system, contact the 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 SIBR/STTR Policy Directive is available at:
https://www.sbir.gov/sites/default/files/SBIRSTTR_Policy_Directive_2019.pdf.

2. 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's (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 prior to award.

2.2 SBA Company Registry

Per the 2019 SBIR-STTR Policy Directive, all STTR applicants 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. 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.

4. CYBER SECURITY

Any Small Business Concern receiving a 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.

5. PHASE I PROPOSAL GENERAL INFORMATION

5.1 Proposal Evaluation

DTRA will evaluate Phase I proposals using the criteria specified in Section 6.0 of the DoD SSTTR Program BAA during the review and evaluation process. The criteria will be in descending order of importance with technical merit, soundness, and innovation of the proposed approach being the most important, followed by qualifications, and followed by the commercialization potential. With other factors being equal, cost of the proposal may be included in the evaluation. DTRA reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. 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). Phase I contracts are limited to a maximum of $167,500 over a period not to exceed seven months. For clarity, the stated maximum dollar amount is exclusive of the Discretionary Technical and Business Assistance (TABA) that firms may request.

DTRA participates in one DoD STTR BAA each year and anticipates funding two Phase I contracts to small business concerns for each topic.

5.2 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: Cherokee Nation Strategic Programs, LLC (contract specialist support), Kent, Campa, and Kate, Inc. (contract closeout support), Engility Corporation (a company under SAIC, Inc), (advisory and assistance services), Quanterion Solutions, Inc. (DTRIAC), Kforce Government Solutions, Inc. (financial/accounting support), and CACI (contract writing system administration). This list is not all-inclusive (e.g., subcontractors) and is subject to change.

6. PHASE I PROPOSAL SUBMITTAL

Detailed guidance on registering in DSIP and using DSIP to submit a proposal can be found at https://www.dodsbirsttr.mil/submissions/learning-support/training-materials. If the proposal status is "In Progress" or "Ready to Certify" it will NOT be considered submitted, even if all volumes are added prior to the BAA close date. The proposer may modify all proposal volumes prior to the BAA close date.

Although signatures are not required on the electronic forms at the time of submission the proposal must be certified electronically by the corporate official for it to be considered submitted. If the proposal is selected for award, the DoD Component program will contact the proposer for signatures at the time of award.

Proposals addressing the topics will be accepted for consideration if received no later than the specified closing hour and date in the DoD Announcement The Agency requires your entire proposal to be submitted electronically through the DoD Submission Web site https://www.dodsbirsttr.mil/submissions/. A hardcopy is NOT required and will not be accepted. Hand or electronic signature on the proposal is also NOT required.

Proposals are required to be submitted in Portable Document Format (PDF), and it is the responsibility of submitters to ensure any PDF conversion is accurate and does not cause the Technical Volume portion of the proposal to exceed the 20-page limit. **Any pages submitted beyond the 20-page limit, will not be read or evaluated.** If you experience problems uploading a proposal, email the DoD SBIR/STTR Help Desk at: dodsbirsupport@reisystems.com

MAXIMUM PHASE I PAGE LIMIT FOR DTRA IS 20 PAGES FOR

VOLUME 2, TECHNICAL VOLUME

DTRA's objective for the Phase I effort is to determine the merit and technical feasibility of the concept. The contract period of performance for Phase I shall be seven (7) months (approx. 6 months technical work plus 1 month final report preparation) and the award shall not exceed $167,500. A list of topics currently eligible for proposal submission is included in these instructions, followed by full topic descriptions.

Animal and Human Research

Companies should plan carefully for research involving animal or human subjects, biological agents, etc. (see Sections 4.7 - 4.9 in the DoD Program Announcement). The few months available for a Phase I effort may preclude plans including these elements unless coordinated before a contract is awarded.

Profit or Fee on Travel Costs

Travel shall not be a profit or fee bearing cost element.

7. DECISION and NOTIFICATION

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.

Following the EA decision, the DTRA SBIR/STTR office will release notification e-mails for each accepted or rejected offer. 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.re.mbx.sbir@mail,mil and include "STTR 21.B / 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 that 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.

8. PHASE II PROPOSAL GUIDELINES

8.1 Phase II Proposal Introduction

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.

8.2 Phase II Proposal Instructions

Each Phase II proposal must be submitted through the DoD STTRSBIR Submission Web site by the deadline as specified in the Phase II Proposal Guidelines, or in the Phase I award or subsequent notification. Each proposal submission must contain a Proposal Cover Sheet, Technical Volume, Cost Volume, a Company Commercialization Report (see Sections 5.4.c.and 5.5 of the BAA Announcement), Volume 5, and Volume 6. The format should be similar to Phase I proposal except the Phase II Technical Proposal is limited to 40 pages. The Commercialization Strategy Volume should more specific than was required for Phase I.

As instructed in Section 5.4.e of the DoD STTR Program BAA, the CCR is generated by the **submission website based on information provided by you through the "Company** Commercialization Report" tool.

8.3 Commercialization Strategy

See Section 7.3 of the DoD STTR 21.B BAA.

8.4 Phase II Evaluation Criteria

Phase II proposals will be reviewed for overall merit based upon the criteria in Section 7.0 of this Broad Agency Announcement and will be similar to the Phase I process.

8.5 Profit or Fee on Travel Costs

Travel shall not be a profit or fee bearing cost element.

9. 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.

10. PROTESTS

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 acknowledgement of receipt from (if mailed letter) Defense Threat Reduction Agency, ATTN: AL-AC (Mr. Herbert Thompson), 1680 Texas Street, SE, Kirtland AFB, NM 87117. If Federal Express is used for the transmittal, the appropriate address is: Defense Threat Reduction Agency, ATTN: AL-AC (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)

DTRA 21.B Phase I Topic Index

DTRA21B-001	Synthetic Aperture Radar (SAR) Image Generation Data Augmentation (SIGDA)
DTRA21B-002	Numerics-Informed Neural Networks (NINNs)
DTRA21B-003	Mathematical models to build multi-radiation detector algorithms

DTRA21B-001 TITLE: Synthetic Aperture Radar (SAR) Image Generation Data Augmentation (SIGDA)

RT&L FOCUS AREA(S): Artificial Intelligence/ Machine Learning

TECHNOLOGY AREA(S): Battlespace; 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 section 3.5 of 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 method to produce synthetic SAR data for augmentation into Artificial Intelligence (AI) Automatic Target Recognition (ATR) algorithms and assess improvement compared to current methods. Leverage existing radiative transfer models (RTMs) within the research community to create phased history as well as radar images from which specific features can be exploited for use in current ATR algorithms. Explore the use of state of the art artificial intelligence (AI) methods such as the Generative Adversarial Network (GAN) in producing realizable synthetic SAR data in conjunction with RTM results to further improve ATR training.

DESCRIPTION: Current Standard Operating Procedures (SOPs) for SAR image analysis consists of manual processes that are labor intensive. SAR analysis currently requires a trained analyst with years of experience to accurately classify targets in a scene. Analysts cannot keep up with the amount of captured data that needs to be processed which has spawned attempts to push human capabilities [1]. The sheer volume of data from desperate systems produces a situation in which reviewing all collected imagery becomes an impossibility for the Intelligence Communities (ICs). Specifically for the Counter Weapons of Mass Destruction (CWMD) mission, foreign governments purposely take actions, such as moving locations and the use of remote sites that make it difficult for analysts to identify objects of interest. AI automated solutions have been proposed as a force multiplier with the potential to significantly increase the amount of actionable intelligence an analyst can produce [2]. Despite the promise that AI presents to the SAR analysis problem, training data for ATR algorithms is scarce.

AI algorithms must first be trained on existing data in order to process and make classifications on new data. Finding quality data that meets the end goal of the algorithm is often the Achilles heel of ATR systems. Moreover, the training data must incorporate all possible aspects of the target, viewpoint, and scene making the task of creating a training set difficult and cumbersome. Images are often translated, rotated, cropped, and noise added in various ways to capture possibilities. However, creating such a dataset for SAR imagery on desired military targets is even more difficult, cost prohibitive, and impractical with the very limited available data.

Instead, the use of RTMs for the creation of synthetic data has shown promise for ATR algorithms on other sensor modalities and can be extended to SAR [3].

A number of RTMs that have SAR capability already exist and should be further developed for the SAR synthetic data augmentation problem. Some of these models include RaySAR [4] CohRas [5], SARViz [6], and DIRSIG [7]. These systems were originally created with engineering studies in mind, for instance, sensor specifications, target characteristics, environmental conditions, platform properties, and so forth. Generally, RTMs are based on statistical ray-tracing techniques into a 3d scene description to predict at sensor radiance contributions from scene components. Scene descriptions can contain detailed information such as surface Bidirectional Reflectance Distribution Functions (BRDFs), textures, and spectral dependencies. Environmental conditions such as atmospheric propagations are also often incorporated with the use of models such as MODTRAN [8]. Sensor and antenna specifications such as power, frequency, and gain pattern are important parameters that are included for robust simulations. With the ability to create physically realizable SAR data, RTM outputs are well suited to solve the lack of training data problem for SAR ATR algorithms.

ATR algorithms are aimed at solving the classification problem of objects in a scene. Convolution Neural Networks (CNNs) have become the most common method for difficult classification problems, and have proven to be highly effective due to their ability to hone in on local features in the vector space. CNNs are comprised of layered connections of convolutions with learned filters that enable neighboring semantic meanings, making it an ideal choice for image classification. A number of CNNs have been developed for the SAR classification problem with promising accuracy but often lack sufficient datasets [2] [9] [10].

One of the most recent studies on the creation of synthetic SAR data for augmentation into ATR algorithms looked at processing RTM visible imagery into SAR like imagery by using a GAN [11]. Although the study showed that important features were missing in the GAN produced synthetic imagery required to improve ATR accuracy, the researchers proposed that instead, RTMs should produce the SAR data directly, and a GAN then could be used to improve the realism of the SAR image.

PHASE I: An in depth literature review comparing current SAR Radiative Transfer Models, data sets, and ATR algorithms is first required to understand the state of the art. An understanding of the advantages and disadvantages of the different available RTMs as well as their availability for use in this effort will be determined. An RTM will then be chosen, acquired, and used to produce synthetic SAR data, both phased history as well as imagery. SAR datasets will also be researched that contain objects of interest, one example being MSTAR [12]. An ATR algorithm will be chosen based on literature review results and availability. The ATR algorithm will be trained with the "off the shelf" data set and tested for accuracy. Training data will then be augmented from synthetically generated SAR data. Metrics, such as precision and recall will tracked to measure the increase in ATR performance with data augmentation. Deliver model, all software, data, and reports on the effort.

PHASE II: Build upon lessons learned from phase I, pursuing efforts that show promise in SAR data augmentation. Research AI methods to enhance synthetic imagery such as usage of GAN

algorithms. Implement AI and other synthetic imagery enhancements and test ATR improvements as a result of the enhancements. Produce TRL level 6 system by incorporating models into operational analytical tools and performing a technology demonstration. Metrics, such as precision and recall will be tracked to measure the increase in ATR performance with data augmentation. Deliver the system, model, all software, data, and reports on the effort.

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. R. A. McKinley, L. McIntire, N. Bridges, C. Goodyear, N. B. Bangera and M. P. Weisend, "Acceleration of image analyst training with trascranial direct current stimulation," Behavioral Neuroscience, vol. 127, no. 6, p. 936, 2013. ;
2. C. Coman, "A deep learning sar target classification experiment on mstar dataset," in International Radar Symposium, Bonn, Germany, 2018. ;
3. R. Kemker, C. Salvaggio and C. Kanan, "Algorithms for semantic segmentation of multispectral remote sensing imagery using deep learning," ISPRS journal of photogrammetry and remote sensing, no. 145, pp. 60-77, 2018. ;
4. S. Auer, R. Bamler and P. Reinartz, "RaySAR-3D SAR simulator: Now open source," IEEE International Geoscience and Remote Sensing Symposium (IGARSS), 2016. ;
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6. M. Gupta, V. Malhotra, B. Shah, S. Prakash, A. Sharma and B. Kartikeyan, "RISAT-1 SAR HRS Mode Data Quality Evaluation," IGARSS IEEE International Geoscience and Remote Sensing Symposium, 2019. ;
7. M. Gartley, A. Goodenough, S. Brown and R. Kauffman, "A comparison of spatial sampling techniques enabling first principles modeling of a synthetic aperture RADAR imaging platform," in SPIE Defense, Security, and Sensing, Orlando, FL, 2010. ;
8. A. Berk, L. Bernstein and D. C., "MODTRAN: A moderate resolution model for LOWTRAN.," Spectral Sciences Inc., Burlington, MA, 1987. ;
9. H. S. Pannu and A. Malhi, "Deep learning-based explainable target classification for synthetic aperture radar images," in 13th International Conference on Huan System Interaction IEEE, Tokyo, Japan, 2020. ;
10. E. G. john, "Convolutional Neural Networks For Feature Extraction and Authomated Target Recognition in Synthetic Aperture Radar Images," Naval Postgraduate School, Monterey, CA, 2020. ;
11. J. Slover, "Synthetic Aperture Radar Simulation by Electro Optical to SAR Transformation Using Generative Adversarial Network," Rochester Institute of Technology, Rochester, NY, 2020. ;
12. T. D. Ross, W. Steven, V. J. Velten, J. C. Mossing and M. L. Bryant, "Standard SAR ATR evaluation experimetns using the MSTAR public release data set," in Algorithms for Sythetic Aperture Radar Imagery V. , Orlando, FL, 1998. ;

KEYWORDS: Synthetic Aperture Radar (SAR), Automatic Target Recognition (ATR), Artificial Intelligence (AI), Convolution Neural Network (CNN), Radiative Transfer Model (RTM), Synthetic Imagery

DTRA21B-002 TITLE: Numerics-Informed Neural Networks (NINNs)

RT&L FOCUS AREA(S): Artificial Intelligence/ Machine Learning

TECHNOLOGY AREA(S): Chem Bio Defense; Information Systems

OBJECTIVE: DTRA has a need to perform high-fidelity CFD modeling of agent defeat phenomenology and associated test and evaluation activities in order to quantify and increase the accuracy of hazard source predictions for counter weapons of mass destruction (C-WMD) defeat and deny tactics. These simulations are technically and computationally challenging due to the long-time duration of interest (weapon detonation through stabilization of plume), the stochastic nature of fragmentation and turbulent mixing phenomena, the temperature dependency of thermal neutralization mechanisms, and the relatively stiff chemical kinetics models. The objective of this topic is to improve the computational efficiency of the chemical kinetics models for chemical weapon agents and simulants by investigating and developing Numerics-Informed Neural Networks (NINNs). This topic explores the premise that simply using the residual of the PDE as in Physics-Informed Neural Networks (PINNs) is not optimal. One might instead use directly the numerical schemes which are employed to integrate the PDEs in time. This leads naturally to numerics-informed neural nets (NINNs).

DESCRIPTION: The last decade has seen a tremendous amount of activity and developments in the field of deep neural networks (DNNs). When trying to apply these to physics governed by partial differential equations (PDEs), traditional DNNs have been ‘supplemented' or ‘informed’ with the underlying physics, leading to physics-informed neural nets (PINNs).
This topic explores the premise that simply using the residual of the PDE (as in PINNs) is not optimal. One might instead directly use the numerical schemes which are employed to integrate the PDEs in time. This leads naturally to Numerics-Informed Neural Networks (NINNs).

To leverage the ongoing research momentum in Artificial Intelligence and Machine Learning, DTRA seeks innovative ideas for replacing the PDE residuals used for PINNs by the discrete time stepping increments of numerical integrators.
Phase I development must demonstrate a NINN approach for local residuals (e.g., chemically reacting flows) and non-local residuals (e.g., PDEs with spatial derivatives). The new techniques should then be compared to PINNs and traditional DNNs. Phase II development will further optimize the NINN approach to extend the range of applicability to other problems.

PHASE I: Define and develop NINNs for chemical reactions (CHEM-NINNs). Define and develop NINNs for PDEs with spatial derivatives. Investigate and validate NINNs and CHEM-NINNs by comparison of results with traditional DNNs and PINNs.

PHASE II: Further develop, test and optimize the NINN approach to extend the range of applicability. Demonstrate use of NINNs on High Performance Computing (HPC) systems. Perform detailed comparisons with high-fidelity Computational Fluid Dynamics (CFD), Computational Chemistry application codes and observational data, to quantify speed and

accuracy of the NINNs and CHEM-NINNs. Generalize and document for pre-commercial release.

PHASE III DUAL USE APPLICATIONS: In addition to implementing 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 private sector HPC applications. The software developed for use in DTRA's very demanding application codes will be well suited, once refined, for use on more general HPC workloads. 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.

REFERENCES:

[1] Shin, Yeonjong , On the Convergence of Physics Informed Neural Networks for Linear Second-Order Elliptic and Parabolic Type PDEs},Communications in Computational Physics
https://arxiv.org/pdf/2004.01806 ;

[2] M Raissi, P Perdikaris, GE Karniadakis, Physics-informed neural networks: A deep learning framework for solving forward and inverse problems involving nonlinear partial differential equations Journal of Computational Physics, 2019
https://www.osti.gov/servlets/purl/1595805 ;

[3] Harbir Antil, Ratna Khatri, Rainald Löhner, Deepanshu Verma, Fractional Deep Neural Network via Constrained Optimization
https://arxiv.org/pdf/2004.00719 ;

[4] Lars Ruthotto, E. Haber, Journal of Mathematical Imaging and Vision 2019 Deep Neural Networks motivated by Partial Differential Equations
https://arxiv.org/pdf/1804.04272 ;

KEYWORDS: High Performance Computing; HPC; Artificial Intelligence; Neural Networks; Deep Learning; Physics; Partial Differential Equations

DTRA21B-003 TITLE: Mathematical models to build multi-radiation detector algorithms

RT&L FOCUS AREA(S): Artificial Intelligence/ Machine Learning

TECHNOLOGY AREA(S): Nuclear; Sensors

OBJECTIVE: Develop flexible radiation algorithms deployed across battlefield networks to enable the linking of multiple detector variants and fusing of raw detector outputs into usable information.

DESCRIPTION: Often, multiple detectors, and multiple detector variants are deployed to characterize a complex scene (i.e. stationary detectors, handheld radioisotope devices, vehicle-mounted detectors, and backpack detectors) within 1 square kilometer. This topic seeks to develop flexible radiation detection algorithms leveraging proven mathematical data models that would sit either at a node for multiple detectors or at a command center that fuses raw detector outputs into useable information. Multiple data types are included in this deployment modality: gross gamma/neutron counts, gamma spectral data, GPS data, etc. Advances in big data theory, machine learning, and artificial intelligence have yielded new mathematical models that could be applied to multiple radiation detection sensors to fuse data in a way that novel algorithms may analyze the overall data input, instead of discrete sensor data. The intent of this topics is to leverage these new mathematical principals and models to decrease time to localize and characterize radiological signature anomalies in a complex scene by leveraging data from all radiation detector types. This would serve to better protect warfighters by reducing mission times and provide commanders better mission radiological characterization for the overall scene.

PHASE I: Identification of multi-radiation detector algorithms and demonstrate their potential to improve the identification, characterization, and/or localization of a radioactive source in a complex scene as compared to the singular detector algorithm. Multiple candidate algorithms shall be down selected for further development in Phase II. Demonstrate pathways for meeting the Phase II performance goals through feasibility studies at the end of Phase I.

PHASE II: Demonstrate enhanced identification, characterization and/or localization of radioactive sources with the multi-detector algorithm that fuses data (gamma and neutron radiation outputs, and GPS location/time) from disparate ground based and mobile detector types. Demonstrate improved performance of the multi-detector algorithm over single-system algorithms. The algorithm should support the integration of additional new detector types.

PHASE III DUAL USE APPLICATIONS: Field demonstration in radiation environment with users deploying multiple and varied radiation detectors linked via communications to a network node in which the algorithm receives detector outputs. The algorithm must conduct scene characterization in real-time as operators move through a complex environment with disparate detector modalities. The multi-system algorithm will be directly compared to legacy single-system algorithms to assess impact on mission. Develop commercialization and transition plan to DoD end users.

REFERENCES:

1. Information Fusion Volume 57, May 2020, Pages 115-129; https://doi.org/10.1016/j.inffus.2019.12.001 ;
2. Joint Pub 3-11 ;

KEYWORDS: RN Detection, Algorithm

Missile Defense Agency (MDA)
21.B Small Business Technology Transfer (STTR)
Proposal Submission Instructions

I. INTRODUCTION

The Missile Defense Agency's (MDA) mission is to develop and deploy a layered Missile Defense System (MDS) to defend the United States, its deployed forces, allies, and friends from missile attacks in all phases of flight.

The MDA Small Business Technology Transfer (STTR) Program is implemented, administered, and managed by the MDA SBIR/STTR Program Management Office (PMO), located within the Innovation, Science, & Technology (DV) directorate. Specific questions pertaining to the administration of the MDA STTR Program and these proposal preparation instructions should be submitted to:

Missile Defense Agency
SBIR/STTR Program Office
MDA/DVR
Bldg. 5222, Martin Road
Redstone Arsenal, AL 35898

Email: sbirsttr@mda.mil
Phone: 256-955-2020

Proposals not conforming to the terms of this Announcement will not be considered. MDA reserves the right to limit awards under any topic, and only those proposals of superior scientific and technical quality as determined by MDA will be funded. MDA 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 MDA instructions carefully prior to submitting your proposal. Please go to https://www.sbir.gov/about/about-sbir#sbir-policy-directive to read the SBIR/STTR Policy Directive issued by the Small Business Administration.

Federally Funded Research and Development Centers (FFRDCs) and Support Contractors

Only Government personnel with active non-disclosure agreements will evaluate proposals. Non-Government technical consultants (consultants) to the Government may review and provide support in proposal evaluations during source selection. Consultants may have access to the offeror's proposals, may be utilized to review proposals, and may provide comments and recommendations to the Government's decision makers. Consultants will not establish final assessments of risk and will not rate or rank offerors' proposals. They are also expressly prohibited from competing for MDA STTR awards in the STTR topics they review and/or on which they provide comments to the Government.

All consultants are required to comply with procurement integrity laws. Consultants will not have access to proposals or pages of proposals that are properly labeled by the offerors as "Government Only." Pursuant to FAR 9.505-4, the MDA contracts with these organizations include a clause which requires them to (1) protect the offerors' information from unauthorized use or disclosure for as long as it remains proprietary

and (2) refrain from using the information for any purpose other than that for which it was furnished. In addition, MDA requires the employees of those support contractors that provide technical analysis to the SBIR/STTR Program to execute non-disclosure agreements. These agreements will remain on file with the MDA SBIR/STTR PMO.

Non-Government advisors will be authorized access to only those portions of the proposal data and discussions that are necessary to enable them to perform their respective duties. In accomplishing their duties related to the source selection process, employees of the aforementioned organizations may require access to proprietary information contained in the offerors' proposals.

II. OFFEROR SMALL BUSINESS ELIGIBILITY REQUIREMENTS

Each offeror must qualify as a small business at time of award per the Small Business Administration's (SBA) regulations at 13 CFR 121.701-121.705 and certify to this in the Cover Sheet section of the proposal. Small businesses that are selected for award will also be required to submit a Funding Agreement Certification document and be register with Supplier Performance Risk System https://www.sprs.csd.disa.mil/ prior to award.

SBA Company Registry

Per the SBIR/STTR Policy Directive, all applicants 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 SBIR or STTR programs. For more information, please visit the SBA's Firm Registration Page: http://www.sbir.gov/registration.

Performance Benchmark Requirements for Phase I Eligibility

MDA does not accept proposals from firms that are currently ineligible for Phase I awards as a result of failing to meet the benchmark rates at the last assessment. Additional information on Benchmark Requirements can be found in the DoD Instructions of this Announcement.

III. ORGANIZATIONAL CONFLICTS OF INTEREST (OCI)

The basic OCI rules for Contractors which support development and oversight of STTR topics are covered in FAR 9.5 as follows (the Offeror is responsible for compliance):

(1) the Contractor's objectivity and judgment are not biased because of its present or planned interests which relate to work under this contract;

(2) the Contractor does not obtain unfair competitive advantage by virtue of its access to non-public information regarding the Government's program plans and actual or anticipated resources; and

(3) the Contractor does not obtain unfair competitive advantage by virtue of its access to proprietary information belonging to others.

All applicable rules under the FAR Section 9.5 apply.

If you, or another employee in your company, developed or assisted in the development of any STTR requirement or topic, please be advised that your company may have an OCI. Your company could be precluded from an award under this BAA if your proposal contains anything directly relating to the development of the requirement or topic. Before submitting your proposal, please examine any potential

OCI issues that may exist with your company to include subcontractors and understand that if any exist, your company may be required to submit an acceptable OCI mitigation plan prior to award.

IV. USE OF FOREIGN NATIONALS (also known as Foreign Persons), GREEN CARD HOLDERS AND DUAL CITIZENS

See the "Foreign Nationals" section of the DoD STTR Program 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. Identify any foreign nationals 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. 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). MDA 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 and/or firm is found ineligible by the government to perform proposed work, the contracting officer will advise the offeror of any disqualifications but is not required to disclose the underlying rationale.

V. EXPORT CONTROL RESTRICTIONS

The technology within most MDA 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. Please refer to the following URLs for additional information: https://www.pmddtc.state.gov and http://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear.

Most MDA STTR topics are subject to ITAR and/or EAR. If the topic write-up indicates that the topic is subject to International Traffic in Arms Regulation (ITAR) and/or Export Administration Regulation (EAR), your company may be required to submit a Technology Control Plan (TCP) during the contracting negotiation process.

VI. CLAUSE H-08 PUBLIC RELEASE OF INFORMATION (Publication Approval)

Clause H-08 pertaining to the public release of information is incorporated into all MDA STTR contracts and subcontracts without exception. Any information relative to the work performed by the contractor under MDA STTR contracts must be submitted to MDA for review and approval prior to its release to the public. This mandatory clause also includes the subcontractor who shall provide their submission through the prime contractor for MDA's review for approval.

VII. FLOW-DOWN OF CLAUSES TO SUBCONTRACTORS

The clauses to which the prime contractor and subcontractors are required to comply include, but are not limited to the following clauses: MDA clause H-08 (Public Release of Information), DFARS 252.204-7000 (Disclosure of Information), DFARS clause 252.204-7012 (Safeguarding Covered Defense Information and Cyber Incident Reporting), and DFARS clause 252.204-7020 (NIST SP 800-171 DoD Assessment Requirements). Your proposal submission confirms that any proposed subcontract is in accordance to the clauses cited above and any other clauses identified by MDA in any resulting contract.

VIII. OWNERSHIP ELIGIBILITY

Prior to award, MDA may request business/corporate documentation to assess ownership eligibility as related to the requirements of STTR Program Eligibility. These documents include, but may not be limited to, the Business License; Articles of Incorporation or Organization; By-Laws/Operating Agreement; Stock Certificates (Voting Stock); Board Meeting Minutes for the previous year; and a list of all board members and officers. If requested by MDA, the contractor shall provide all necessary documentation for evaluation prior to STTR award. Failure to submit the requested documentation in a timely manner as indicated by MDA may result in the offeror's ineligibility for further consideration for award.

IX. FRAUD, WASTE, AND ABUSE

All offerors must complete the fraud, waste, and abuse training (Volume 6) that is located on the Defense SBIR/STTR Innovation Portal (DSIP) (https://www.dodsbirsttr.mil). Please follow guidance provided on DSIP to complete the required training.

To report fraud, waste, or abuse, please contact:

MDA Fraud, Waste & Abuse
Hotline: (256) 313-9699
MDAHotline@mda.mil

DoD Inspector General (IG) Fraud, Waste & Abuse
Hotline: (800) 424-9098
hotline@dodig.mil

Additional information on Fraud, Waste and Abuse may be found in the DoD Instructions of this Announcement.

X. INTELLECTUAL PROPERTY RIGHTS

Per section 8, paragraph (d), part 1 of the SBIR/STTR Policy Directive, (1) A small business concern (SBC), before receiving an STTR award, must negotiate a written agreement between the SBC and the partnering Research Institution, allocating Intellectual Property rights and rights, if any, to carry out follow-on research, development, or Commercialization. The SBC must submit this agreement to the awarding agency with the proposal as part of Volume 5 (using the "Funding Agreement Certification" option) . The SBC must certify in all proposals that the agreement is satisfactory to the SBC. DoD has made a model agreement for the Allocation of Rights available here: https://rt.cto.mil/wp-content/uploads/STTR-Model-Agreement-for-the-Allocation-of-Rights.pdf

XI. PROPOSAL FUNDAMENTALS

Proposal Submission

All proposals MUST be submitted online using DSIP (https://www.dodsbirsttr.mil). Any questions pertaining to the DoD SBIR/STTR submission system should be directed to the DoD SBIR/STTR Help Desk at DoDSBIRSupport@reisystems.com.

It is recommended that potential offerors email topic authors to schedule a time for topic discussion during the pre-release period listed in the DoD STTR Program BAA.

Classified Proposals

Classified proposals **ARE NOT** accepted under the MDA STTR Program. The inclusion of classified data in an unclassified proposal MAY BE grounds for the Agency to determine the proposal as non-responsive and the proposal not to be evaluated. Contractors currently working under a classified MDA STTR contract must use the security classification guidance provided under that contract to verify new STTR proposals are unclassified prior to submission. Phase I contracts are not typically awarded for classified work. However, in some instances, work being performed on Phase II contracts will require security clearances. If a Phase II contract will require classified work, the offeror must have a facility clearance and appropriate personnel clearances in order to perform the classified work. For more information on facility and personnel clearance procedures and requirements, please visit the Defense Counterintelligence and Security Agency Web site at: https://www.dcsa.mil.

Use of Acronyms

Acronyms should be spelled out the first time they are used within the technical volume (Volume 2), the technical abstract, and the anticipated benefits/potential commercial applications of the research or development sections. This will help avoid confusion when proposals are evaluated by technical reviewers.

Communication

All communication from the MDA SBIR/STTR PMO will originate from the sbirsttr@mda.mil email address. Please white-list this address in your company's spam filters to ensure timely receipt of communications from our office.

Proposal Status

The MDA Contracting Office will distribute selection or non-selection email notices to all firms who submit a MDA STTR proposal. The email will be distributed to the "Corporate Official" and "Principal Investigator" listed on the proposal coversheet. MDA cannot be responsible for notification to a company that provides incorrect information or changes such information after proposal submission. MDA anticipates that selection and non-selection notifications will be distributed to all offerors in the September 2021 timeframe.

Proposal Feedback

MDA will provide written feedback to unsuccessful offerors regarding their proposals upon request. Requests for feedback must be submitted in writing to the MDA SBIR/STTR PMO within 30 calendar days of non-selection notification. Non-selection notifications will provide instructions for requesting proposal feedback. Only firms that receive a non-selection notification are eligible for written feedback.

Technical and Business Assistance (TABA)

The SBIR/STTR Policy Directive allows agencies to enter into agreements with suppliers to provide technical assistance to STTR awardees, which may include 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.

All requests for TABA must be completed using the MDA SBIR/STTR Phase I TABA Form (https://www.mda.mil/global/documents/pdf/SBIR_STTR_PHI_TABA_Form.pdf) and included as a part of Volume 5 of the proposal package. MDA will not accept requests for TABA that do not utilize the MDA SBIR/STTR Phase I TABA Form or are not provided as part of Volume 5 of the Phase I proposal package.

An STTR firm may acquire the technical assistance services described above on its own. Firms must request this authority from MDA and demonstrate in its STTR proposal that the individual or entity selected can provide the specific technical services needed. In addition, costs must be included in the cost volume of the offeror's proposal. The TABA provider may not be the requesting firm, an affiliate of the requesting firm, an investor of the requesting firm, or a subcontractor or consultant of the requesting firm otherwise required as part of the paid portion of the research effort (e.g. research partner or research institution).

If the awardee supports the need for this requirement sufficiently as determined by the Government, MDA will permit the awardee to acquire such technical assistance, in an amount up to $5,000 per year. This will be an allowable cost on the STTR award. The per year amount will be in addition to the award and is not subject to any burden, profit or fee by the offeror. The per-year amount is based on the original contract period of performance and does not apply to period of performance extensions. Requests for TABA funding outside of the base period of performance (6 months) for Phase I proposal submission will not be considered.

The purpose of this technical assistance is to assist STTR awardees in:

1. Making better technical decisions on STTR projects;
2. Solving technical problems that arise during STTR projects;
3. Minimizing technical risks associated with STTR projects; and
4. Developing and commercializing new commercial products and processes resulting from such projects including intellectual property protections.

The MDA Phase I TABA form can be accessed here (https://www.mda.mil/global/documents/pdf/SBIR_STTR_PHI_TABA_Form.pdf) and must be included as part of Volume 5 using the "Other" category.

STTR Proposal Funding

All MDA STTR contracts are funded with 6.2/6.3 funding which is defined as:

1. Applied Research (6.2), Systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.

2. Advanced Technology Development (6.3), Includes all efforts that have moved into the development and integration of hardware for field experiments and tests.

As stated in Section VI "CLAUSE H-08 PUBLIC RELEASE OF INFORMATION", MDA requires prior review and approval before public release of any information arising from STTR-sponsored research. As such, MDA does not consider STTR-sponsored research as fundamental research.

Protests Procedures
Refer to the DoD Program Announcement 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:
Tina Barnhill | 256-450-2817 | sbristtr@mda.mil

XII. PHASE I PROPOSAL GUIDELINES

DSIP (available at https://www.dodsbirsttr.mil) will lead you through the preparation and submission of your proposal. Read the front section of the DoD Announcement for detailed instructions on proposal format and program requirements. Proposals not conforming to the terms of this Announcement will not be considered. To be considered for evaluation the proposal package must be formally submitted on DSIP.

MAXIMUM PHASE I PAGE LIMIT FOR MDA IS 15 PAGES FOR VOLUME 2, TECHNICAL VOLUME

Any pages submitted beyond the 15-page limit within the Technical Volume (Volume 2) will not be evaluated**.** If including a letter(s) of support and/or TABA request, it must be included as part of Volume 5 and will not count towards the 15-page Technical Volume (Volume 2) limit. Any technical data/information that should be in the Technical Volume (Volume 2) but is contained in other Volumes will not be considered.

MDA's objective for the Phase I effort is to determine the merit and technical feasibility of the concept. The contract period of performance for Phase I shall be six (6) months and the award shall not exceed $150,000. A list of topics currently eligible for proposal submission is included in these instructions, followed by full topic descriptions. These are the only topics for which proposals will be accepted at this time.

Phase I Proposal

A complete Phase I proposal consists of six volumes:

- Volume 1 (required): Proposal Cover Sheet *(does not count towards 15-page limit)*
- Volume 2 (required): Technical Volume (maximum of 15 pages)
- Volume 3 (required): Cost Volume *(does not count towards 15-page limit)*
- Volume 4 (required): Company Commercialization Report *(does not count towards 15-page limit)*
- Volume 5: Supporting Documents-
    - Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment (required),
    - Foreign Ownership or Control Disclosure (Proposers must review Attachment 2 in the DoD STTR 21.B BAA: Foreign Ownership or Control Disclosure to determine applicability). A proposal that has an answer of "Yes" to any question regarding foreign investment disclosure

in the Firm Certifications section of Volume 1 (Proposal Cover Sheet) must include as part of their submission a Foreign Disclosure Addendum,
    - Written Agreement of Allocation of Rights in Intellectual Property and Rights to Carry Out Follow-on Research, Develoment, or Commercialization (using the "Funding Agreement Certification" option) (required).
    - Letters of Supports (optional),
    - TABA (optional).
- Volume 6 (required): Fraud, Waste, and Abuse Training Certification

Volume 5 – Supporting Documents

MDA will only accept the following five documents as part of Volume 5:

1. Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment (Required).
2. Foreign Ownership or Control Disclosure (Proposers must review Attachment 2 in the DoD SBIR 21.B BAA: Foreign Ownership or Control Disclosure to determine applicability).
3. Written Agreement of Allocation of Rights in Intellectual Property and Rights to Carry Out Follow-on Research, Develoment, or Commercialization (if applicable). The agreement should be uploaded using the "Funding Agreement Certification" option. A model agreement is available here: https://rt.cto.mil/wp-content/uploads/STTR-Model-Agreement-for-the-Allocation-of-Rights.pdf
4. Letters of support (optional).
5. Request for TABA using the MDA Phase I TABA form (optional).

If including a request for TABA, the MDA Phase I TABA Form MUST be completed and uploaded using the "Other" category within Volume 5 of DSIP.

If including letters of support, they MUST be uploaded using the "Letters of Support" category within Volume 5 of DSIP. A qualified letter of support is from a relevant commercial or Government Agency procuring organization(s) working with MDA, articulating their pull for the technology (i.e., what MDS need(s) the technology supports and why it is important to fund it), and possible commitment to provide additional funding and/or insert the technology in their acquisition/sustainment program. Letters of support shall not be contingent upon award of a subcontract.

Any documentation other than the prohibited Video Surveillance and Telecommunications Services and Equipment form, Foreign Ownership or Control Disclosure, Allocation of Rights agreement, letter(s) of support, or requests for TABA included as part of Volume 5 WILL NOT be considered.

References to Hardware, Computer Software, or Technical Data

In accordance with the SBIR/STTR Policy Directive, SBIR/STTR contracts are to conduct feasibility-related experimental or theoretical R/R&D related to described agency requirements. The purpose for Phase I is to determine the scientific and technical merit and feasibility of the proposed effort.

It is not intended for any formal end-item contract delivery and ownership by the Government of your hardware, computer software, or technical data. As a result, your technical proposal should not contain any reference to the term "Deliverables" when referring to your hardware, computer software, or technical data. Instead use the term: "Products for Government Testing, Evaluation, Demonstration, and/or possible destructive testing."

The standard formal deliverables for a Phase I are the:
A001: Report of Invention(s), Contractor, and/or Subcontractor(s) // Patent Application for Invention
A002: Status Report // Phase I Bi-monthly Status Report

A003: Contract Summary Report // Phase I Final Report
A004: Certification of Compliance // STTR Funding Agreement Certification - Life Cycle Certification
A005: Computer Software Product // Product Description
A006: Technical Report - Study Services // Prototype Design and Operation Document

52.203-5 Covenant Against Contingent Fees
As prescribed in FAR 3.404, the following FAR 52.203-5 clause shall be included in all contracts awarded under this Broad Agency Announcement (BAA):

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

XIII. PHASE I PROPOSAL SUBMISSION CHECKLIST

____1. The following have been submitted electronically through DSIP by the date and time listed on the first page of the DoD Program BAA.

- ✓ Volume 1: DoD Proposal Cover Sheet
- ✓ Volume 2: Technical Volume (DOES NOT EXCEED 15 PAGES)**: Any pages submitted beyond this will not be evaluated. Your Proposal Cover Sheet, Cost Volume, and Company Commercialization Report DO NOT count toward your maximum page limit.**

  If proposing to use foreign nationals (also known as foreign persons), green card holders, and/or dual citizens; identify the personnel you expect to be involved on this project, the type of visa or work permit under which they are performing, country of origin and level of involvement.
- ✓ Volume 3: Cost Volume. **(Online Cost Volume form is REQUIRED by MDA)**

- ✓ Volume 4: Company Commercialization Report. (required even if your firm has no prior SBIR/STTR awards).

- ✓ Volume 5: Contractor Certification Regarding Provision of Prohibited Video Surveillance and Telecommunications Services and Equipment (required), Foreign Ownership or Control Disclosure, Written Agreement of Allocation of Rights in Intellectual Property and Rights to Carry Out Follow-on Research, Develoment, or Commercialization (required), Letters of Supports (optional), and/or TABA (optional).

- ✓ Volume 6 (required): Fraud, Waste, and Abuse Training Certification.

____2. Phase I proposal is not to exceed $150,000. (or not to exceed $155,000 if TABA is included)

____3. The proposal must be formally submitted on DSIP. Proposals that are not submitted will not be evaluated.

XIV. MDA SECURITY REVIEW OF ABSTRACTS, BENEFITS, AND KEYWORDS

Proposal titles, abstracts, anticipated benefits, and keywords of proposals that are selected for contract award will undergo an MDA Policy and Security Review. Proposal titles, abstracts, anticipated benefits, and keywords are subject to revision and/or redaction by MDA. Final approved versions of proposal titles, abstracts, anticipated benefits, and keywords may appear on DSIP and/or the SBA's SBIR/STTR award site (https://www.sbir.gov/sbirsearch/award/all).

XV. MDA PROPOSAL EVALUATIONS

MDA will evaluate and select Phase I and Phase II proposals using scientific review criteria based upon technical merit and other criteria as discussed in this announcement document. MDA reserves the right to award none, one, or more than one contract under any topic. MDA is not responsible for any money expended by the offeror before award of any contract. Due to limited funding, MDA reserves the right to limit awards under any topic and only proposals considered to be of superior quality as determined by MDA will be funded.

Phase I proposals will be evaluated based on the criteria outlined below, including potential benefit to the MDS. Selections will be based on best value to the Government considering the following factors which are listed in descending order of importance:

a) The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.
b) The qualifications of the proposed principal/key investigators, supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.
c) The potential for commercial (Government or private sector) application and the benefits expected to accrue from this commercialization.

Please note that potential benefit to the MDS will be considered throughout all the evaluation criteria and in the best value trade-off analysis. When combined, the stated evaluation criteria are significantly more important than cost or price.

It cannot be assumed that reviewers are acquainted with the firm or key individuals or any referenced experiments. Technical reviewers will base their conclusions only on information contained in the proposal. Relevant supporting data such as journal articles, literature, including Government publications, etc., should be listed in the proposal and will count toward the applicable page limit.

Phase II Proposal Submission

Per DoD STTR Phase II Proposal guidance, all Phase I awardees from the 21.B Phase I announcement will be permitted to submit a Phase II proposal for evaluation and potential award selection. Details on the due date, format, content, and submission requirements of the Phase II proposal will be provided by the MDA SBIR/STTR PMO on/around the fourth month of the Phase I period of performance. Only firms who receive a Phase I award resulting from the 21.B announcement may submit a Phase II proposal.
MDA will evaluate and select Phase II proposals using the Phase II evaluation criteria listed in the DoD Program Announcement. While funding must be based upon the results of work performed under a Phase I award and the scientific and technical merit, feasibility and commercial potential of the Phase II proposal; Phase I final reports will not be reviewed as part of the Phase II evaluation process. The Phase II proposal should include a concise summary of the Phase I effort including the specific technical problem or opportunity addressed and its importance, the objective of the Phase I effort, the type of research conducted, findings or results of this research, and technical feasibility of the proposed technology. Due to limited funding, MDA reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded.

All Phase II awardees must have a Defense Contract Audit Agency (DCAA) approved accounting system. It is strongly urged that an approved accounting system be in place prior to the MDA Phase II award timeframe. If you do not have a DCAA approved accounting system, this will delay/prevent Phase II contract award. Please visit https://www.dcaa.mil/Customers/Small-Business for more information on obtaining a DCAA approved accounting system.

Approved for Public Release
21-MDA-10735 (12 Mar 21)

MDA 21.B STTR PHASE I TOPIC INDEX

MDA21-T001 TITLE: Methodologies to Develop Radiation Testing Environments for Survivable Microelectronics

RT&L FOCUS AREA(S): Microelectronics

TECHNOLOGY AREA(S): Sensors; Electronics; Space Platform

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 section 3.5 of 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 methodologies to evaluate and distinguish between radiation effects from a persistent beta and gamma environment, and determine the circumstances where testing for one environment is sufficient to show survivability in the other, or in a combined environment.

DESCRIPTION: This topic seeks innovative, cost effective, solutions for radiation testing of microelectronics. The need for testing of microelectronics in a persistent beta environment vs. a persistent gamma environment is a subject of discussion and debate within the radiation survivability community. Aspects of the discussion include the best way to generate a persistent beta environment in a ground test, the best way to generate a persistent gamma environment in a ground test, whether successful testing in one environment is sufficient to show survivability in the other, and whether combined testing in both persistent beta and gamma environments is required or whether broader combined testing involving the full environment is necessary.

PHASE I: In Phase I, show feasibility of a methodology to develop test environments that will demonstrate survivability using partial vs. combined environments. Select representative electronic parts and show survivability results, either using an analytical approach or leveraging existing test data. Consider whether existing methods of generating gamma and beta environments can be used, or whether innovative approaches are needed.

PHASE II: In Phase II, implement the Phase I results in a prototype test design. Demonstrate the methodology by conducting an experimental study where electronic parts are tested in partial and combined environments. Consider whether existing methods of generating gamma and beta environments can be used, or whether innovative approaches are needed.

PHASE III DUAL USE APPLICATIONS: The offeror should evaluate whether these approaches can be used for commercial space applications where radiation survivability is required, in addition to military system requirements.

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KEYWORDS: Electronics Testing, Radiation Survivability, Rad-Hard, gamma and beta environments

MDA21-T002 TITLE: Cyber Secure Collaboration

RT&L FOCUS AREA(S): Artificial Intelligence/ Machine Learning; Cybersecurity

TECHNOLOGY AREA(S): Information Systems

OBJECTIVE: Create a secure environment for collaboration between small businesses and government personnel and provide a central location for SBIR/STTR knowledge management.

DESCRIPTION: Industry and the government require access to collaborative data repositories that are tightly controlled with cyber secure protocols, Risk Management Framework (RMF) compliance, and role-based access controls, resulting in the warrant and implementation of DFARS Clause 252.204-7012, Safeguarding Covered Defense Information and Cyber Incident Reporting. This regulation can be costly to small businesses with limited resources, hindering their ability to exchange innovative ideas and research with government entities. Another challenge that faces most small business employees is not being able to send encrypted emails due to the lack of a Common Access Card (CAC) or the required certificates, making secure collaboration difficult. Current processes for collaboration are not only an issue for small businesses lacking the necessary tools for security, but also encourages the unnecessary duplication of data. The Contract Data Requirements List (CDRL) list several directorates to submit SBIR/STTR related deliverables, resulting in the accumulation of costs for storage. The CDRLs also contain a number of deadlines that companies involved in the SBIR/STTR effort must keep track of. This topic seeks solutions for a collaborative repository that:

(1) Leverages Artificial Intelligence/Machine Learning (AI/ML) techniques to ensure security.
(2) Provides enough flexibility to seamlessly integrate plug-ins and supplemental tools.
(3) Employs two-factor authentication methods that do not restrict small businesses to the use of a CAC and username/complex password combination.
(4) Encrypts communication while also preserving the integrity and non-repudiation of the message.
(5) Implements the Least Privilege principle.
(6) Monitors and audits user activity and data movement.
(7) Provides authorized users with reminders of upcoming deadlines as established in the CDRLs.

PHASE I: Provide proof of concept for the technology.

PHASE II: Further develop proof of concept and begin adding technical requirements (1) – (7) (refer to Description).

PHASE III DUAL USE APPLICATIONS: Implement collaborative environment within relevant missile defense elements.

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KEYWORDS: Cybersecurity, Collaboration, Information Management, Task Management, Machine Learning

MDA21-T003 TITLE: Validation of Data Driven Models for Simulation

RT&L FOCUS AREA(S): Artificial Intelligence/ Machine Learning; Cybersecurity

TECHNOLOGY AREA(S): Information Systems

OBJECTIVE: Develop methodologies for validating models of phenomenon and processes generated by advanced data fitting methods, such as machine learning techniques.

DESCRIPTION: This topic seeks innovative methods for validating data fitted models. Use of collected input and output data from phenomenon/process to generate a data-fitted model has increased with the advent of new techniques in Artificial Intelligence/Machine Learning (AI/ML). AI/ML techniques have made it much easier to create data-fitted models of very complex systems with unknown complex relationships. The standard method for validating data generated models is to withhold a portion (e.g. 20%) of the collected data from the fitting process in order to have an independent validation sample. When data is expensive and/or hard to collect, the bifurcation of the data both limits the available data to fit and to validate the models, therefore limiting the quality of both. The government is in search of methods to mitigate this conundrum. Possibilities include, but are not limited to, use of partial knowledge of the modeled systems (e.g. first order physics models, process flows, etc.), guided sampling/data collection for initial and validation data, cross comparisons of models generated from data-subsets, etc.

PHASE I: Provide the following:
1. Method concept descriptions (one or more).
2. Application architecture description, including data management concepts.
3. Proof-of-concept demonstration.
4. Phase II plan, including cyber security approval steps.

PHASE II: Complete a detailed prototype design incorporating government performance requirements.

PHASE III DUAL USE APPLICATIONS: Develop solution from Phase II into a mature, field-able capability. Work with missile defense integrators to integrate the technology for a missile defense system level test-bed and test in a relevant environment.

REFERENCES:

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KEYWORDS: Validation, Verification, Training, Machine Learning, Models, Processes, Phenomenon, Analysis, Confidence

MDA21-T004 TITLE: Alternatives to Mercury Cadmium Telluride for High-Performance Long-wave Infrared Focal Plane Arrays

RT&L FOCUS AREA(S): Microelectronics

TECHNOLOGY AREA(S): Materials; Sensors; Electronics

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OBJECTIVE: Conduct applied research and development of innovative long-wave infrared (LWIR) focal plane arrays (FPAs) in order to approach the state-of-the-art performance of mercury cadmium telluride (MCT).

DESCRIPTION: The government seeks to identify and further develop alternatives to MCT for high-performance LWIR FPAs. MCT provides an excellent solution for missile defense applications but it can also be a difficult material to produce, integrate, and maintain (which increases system cost and complexity). For decades, researchers have been working on alternatives to MCT and have made great progress, particularly with superlattice detectors based on III-V material system. Superlattice detectors are easier to use than MCT and, in theory, should also have lower dark current and similar quantum efficiency (QE) when operated at the same cryogenic temperature. However, more work is needed in order to routinely realize all of these benefits for LWIR. In addition to superlattice detectors, there are potentially other detector architectures and other material systems that could, in the future, be viable alternatives to both MCT and superlattice detectors for missile defense applications. Proposed solutions do not need to outperform MCT but should at least have a combination of beneficial properties that would allow it to outcompete MCT in the marketplace for high-performance LWIR FPAs.

This topic seeks to invest primarily in LWIR FPA materials, detector design, and growth techniques in order to help close the gap between the performance of MCT and its alternatives. Examples of responsive solutions include innovative superlattice detector designs that enhance QE, suppress dark current, and/or tolerate defects or impurities. Other examples include growth techniques to minimize defects and impurities, or produce features that contribute towards improved performance. Examples also include applied research into new material systems and detector architectures that might outcompete both MCT and superlattice technology. Proposals related to the substrate (e.g. surface preparation), reagents (e.g. purification), growth equipment (e.g. improvements to the MBE (molecular-beam epitaxy) or MOCVD (metal organic chemical vapor deposition) equipment), finishing (e.g. pixel delineation, passivation, coatings), and integration (e.g. with a readout integrated circuit (ROIC)) are allowed but must account for less than half of the total funding and must directly support topic goals. Proposals related to other components of the sensor (e.g. ROIC, optics, image processor, image stabilization) will be considered non-responsive even if the intent is to relax the performance requirements for the LWIR detector (thereby making lower-performing alternatives more acceptable). Currently, we believe that thermal (instead of photon) detectors, as defined in chapter 3 of reference 1, are not sensitive or responsive enough for the intended applications. Therefore, proposals related to thermal detectors would likely be considered non-responsive.

The LWIR detector should be sufficiently sensitive and responsive to detect dim fast-moving missile threats at ranges of 100s-1000s of kilometers using narrow field-of-view optics hosted on a dynamic platform. Solutions should be able to approach a QE of 80% anywhere within the 8-12 micrometer waveband and should approach Rule 07 dark current at 77K, or have some other combination of parameters that provides equivalent sensitivity for short (e.g. milliseconds) integration times. The objective FPAs should be 1024x1024 or larger with a 20 micrometer pixel pitch. Integrated FPAs must withstand both a bake-out and a rapid cool-down from room-temperature to cryogenic operating temperatures (e.g. 77K). FPAs might be exposed to natural and manmade radiation during operation. The ability to detect multiple wavebands from a single FPA (e.g. "2-color") is desirable but not crucial. These are notional specifications that may be negotiated during Phase I.

Proposers are highly encouraged to either have an in-house capability to produce test articles or form a major partnership with someone who does. The Research Institute (RI) partner should be a key member of the research team and a source of many of the innovative ideas, rather than a service provider.
Reference 1 provides the basis for definitions used in this topic. The remaining references either describe the state-of-the-art for LWIR detectors or provide examples of innovative approaches for improving the performance of MCT alternatives. They should not be misconstrued as describing a preferred approach, organization, or technology, or describing the boundaries within which proposed solutions must fall.

PHASE I: Study the scientific and technical feasibility of the proposed approach. Model the expected performance of the proposed solution and compare it to MCT and other emerging alternatives. Identify the disadvantages of the proposed solution and describe how these disadvantages would be overcome or otherwise acceptable. Show, by analysis, the ability to scale up to multi-element arrays meeting the notional specifications described above. Show, by analysis, that the solution is integrate-able and suitable for the intended applications. If possible, grow and characterize single-element detectors to demonstrate proof-of-concept and validate model predictions. Complete a plan for Phase II and contact suppliers to verify that the plan is executable. Seek letters of interest from LWIR sensor suppliers to include in the Phase II proposal. No travel to government facilities would be necessary during Phase I.

PHASE II: Study and optimize the growth process in order to steadily improve performance and mitigate challenges. Begin scaling up the size of the FPA to demonstrate its performance and uniformity. Grow and characterize small (e.g. 32x32) detector arrays. Upon request, provide detector samples to the government for an independent assessment. Sample sizes, quantities, and configuration for testing will be coordinated with the government. Complete a plan for Phase III and seek letters of commitment from proposed partners. Seek letters of support from LWIR sensor suppliers to include in the Phase III proposal.

PHASE III DUAL USE APPLICATIONS: Grow and characterize moderate-sized (e.g. 256x256) detector arrays. Integrate these arrays with a representative ROIC and Dewar and test performance. Begin early screening tests to verify the ability of the detector to survive and operate in the environments of the intended application. Begin optimizing the growth process to support production and commercialization. Generate plans to scale up the size of the detector to 1024x1024 or larger. Obtain letters of commitment from LWIR sensor suppliers to start transitioning the technology into a product line.

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KEYWORDS: LWIR, Longwave, Long-wave, Infrared, FPA, Detector, Superlattice, Super-lattice, III-V, MCT, HgCdTe, Molecular Beam Epitaxy, MBE, Metal Organic Chemical Vapor Deposition, MOCVD

MDA21-T005 TITLE: Geometry Based Thermal Management Solutions for Propulsion

RT&L FOCUS AREA(S): Hypersonics; Space

TECHNOLOGY AREA(S): Space Platform; Weapons

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OBJECTIVE: Develop novel geometry based solutions to thermal management for future interceptor propulsion systems.

DESCRIPTION: Thermal paths for heat from rocket motors are one of the greatest considerations in propulsion system design. Thermal design for components, such as the nozzles, pintles, and motor cases drives the capability of rocket motors. Considerable amounts of insulation are necessary to shield temperature sensitive components, such as electronics and lightweight structures. Newly available manufacturing techniques can enable thermal management designs, such as tortuous paths, that were previously impossible to manufacture. This could enable significant savings in mass and volume, or enable use of higher performing hotter burning propellants. Ultimately, these benefits would manifest as greater reach and containment area for future interceptors. The thermal management design must apply to systems with pressures over 3,000 psi and propellant burn temperatures over 4,000 degrees F.
The proposer will be expected to identify specific thermal management techniques, geometry type, materials, and components for development. The proposer may select one of a number of different propulsion components for development, such as pintle, nozzle, motor case, etc.

PHASE I: During Phase I, the contractor can develop models and perform simulations to evaluate feasibility and/or down select designs. Coupon fabrication and/or material formulation can be done to provide evaluation of critical properties. The contractor is expected to become familiar with solid propulsion system environments.

PHASE II: During Phase II, prototype(s) should be developed in order to validate Phase I models/simulations. The prototype designs can be updated and optimized through experimentation and enhance process/manufacturing techniques. Phase II work should lead the contractor to identify potential applications and insertion into a missile system.

PHASE III DUAL USE APPLICATIONS: During Phase III, the contractor will work with a solid propulsion system manufacturer/developer to iteratively design and fabricate prototype thermal management system/techniques for high-fidelity testing in a relevant missile defense environment. The contractor would then provide the necessary technical data to transition the technology into a missile defense application.

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KEYWORDS: Thermal Management, Solid Propulsion, Propulsion Components, Solid Component Geometries, Additive Manufacturing