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

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 Small Business Innovation Research (SBIR)/STTR Program Management Office (PMO), located within the Innovation, Science, & Technology (DV) directorate.

Offerors responding to a topic in this Broad Agency Announcement (BAA) must follow all general instructions provided in the Department of Defense (DoD) STTR Program BAA. MDA requirements in addition to or deviating from the DoD Program BAA are provided in the instructions below.

Specific questions pertaining to the administration of the MDA STTR Program and these proposal preparation instructions should be directed to:

Missile Defense Agency
SBIR/STTR Program Management Office
MDA/DVR
Bldg. 5224, Martin Road
Redstone Arsenal, AL 35898
Email: sbirsttr@mda.mil

Your proposal must conform to the terms of this announcement. MDA reserves the right not to consider any or all non-conforming proposals. 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). Only United States small businesses and certain individuals are eligible to participate in the SBIR/STTR programs. A small business must meet the eligibility requirements set forth in 13 CFR 121.702. Please see the Small Business Administration (SBA) SBIR/STTR website: https://www.sbir.gov/about#eligibility

Please read the entire DoD Announcement and MDA instructions carefully prior to submitting your proposal. Please go to https://www.sbir.gov/about#policy-directive to read the SBIR/STTR Policy Directive issued by the Small Business Administration.

PHASE I PROPOSAL GUIDELINES

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

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 may not be considered.

MDA's objective for Phase I is to determine the merit and technical feasibility of the concept. The contract period of performance for Phase I is six months.

Proposal Cover Sheet (Volume 1)
On DSIP at https://www.dodsbirsttr.mil/submissions, prepare the Proposal Cover Sheet.

Technical Volume (Volume 2)
The technical volume is not to exceed 15 pages and must follow the formatting requirements provided in the DoD STTR Program BAA. Any pages submitted beyond the 15-page limit will not be evaluated.

Content of the Technical Volume
For technical volume format guidance, please refer to the "Format of Technical Volume" section within the DoD STTR 24.B BAA

If including a letter(s) of support and/or Technical and Business Assistance (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.

Cost Volume (Volume 3)
The Phase I Base amount must not exceed $150,000 or not to exceed $155,000 if TABA is included. MDA does not utilize the Phase I Option. MDA will not accept any deviation to the percentage of work requirements.

Company Commercialization Report (CCR) (Volume 4)
Completion of the CCR as Volume 4 of the proposal submission in DSIP is required. Please refer to the DoD STTR Program BAA for full details on this requirement. Information contained in the CCR will not be considered by MDA during proposal evaluations.

Supporting Documents (Volume 5)
All proposing small business concerns are REQUIRED to submit the following documents to Volume 5:

1. Contractor Certification Regarding Provision of Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment
2. Disclosures of Foreign Affiliations or Relationships to Foreign Countries =
3. Request for TABA using the MDA Phase I TABA form (optional).
4. Letters of support (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 required documents listed in the DoD STTR 24.B BAA and letter(s) of support included as part of Volume 5 WILL NOT be considered.

PHASE II PROPOSAL GUIDELINES

Phase II proposals may only be submitted by Phase I awardees. Details on the due date, format, content, and submission requirements of the Phase II proposal will be provided by the MDA SBIR/STTR Program Management Office during the fourth month of the Phase I period of performance.

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.

DISCRETIONARY TECHNICAL AND BUSINESS ASSISTANCE (TABA)

The SBIR/STTR Policy Directive allows agencies to enter into agreements with suppliers to provide technical assistance to SBIR and 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 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.

A 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.

EVALUATION AND SELECTION

All proposals will be evaluated in accordance with the evaluation criteria listed in the DoD STTR Program BAA. Selections will be based on best value to the Government considering the evaluation criteria listed in the DoD STTR Program BAA which are listed in descending order of importance.

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.

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.

AWARD AND CONTRACT INFORMATION

The MDA SBIR/STTR Program Management Office will distribute selection and non-selection email notices to all firms who submit an MDA STTR proposal. Proposing firms will be notified of selection or non-selection status for a Phase I award within 90 days of the closing date of the BAA. The email will be distributed to the "Corporate Official" and "Principal Investigator" listed on the proposal coversheet and will originate from the sbirsttr@mda.mil email address. MDA cannot be responsible for notification to a company that provides incorrect information or changes such information after proposal submission.

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. Refer to the DoD STTR Program BAA for procedures to protest the announcement.

As further prescribed in Federal Acquisition Regulation (FAR) 33.106(b), and in accordance with FAR clause 52.233-3 Protest after Award, any protests after award should be submitted to Candace Wright via email: sbirsttr@mda.mil.

The MDA will issue all contract awards. The cognizant Government Contracting Officer is the only Government official authorized to enter into any binding agreement or contract on behalf of the Government.

Offeror Small Business Eligibility Requirements

Each offeror must qualify as a small business at time of award per the SBA's 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 registered with Supplier Performance Risk System https://www.sprs.csd.disa.mil/ prior to award.

Ownership Eligibility

Prior to award, MDA may request business/corporate documentation to assess ownership eligibility as related to the requirements of SBIR/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.

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 SBIR/STTR Program BAA.

References to Hardware, Computer Software, or Technical Data

In accordance with the SBIR/STTR Policy Directive, the work within the SBIR/STTR contracts are to conduct feasibility-related experimental or theoretical Research/Research and Development (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.

A Phase I is not intended for any formal end-item contract delivery nor ownership by the Government of your hardware, computer software, or rights in your 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 (if applicable) 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

FAR 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 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.

ADDITIONAL INFORMATION

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

Only Government personnel with active non-disclosure agreements will evaluate proposals. Non-Government technical support contractors and FFRDCs (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 consultants 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.

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 Identification number to be used for submissions at any of the 11 participating agencies in the SBIR or STTR program. For more information, please visit the SBA's Firm Registration Page: http://www.sbir.gov/registration.

Organization Conflicts of Interest (OCI)

The general OCI rules for Contractors that support development and oversight of STTR topics are

covered in FAR 9.505-1 through FAR 9.505-4 and DFARS 209.505 through DFARS 209.571-8 as the means of avoiding, neutralizing, or mitigating organizational conflicts of interest.

All applicable rules under the FAR Section FAR 9.5 and DFARS 209.5 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.

In addition, FAR 3.101-1 states that Government business shall be conducted in a manner above reproach and, except as authorized by statute or regulation, with complete impartiality and with preferential treatment for none. The general rule is to avoid strictly any conflict of interest or even the appearance of a conflict of interest in Government-contractor relationships. An appearance of impropriety may arise where an offeror may have gained an unfair competitive advantage through its hiring of, or association with, a former Government official if there are facts indicating the former Government official, through their former Government employment, had access to non-public, competitively useful information. (See *Health Net Fed. Svcs*, B-401652.3; *Obsidian Solutions Group*, LLC, B-417134, 417134.2). The existence of an unfair competitive advantage may result in an offeror being disqualified and this restriction cannot be waived.

It is MDA policy to ensure all appropriate measures are taken to resolve OCI's arising under FAR 9.5 and unfair competitive advantages arising under FAR 3.101-1 to prevent the existence of conflicting roles that might bias a contractor's judgment and deprive MDA of objective advice or assistance, and to prevent contractors from gaining an unfair competitive advantage.

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 un-cleared 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.

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 https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear.

All MDA STTR topics are subject to ITAR and/or EAR. Your company will be required to submit a Technology Control Plan (TCP) during the contracting negotiation process.

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) (see Attachment), DFARS 252.204-7000 (Disclosure of Information), DFARS clause 252.204-7012 (Safeguarding Covered Defense Information and Cyber Incident Reporting), DFARS clause 252.204-7020 (NIST SP 800-171 DoD Assessment Requirements), MDA clause H-09 (Organizational Conflict of Interest) (see Attachment), MDA clause H-27 (Foreign Persons) (see Attachment), and MDA clause H-28 (Distribution of Control Technical Data) (see Attachment). 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. All proposed universities will need to provide written acceptance of the Flow-Down Clauses in both SBIR and STTR proposals.

MDA Clause H-08 Public Release of Information (Publication Approval)

MDA 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 all MDA STTR contracts must be submitted to the Procuring Contracting Officer (PCO) for review and approval prior to its release to the public. This mandatory clause also includes subcontractors, who shall provide their submission through the prime contractor for MDA's approval for release.

a. In addition to the requirements of National Industrial Security Program Operations Manual (DoD 5220.22-M), all foreign and domestic contractor(s) and its subcontractors are required to comply with the following:

> 1) Any official MDA information/materials that a contractor/subcontractor intends to release to the public that pertains to any work under performance of this contract, the MDA will perform a prepublication review prior to authorizing any release of information/materials.
>
> 2) At a minimum, these information/materials may be technical papers, presentations, articles for publication, key messages, talking points, speeches, and social media or digital media, such as press releases, photographs, fact sheets, advertising, posters, videos, etc.

b. Subcontractor public information/materials must be submitted for approval through the prime contractor to MDA.

c. Upon request to the MDA PCO, contractors shall be provided the "Request for Industry Media Engagement" form (or any superseding MDA form).

d. At least 45 calendar days prior to the desired release date, the contractor must submit the required form and information/materials to be reviewed for public release to MDAPressOperations@mda.mil, and simultaneously provide courtesy copy to the appropriate PCO.

e. All information/materials submitted for MDA review must be an exact copy of the intended item(s) to be released, must be of high quality and are free of tracked changes and/or comments. Photographs must have captions, and videos must have the intended narration included. All items must be marked with the applicable month, day, and year.

f. No documents or media shall be publically released by the Contractor without MDA Public Release approval.

g. Once information has been cleared for public release, it resides in the public domain and must always be used in its originally cleared context and format. Information previously cleared for public release but containing new, modified or further developed information must be re-submitted

Rights in Noncommercial Technical Data and Computer Software – SBIR/STTR Program (DFARs 252.227-7018)
Use this link for full description of Data Rights:
https://www.acq.osd.mil/dpap/policy/policyvault/USA001352-23-DPC.pdf

Fraud, Waste, and Abuse
All offerors must complete the fraud, waste, and abuse training (Volume 6) that is located on 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.

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: DoDSBIRSupport@reisystems.com.

It is recommended that potential offerors email topic authors to schedule a time for topic discussion during the pre-release period.

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 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).

Attachment – Standard MDA Mandatory Flowdown Local Clauses

H-08 PUBLIC RELEASE OF INFORMATION (MAR 2020)

a. In addition to the requirements of National Industrial Security Program Operations Manual (DoD 5220.22-M), all foreign and domestic contractor(s) and its subcontractors are required to comply with the following:

1) Any official MDA information/materials that a contractor/subcontractor intends to release to the public that pertains to any work under performance of this contract, the Missile Defense Agency (MDA) will perform a pre-publication review prior to authorizing any release of information/materials.

2) At a minimum, these information/materials may be technical papers, presentations, articles for publication, key messages, talking points, speeches, and social media or digital media, such as press releases, photographs, fact sheets, advertising, posters, videos, etc.

b. Subcontractor public information/materials must be submitted for approval through the prime contractor to MDA.

c. Upon request to the MDA Procuring Contracting Officer (PCO), contractors shall be provided the "Request for Industry Media Engagement" form (or any superseding MDA form).

d. At least 45 calendar days prior to the desired release date, the contractor must submit the required form and information/materials to be reviewed for public release to MDAPressOperations@mda.mil, and simultaneously provide courtesy copy to the appropriate PCO. (Additional distribution emails can be added by the Program Office to ensure proper internal coordination and tracking of PR requests.)

e. All information/materials submitted for MDA review must be an exact copy of the intended item(s) to be released, must be of high quality and are free of tracked changes and/or comments. Photographs must have captions, and videos must have the intended narration included. All items must be marked with the applicable month, day, and year.

f. No documents or media shall be publically released by the Contractor without MDA Public Release approval.

g. Once information has been cleared for public release, it resides in the public domain and must always be used in its originally cleared context and format. Information previously cleared for public release but containing new, modified or further developed information must be re-submitted.

H-09 ORGANIZATIONAL CONFLICT OF INTEREST (Apr 2020)

a. Purpose: The purpose of this clause is to ensure that:

(1) the Contractor is rendering impartial assistance and advice to the Government at all times under this contract and related Government contracts;

(2) the Contractor's objectivity in performing work under this contract or related Government contracts is not impaired; and

(3) the Contractor does not obtain an unfair competitive advantage by virtue of its access to non-public Government information, or by virtue of its access to proprietary information belonging to others.

b. Scope: The Organizational Conflict of Interest (OCI) rules, procedures and responsibilities described in FAR 9.5 "Organizational and Consultant Conflicts of Interest", FAR 3.101-1 "Standards of Conduct – General, DFARS 209.5 "Organizational and Consultant Conflicts of Interest," and in this clause are applicable to the prime Contractor (including any affiliates and successors-in-interest), as well as any co-sponsor, joint-venture partner, consultant, subcontractor or other entity participating in the performance of this contract. The Contractor shall flow this clause down to all subcontracts, consulting agreements, teaming agreements, or other such arrangements which have OCI concerns, while modifying the terms "contract", "Contractor", and "Contracting Officer" as appropriate to preserve the Government's rights.

c. Access to and Use of Nonpublic Information: If in performance of this contract the contractor obtains access to nonpublic information such as plans, policies, reports, studies, financial plans, or data which has not been released or otherwise made available to the public, the Contractor agrees it shall not use such information for any private purpose or release such information without prior written approval from the Contracting Officer.

d. Access to and Protection of Proprietary Information: The Contractor agrees to exercise due diligence to protect proprietary information from misuse or unauthorized disclosure in accordance with FAR 9.505-4. The Contractor may be requested to enter into a written non-disclosure agreement with a third party asserting proprietary restrictions, if required in the performance of the contract.

e. In accordance with FAR 3.101-1, the Contractor shall also take all appropriate measures to prevent the existence of conflicting roles that might bias the Contractor's judgement, give the Contractor an unfair competitive advantage, and deprive MDA of objective advice or assistance that can result from hiring former Government employees. (See Health Net Fed. Svcs, B-401652.3).

f. Restrictions on Participating in Other Government Contract Efforts.

g. OCI Disclosures: The Contractor shall disclose to the Contracting Officer all facts relevant to the existence of an actual or potential OCI, using an OCI Analysis/Disclosure Form which the Contracting Officer will provide upon request. This disclosure shall include a description of the action the Contractor has taken or plans to take to avoid, neutralize or mitigate the OCI.

h. Remedies and Waiver:

(1) If the contractor fails to comply with any requirements of FAR 9.5, FAR 3.101-1, DFARS 209.5, or this clause, the Government may terminate this contract for default, disqualify the Contractor from subsequent related contractual efforts if necessary to neutralize a resulting organizational conflict of interest, and/or pursue other remedies permitted by law or this contract. If the Contractor discovers and

promptly reports an actual or potential OCI subsequent to contract award, the Contracting Officer may terminate this contract for convenience if such termination is deemed to be in the best interest of the Government, or take other appropriate actions.

(2) The parties recognize that the requirements of this clause may continue to impact the contractor after contract performance is completed, and that it is impossible to foresee all future impacts. Accordingly, the Contractor may at any time seek an OCI waiver from the Director, MDA by submitting a written waiver request to the Contracting Officer. Any such request shall include a full description of the OCI and detailed rationale for the OCI waiver.

H-27 FOREIGN PERSONS (Jun 2010)

1. "Foreign National" (also known as Foreign Persons) as used in this clause means any person who is NOT:

a. a citizen or national of the United States; or

b. a lawful permanent resident; or

c. a protected individual as defined by 8 U.S.C.1324b(a)(3).

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

"Protected individual" is an alien who is lawfully admitted for permanent residence, is granted the status of an alien lawfully admitted for temporary residence under 8 U.S.C.1160(a) or 8 U.S.C.1255a(a)(1), is admitted as a refugee under 8 U.S.C.1157, or is granted asylum under 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."

2. Prior to contract award, the contractor shall identify any lawful U.S. permanent residents and foreign nationals expected to be involved on this project as a direct employee, subcontractor or consultant. For these individuals, in addition to resumes, 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 contract. Supplemental information provided in response to this clause will be protected in accordance with Privacy Act (5 U.S.C. 552a), if applicable, and the Freedom of Information Act (5 U.S.C. 552(b)(6)). After award of the contract, the Contractor shall promptly notify the Contracting Officer and Contracting Officer's Representative with the information above prior to making any personnel changes involving foreign persons. No changes involving foreign persons will be allowed without prior approval from the Contracting Officer. This clause does not remove any liability from the contractor to comply with applicable ITAR and EAR export control obligations and restrictions. This clause shall be included in any subcontract."

H-28 DISTRIBUTION CONTROL OF TECHNICAL INFORMATION (AUG 2014)

a. The following terms applicable to this clause are defined as follows:

1. DoD Official. Serves in DoD in one of the following positions: Program Director, Deputy Program Director, Program Manager, Deputy Program Manager, Procuring Contracting Officer, Administrative Contracting Officer, or Contracting Officer's Representative.

2. Technical Document. Any recorded information (including software) that conveys scientific and technical information or technical data.

3. Scientific and Technical Information. Communicable knowledge or information resulting from or pertaining to the conduct or management of effort under this contract. (Includes programmatic information).

4. Technical Data. As defined in DFARS 252.227-7013.

b. Except as otherwise set forth in the Contract Data Requirements List (CDRL), DD Form 1423 the distribution of any technical documents prepared under this contract, in any stage of development or completion, is prohibited outside of the contractor and applicable subcontractors under this contract unless authorized by the Contracting Officer in writing. However, distribution of technical data is permissible to DOD officials having a "need to know" in connection with this contract or any other MDA contract provided that the technical data is properly marked according to the terms and conditions of this contract. When there is any doubt as to "need to know" for purposes of this paragraph, the Contracting Officer or the Contracting Officer's Representative will provide direction. Authorization to distribute technical data by the Contracting Officer or the Contracting Officer's Representative does not constitute a warranty of the technical data as it pertains to its accuracy, completeness, or adequacy. The contactor shall distribute this technical data relying on its own corporate best practices and the terms and conditions of this contract. Consequently, the Government assumes no responsibility for the distribution of such technical data nor will the Government have any liability, including third party liability, for such technical data should it be inaccurate, incomplete, improperly marked or otherwise defective. Therefore, such a distribution shall not violate 18 United States Code § 1905.

c. All technical documents prepared under this contract shall be marked with the following distribution statement, warning, and destruction notice identified in sub-paragraphs 1, 2 and 3 below. When it is technically not feasible to use the entire WARNING statement, an abbreviated marking may be used, and a copy of the full statement added to the "Notice To Accompany Release of Export Controlled Data" required by DoD Directive 5230.25.

1. DISTRIBUTION - [PCO, Insert the appropriate distribution statement and complete the statement, if necessary, to include the applicable controlling office.]

2. WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C., App. 2401 et seq), as amended. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25

3. DESTRUCTION NOTICE - For classified documents follow the procedures in DOD 5220.22-M, National Industrial Security Program Operating Manual, February 2006, Incorporating Change 1, March 28, 2013, Chapter 5, Section 7, or DoDM 5200.01-Volume 3, DoD Information Security Program: Protection of Classified Information, Enclosure 3, Section 17. For controlled unclassified information

follow the procedures in DoDM 5200.01-Volume 4, Information Security Program: Controlled Unclassified Information.

d. The Contractor shall insert the substance of this clause, including this paragraph, in all subcontracts.

MDA STTR 24.B Topic Index

MDA24B-T001 TITLE: Generative Artificial Intelligence Algorithm Development for Glide Phase Hypersonic Interceptors

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Hypersonics; Emerging Threat Reduction

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

OBJECTIVE: Develop Glide Phase Intercept (GPI) Interceptors Actively Responsive to Artificial Intelligence (AI) Guided Hypersonic Threats.

DESCRIPTION: Adversary use of AI in hypersonic weapons employment & operations will outstrip and negate US hypersonic interceptor capabilities for interception and kill.

PHASE I: Develop strategic approach and commence evaluating feasibility of proposed solutions. As relevant, leverage physics-driven computational models and validate the ability of generative artificial intelligence (GAI) use in models to predict impact points, tracks leading to intercept, or failure to track/intercept a target. Establish the technical basis through small-scale validation and theoretical analysis.

PHASE II: Updated strategic approach developed in Phase I and continue evaluations to assess the feasibility of proposed solutions. Continue maturation and validation of physics-driven computational models. Down select any competing technologies and provide more extensive testing.

PHASE III DUAL USE APPLICATIONS: Develop or transition the technology to pilot-scale strategic approach as developed in Phase II. Evaluate physics based computational models for transition. Prepare documentation for technology transition and training.

REFERENCES:

1. DoD Joint Artificial Intelligence Center (JAIC) https://www.ai.mil/
2. DoD Data, Analysis, and Artificial Intelligence Adoption Strategy 2023 https://media.defense.gov/2023/Nov/02/2003333300/-1/-1/1/DOD_DATA_ANALYTICS_AI_ADOPTION_STRATEGY.PDF

KEYWORDS: Artificial Intelligence; Algorithm; Glide Phase Interceptor; Hypersonic

MDA24B-T002 TITLE: Hypersonic Kill Vehicle Range Extension Research

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

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

OBJECTIVE: Significantly enhance hypersonic vehicle range performance by using in-flight shape, configuration or control surface configuration changes that maximize and adapt to varying flight conditions that optimize the aerodynamics, control or propulsion properties of the vehicle.
Perform basic, first principles research into these concepts that extend the effective intercept range of a hypersonic kill vehicle in basic defensive mission engagements.

DESCRIPTION: Current defensive hypersonic interceptor approaches are limited in battle space range and combat effectiveness by basic factors such as propulsion capability, flight dynamics, lethality methods and concept of operations. Hypersonic aerodynamics are a significant part of range limitations of a kill vehicle to achieve required end-game vehicle maneuverability. Improving aerodynamic performance would permit improving a number of crucial hypersonic weapon system performance parameters simultaneously.

PHASE I: Develop and execute a first-principles research approach in optimal lift-to-drag methods and vehicle control geometries. Also, identify materials for high temperatures and mechanical strain with long term abilities to tolerate hypersonic flight conditions. Consider high bandwidth vehicle control mechanisms and flight control algorithms that optimize and increase flight ranges. Leverage new state-of-the-art research in materials and aerodynamic sciences. Use digital models to achieve insights into potential non-traditional hypersonic flight dynamics. Adopt an innovative approach for evaluating feasibilities of proposed solutions.

PHASE II: Build on and evolve the physics-based and engineering solutions developed in Phase I involving typical hypersonic basics: Lift, Lift-to-drag ratios leading to long range; high agility and maneuverability; high efficiency propulsion concepts and wide flight envelopes; materials tolerating temperature on leading edges and vehicle body.
Continue evaluations to assess the feasibility of proposed approaches. Utilize and validate functional computational models. Down-select technologies and provide concluding approaches for vehicle range extensions.

PHASE III DUAL USE APPLICATIONS: Dual-use applications could be offensive hypersonic weapons for both tactical and strategic use. Materials sciences under considerations could be utilized in space flight and hypersonic civilian airliner development.

REFERENCES:

1. Hypersonic Aerodynamics – VT - https://archive.aoe.vt.edu/mason/Mason_f/ConfigAeroHypersonics.pdf
2. High-enthalpy hypersonic flows – Shang & Yan, 7 Aug 2020 https://aia.springeropen.com/articles/10.1186/s42774-020-00041-y

3. The physical characteristics of hypersonic flows, Urzay, July 2020 https://web.stanford.edu/~jurzay/hypersonicsCh2_Urzay.pdf

KEYWORDS: Hypersonic interceptor; Extend Interceptor Range; Aerodynamic Research; high temperature materials

MDA24B-T003 TITLE: Tailored Refractory Metal Alloys for Additive Manufacturing

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Advanced Infrastructure & Advanced Manufacturing; Advanced Materials

OBJECTIVE: Use computational tools to develop new refractory alloy compositions for use in additive manufacturing of high temperature hypersonic flight components.

DESCRIPTION: This topic seeks the development of novel refractory metal alloy compositions that enhance reliability and additive manufacturability of components for hypersonic flight vehicles. Extreme environmental conditions require structural components of hypersonic flight vehicles such as pintles, nosecones, and control surfaces to exhibit high specific strength and temperature resiliency. This has led to renewed interest in refractory metal alloys (e.g., tungsten, molybdenum), as they can withstand these temperatures and loads. Moreover, additive manufacturing (AM) is of particular focus for such alloys due to the advantages of enabled complex geometries, fewer tooling costs, and reduced scrap rate. Challenges to broad adoption of refractory alloy AM within the Missile Defense System are twofold. First, most existing alloys were developed for wrought and powder metallurgical processes. AM build variables such as thermal cycling, gradients, and alloy properties are known to induce solidification cracking, excess grain growth, and transition across the ductile-to-brittle transition mid-build. Second, many refractory ore or refinery locations are such that defense supply chains may become contested in the event of regional conflicts.

As such, alternative refractory alloy compositions that help allay these manufacturing and supply chain hurdles are needed, with application to both test targets and interceptors. Integrated computational materials engineering (ICME) tools have demonstrated the ability to conduct rapid evaluation and optimization of candidate materials based on desired properties, resulting in appreciable cost and time savings compared to traditional “guess and check” methodologies of development.

Performance criteria for evaluating refractory alloy candidates include, but are not limited to, thermophysical properties such as thermal expansion, thermal conductivity, and specific heat; specific strength; and additive manufacturing quality metrics such as build density vs. bulk value and build defect prevention. The developed alloys should show the ability to perform in environments representative of hypersonic flight. Consideration of geographic locations for both ore extraction and primary metal production facilities of constituent alloy elements is also important, specifically large production in either the United States or North America. Lastly, the developed alloys must be cost effective with a well-developed technology transition plan for powder or wire feedstock production sufficient for meeting the emerging needs of the hypersonic industrial base.

PHASE I: Demonstrate the feasibility of the proposed alloy development approach via program implementation and algorithm testing. The algorithms must consider cost, material performance, and supply chain resiliency, with rationale provided regarding their respective weights. Performers should identify firms or in-house capabilities for maturing production of novel AM powders and obtain rough order of magnitude pricing for initial powder batches or wire feedstock. Provide test plans for determining AM parameters and material properties, and obtain rough order of magnitude pricing for initial batch powder or wire production.

PHASE II: Procure or produce initial batches of powder of downselected candidate alloys and manufacture representative laboratory test coupons. Test such coupons in accordance with test plans and determine level of agreement of material performance with predictions. Refine and optimize the alloy composition based on experimental results. Conduct manufacturing assessments to determine statistical

parameters for quality and repeatability. Provide the test data to the Government along with preliminary cost, initial raw material sourcing, and schedule projections for pilot-scale powder production.

PHASE III DUAL USE APPLICATIONS: Develop or transition the technology to pilot-scale feedstock production. Advance maturity of the AM process for these feedstocks, providing data on quality and repeatability of the both production and printing processes. Manufacture representative components for hypersonic or propulsion applications.

REFERENCES:

1. Gradl, P.; Mireles, O.R.; Katsarelis, C.; et al. Advancement of Extreme Environment Additively Manufactured Alloys for Next Generation Space Propulsion Applications. Acta Astronautica 2023, 211, 483-497.
2. Pollock, T.M.; Clarke, A.J.; Babu, S.S. Design and Tailoring of Alloys for Additive Manufacturing. Metallurgical and Materials Transactions A 2020, 51, 6000-6019.
3. Bose, A.; Schuh, C.A.; Tobia, J.C.; et al. Traditional and Additive Manufacturing of a New Tungsten Heavy Alloy Alternative. International Journal of Refractory Metals and Hard Materials 2018, 73, 22-28.
4. Wang, X.; Xiong, W. Uncertainty Quantification and Composition Optimization for Alloy Additive Manufacturing through a CALPHAD-Based ICME Framework. NPJ Computational Materials 2020, 6, 188.

KEYWORDS: Additive Manufacturing; Refractory Alloys; Integrated Computational Materials Engineering; Alloy Development

MDA24B-T004 TITLE: High ISP Controllable Solid Propellant

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Hypersonics; Advanced Materials

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

OBJECTIVE: Develop high-slope solid propellants with higher specific impulse (Isp) than state of the art for use with controllable solid propellant rockets.

DESCRIPTION: As controllable solid rocket material technologies advance, high-slope propellants with higher specific impulse can be developed to maximize the performance of thrusters. The burn rate of propellants is an exponential function of chamber pressure. Because the burn rate as a function of pressure is normally graphed on a log-log plot where the burn rate would be linear, propellants with high exponent values are commonly called high slope propellants. This topic seeks new propellants or improvements to existing propellant formulations to maximize specific impulse while achieving high burn rate exponents at a wide range of pressures. Additional factors to consider are communications interference and high melting point by-products that may solidify on motor components during operation. For these reasons, reduced smoke propellants typically trade more favorably than smoky propellants. Desired applications include throttling axial motors and divert and attitude control systems.

PHASE I: Develop a class 1.3 propellant optimized for high specific impulse, burn rate exponents greater than 0.7, and stable combustion at wide range of pressures. Proposers may demonstrate the combustion temperature and specific impulse of the proposed propellant by analysis, but must physically demonstrate actual burn rates at multiple pressures. Low fidelity burn rate measurements like strand burning are acceptable for Phase I. A propellant whose combustion gas composition minimizes partial pressures of oxidizing species like oxygen and water is desired but not required. Partnership with a propulsion system manufacturer would help significantly to guide Phase I goals for desired pressure ranges, combustion temperatures, and other values.

PHASE II: Determine the burn rate of the propellant developed in Phase I through small scale motor burn rate testing for the pressures tested in Phase I. Demonstrate repeatable production of propellant or ingredients using scalable production methods. The proposed propellant must have a shelf-life of more than 20 years as determined by aging data. Thermal structural analysis, testing, or a combination of both must demonstrate that the proposed propellant can survive storage in temperatures as low as -40 °C.

PHASE III DUAL USE APPLICATIONS: Partner with a controllable solid propellant thruster manufacturer to test the propellant. Demonstrate that the burn rate of the proposed propellant is reproducible at ambient temperature with a variation less than 10% at the pressures specified by a manufacturer. During Phase III the effect of initial motor temperature on the burn rate of the propellant must be determined.

REFERENCES:

1. G. P. Sutton and O. Biblarz, Rocket Propulsion Elements, New York: Wiley, 2001.
2. A. E. Oberth, Principles of Solid Propellant Development, Fair Oaks, 1986.

3. R. L. Lou and A. Katsakian, Fast-Burning Rate/High Slope Propellant Technology Program, AD0514877

KEYWORDS: propellant; controllable solid propulsion; specific impulse

MDA24B-T005 TITLE: Using Cognitive Digital Twin Framework for Autonomous Target Discrimination

OUSD (R&E) CRITICAL TECHNOLOGY AREA(S): Trusted AI and Autonomy; Advanced Computing and Software; Integrated Sensing and Cyber; Emerging Threat Reduction

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

OBJECTIVE: Seek the Cognitive Digital Twin technology to develop a novel method for fusion of heterogeneous multi-sensor information to characterize and understand environment, identify high interest objects, and support intelligent decision-making.

DESCRIPTION: To protect the United States and allies from current ballistic missiles and preparing to defend against future increasingly more complex threats, the BMDS assigned the high priority to advance current architecture models to incorporate novel methodologies and techniques. This architecture model advancement can be also performed in the commercial domain and the obtained results transferred to military applications.

One of the most critical characteristics of many military and commercial assets is its ability to utilize all the available information from deployed sensors and the state-of-the art Machine Learning (ML) and Artificial Intelligence (AI) algorithms to perform their important functions as scene characterization and understanding, target selection and decision-making. To boost quality of these tasks, an autonomous system needs to be designed and developed that employs an information fusion scheme with contextual adaptation, a time-evolving ML/AI discrimination of high priority objects, and fire engagement decision-making procedures derived from estimated classification confidence.

Current machine learning approaches to information fusion and decision-making in both military and commercial often have no means of properly handling differences in sensor resolution and coverage, disparate phenomenology, and limited viewing geometry, as well as the inherent uncertainty of the collection of observed data or/and of exploiting the available higher level contextual information on the threat evolution and environment.

Due to the development of new-generation information and digitalization technologies, more data can be collected, which in turn require better ways for the deep application of these data. As a result, the concept of Digital Twin (DT) has aroused much attention and is developing rapidly. DT is typically described as consisting of a physical system, its virtual replica, and the data connections between them. It is increasingly being explored as a means of describing and improving the performance of physical systems through leveraging various computational techniques including ML and AI algorithms. The advantage of DT over simulations is that it creates an active virtual environment capable of involving several simulations, utilizing real-time data and a two-way flow of information between the twin and the data sensors. The DT technology becoming increasingly prevalent in many fields, including the autonomous systems industry.

Characterizing and identification of incurring military or commercial objects in complex environments using diverse sensing has a number of significant challenges. Typically, data may be sparse, collection times are limited, a priori information is incomplete and/or may be in error, additionally, unexpected events and objects may appear. Though DT technology can support many of the necessary integration and correlation procedures, it needs to fuse all available data with information and knowledge related to the scene characterization and target identification. Hence, it becomes necessary to augment the DT with cognitive capabilities. Semantic technologies such as ontology and knowledge graphs could provide potential solutions by empowering DTs with reasoning abilities.

The Cognitive Digital Twin (CDT) concept has been recently proposed which reveals a promising evolution of the current DT concept towards a more intelligent, comprehensive and full lifecycle representation of complex systems. It is intended to harness a high level of intelligence that can replicate human cognitive processes and execute conscious actions autonomously, with minimal or no human intervention. The CDT structure provides an excellent framework to greatly improve the effectiveness of autonomous system actions. The novel fusion and decision-making system structured as a cognitive digital twin can be suitably integrated with relevant digital twins developed by many developers via its capabilities of communication, analytics, and cognition. Consequently, it will perfectly support development and evolution of capabilities for autonomous systems.

A CDT based fusion system would replace and/or improve legacy and current approaches like Dempster-Schafer theory, rule-based expert systems, Bayesian networks, probabilistic relational models, etc.
In summary, the successful proposal will address all the technical challenges in designing and developing an onboard CDT based fusion and decision-making system including:
1. Appropriate handling differences in sensor resolution and coverage, disparate phenomenology, and limited viewing geometry, as well as the inherent uncertainty of the collection of observed data;
2. Exploiting the available higher level contextual information on the threat evolution and scenery;
3. Optimizing real-time data collection and minimizing the required data transmission;
4. A time-evolving, adaptive ML/AI important entities identification algorithms providing class probabilities of high priority items as well as dealing with absence of information on some objects;
5. Commitment decision-making procedures derived from estimated classification confidence and contextual reasoning;
6. Supporting future evolution of capabilities of autonomous systems in complex and evolving environments.

PHASE I: Demonstrate proof of principle with a cognitive digital twin prototype for an innovative fusion, classification, and decision-making concept. Utilizing surrogate objects generation, their data, and contextual information, conceptualize, develop, and model near real-time solutions that satisfy the problem objectives and requirements.

PHASE II: Using realistic, relevant threat data, refine and implement designs from Phase I. Validate concept with available test data.

PHASE III DUAL USE APPLICATIONS: The topic has numerous military and commercial applications, where fusion of available time-evolving information can assist with scene description and its understanding to support optimal decision-making, e.g., advanced assistance systems and autonomous vehicle development.

REFERENCES:

1. Li, Luning, et al. "Digital twin in aerospace industry: A gentle introduction." IEEE Access 10 (2021): 9543-9562.

2. Hossain, S M Mostaq, et al. “A New Era of Mobility: Exploring Digital Twin Applications in Autonomous Vehicular Systems.” 2023 IEEE World AI IoT Congress IEEE, (2023): 493-499.
3. Eirinakis, Pavlos, et al. "Enhancing cognition for digital twins." 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC) IEEE, (2020): 1-7.
4. Sahlab, Nada, et al. "Extending the Intelligent Digital Twin with a context modeling service: A decision support use case." Procedia CIRP 107 (2022): 463-468.
5. Maurer, Donald E., et al. "Sensor fusion architectures for ballistic missile defense." Johns Hopkins APL technical digest 27.1 (2006): 19-31.
6. Domingos, Pedro and Richardson, Matthew. "Markov logic: A unifying framework for statistical relational learning." Statistical Relational Learning (2007): 339-344.

KEYWORDS: Target Discrimination; Remote Sensing; Information Fusion; Digital Twin; Cognitive Process; Machine Learning; Artificial Intelligence; Autonomous System; Decision-making

MDA24B-T006 TITLE: Over-the-Horizon Radar (OTHR) Waveform Design for Maneuvering Targets

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

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

OBJECTIVE: Develop a methodology or algorithm for developing an ensemble of waveforms for OTHR applications against fast and maneuvering targets in endo environments that provide thumbtack range/Doppler resolution, resilient range/Doppler sidelobe suppression, and enable spectrum tailoring. OTHRs provide detection and tracking capabilities against potential threats within the atmosphere (aircraft, cruise missiles, hypersonic missiles, etc.) by refracting radio frequency (RF) energy within the ionosphere to extend radar coverage beyond line-of-sight. Waveforms must be resilient to ionospheric propagation effects including natural and human-made electromagnetic interference. Secondary objective is to understand the inherent electronic protection features of these waveforms.

DESCRIPTION: New types of waveforms are needed to support the high frequency (HF) continuous wave (CW) transmitter that the government is developing for the OTHR Testbed, which will support US Air Force acquisition of a national OTHR system. The testbed would demonstrate and mature key technologies for NORTHCOM and INDOPACOM OTHR acquisitions in defense of against hypersonic threats.

PHASE I:
•Develop a methodology or algorithm for defining multiple coded HF CW transmitter waveforms that produce thumbtack-type matched-filter response – no range or Doppler ambiguities
•Matched-filter range/Doppler sidelobe peaks should be at least 1/TBP below the peak response where TBP is the time-bandwidth product of a single dwell
•Matched filtering must accommodate high-speed targets such that target Doppler offset is significantly greater than Waveform Repetition Rate
•Waveform-generation algorithm should include provision for tailoring transmitted spectrum of waveform such as enforcing suppression of out-of-band emissions
•Report potential electronic protection features of proposed waveforms

PHASE II:
•Demonstrate resilience of Range/Doppler sidelobe suppression to ionospheric propagation effects including natural and human-made electromagnetic interference
•Model target returns and provide interface to Government furnished signal processing and tracking algorithm simulation. Compare relative performance between nominal linear frequency modulated (LFM) waveforms and representative substantiations of the thumbtack response waveform
•Delineate implementation requirements for real-time operation including throughput and buffering

PHASE III DUAL USE APPLICATIONS: Integrated waveforms in OTHR transmitter testbed

REFERENCES:

1. Y. Abramovich, D. Dickey and V. Abramovich, "Spectrum-Controlled Waveforms Design with the Thumb-Tack Ambiguity Function for HF OTH Radars," 2023 IEEE Radar Conference (RadarConf23), San Antonio, TX, USA, 2023, pp. 1-6, doi: 10.1109/RadarConf2351548.2023.10149799
2. Y. Abramovich, D. Dickey and V. Abramovich," Spectrally Limited Periodic Waveforms for HF OTHR Applications," https://www.researchgate.net/publication/365189135_Spectrally_Limited_Periodic_Waveforms_for_HF_OTHR_Applications, November 2022
3. "Radar Spectrum Engineering and Management," NATO Science and Technology Organization TR-SET-182, April 2017, https://apps.dtic.mil/sti/pdfs/AD1039816.pdf Approved for Public Release 24-MDA-11708 (5 Mar 24)

KEYWORDS: over the horizon radar; OTHR; waveform; maneuvering; hypsersonic; cruise missile; high frequency; HF; transmitter