Missile Defense Agency (MDA)
20.C 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 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 Advanced Technology (DV). Specific questions pertaining to the administration of the MDA STTR Program 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).


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 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 an application. 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**

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 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.

**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](https://www.pmddtc.state.gov) and [http://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear](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), and DFARS clause 252.204-7012 (Safeguarding Covered Defense Information and Cyber Incident Reporting). 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.
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. The SBC must certify in all proposals that the agreement is satisfactory to the SBC.

X. 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: 703-214-1333 or DoDSBIRSupport@reisystems.com (9:00 a.m. to 5:00 p.m. ET, Monday through Friday). It is recommended that potential offerors email topic authors to schedule a time for topic discussion during the pre-release period from 25 August 2020 – 22 September 2020.

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 SBIR/STTR PMO 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. Selection and non-selection notifications will be distributed to all offerors in the January 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.

**Technical and Business Assistance (TABA)**
The [SBIR/STTR Policy Directive](https://www.mda.mil/global/documents/pdf/SBIR_STTR_Policy_Directive.pdf) 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](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](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 | sbirsttr@mda.mil

XI. PHASE I PROPOSAL GUIDELINES

The Defense SBIR/STTR Innovation Portal (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 $125,000. 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 four volumes (five if TABA and/or Letters of Support are provided):
- 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 (not required): DSIP not accepting Volume 4 at this time.
- Volume 5 (optional): Letters of Support and/or TABA (does not count towards 15-page limit)
- Volume 6 (required): Fraud, Waste, and Abuse Training Certification
**Volume 5 Information**

MDA will only accept letters of support and/or TABA as part of Volume 5. Any other type of documentation included as part of Volume 5 will not be considered. Letters of support should be loaded within Volume 5 using the “Letters of Support” category on DSIP. TABA should be loaded using the Phase I TABA form within Volume 5 using the “Other” drop-down category.

**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.”

**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 itself 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.

**XII. PHASE I PROPOSAL SUBMISSION CHECKLIST**

1. The following have been submitted electronically through the DoD submission site by 12:00 p.m. (noon) EDT 22 October 2020.

   - Check the corresponding box

   - Volume 1: DoD Proposal Cover Sheet

If proposing to use foreign nationals, 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: (NOT REQUIRED). DSIP not accepting Volume 4 at this time.

✓ Volume 5 (optional): Letters of Support and/or TABA.

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

2. Phase I proposal is not to exceed $125,000. (or not to exceed $130,000 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).

XIV. 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 BMDS. 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 BMDS 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.

Qualified letters of support, if provided, must be included as part of Volume 5 within the “Letters of Support” category on the DoD submission site and will not count towards the 15-page Volume 2 page limit. Letters of support will be evaluated towards criterion C if included as part of Volume 5, but are not required for Phase I or Phase II. Letters of support shall not be contingent upon award of a subcontract.

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 BMDS requirements does the technology support 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. This letter must be included as Volume 5. Letters of support which are faxed, e-mailed separately, or otherwise not included as part of Volume 5 will NOT be considered.

**Phase II Proposal Submission**

Per DoD STTR Phase II Proposal guidance, all Phase I awardees from the 20.C Phase I announcement will be permitted to submit a Phase II proposal for evaluation and potential award selection. Details on the due date, 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 20.C 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. MDA does not participate in the DoD Fast Track program.

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/Customer/Small-Business](https://www.dcaa.mil/Customer/Small-Business) for more information on obtaining a DCAA approved accounting system.
| MDA20-T001 | Reduction of Solid Propellant Infrared (IR) Signature |
| MDA20-T002 | Non Real-Time Hardware Assisted Computer System Simulation |
| MDA20-T003 | Autonomous Missile Detection using Bio-Inspired Sensors |
| MDA20-T004 | Inherently Radiation Hardened Microelectronic Components |
| MDA20-T005 | Advanced Particle Accelerators to Support Heavy-Ion Radiation Testing of Electronics |
| MDA20-T006 | Radiation Hardened By Design (RHBD) Technologies Designed Using On-Shore 22nm FinFETs |
MDA20-T001 TITLE: Reduction of Solid Propellant Infrared (IR) Signature

RT&L FOCUS AREA(S): Hypersonics, General Warfighting Requirements (GWR)
TECHNOLOGY AREA(S): Ground Sea, Weapons, Battlespace

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 solid propellant that greatly reduces the exhaust IR signature emitted while maintaining the thrust to mass ratio of the existing solid propellant.

DESCRIPTION: This topic seeks to develop solid propellants that exhibit reduced IR signatures while maintaining thrust to mass ratio performance. Detection of missile launch and booster burnout are important threat identification points. Since remote IR surveillance is often used to detect and track missile launches, the ability to avoid detection through IR signature reduction would be beneficial for mobile defense platforms as well as forward deployed offensive assets.

PHASE I: Develop a proof of concept solid rocket motor propellant that greatly reduces the exhaust IR signature. Perform an analysis to demonstrate the concept and an initial understanding of the signature calculations while maintaining the thrust to mass ratio. Phase I should be a feasibility concept study that supports the proposed design solution and down selection of alternatives.

PHASE II: Enhance and refine the proposed propellant based on the results and findings of Phase I and expand its capabilities. Validate the feasibility of the Phase I concept by development and demonstrations that will be tested to ensure performance objectives are met. The Phase II effort should result in a prototype with substantial commercialization potential.

PHASE III DUAL USE APPLICATIONS: Productize the propellant to expand the capabilities to other interested users. Develop and execute a Phase III incremental test & integration plan that produces a final prototype.

REFERENCES:
3. Sam Judd, Matthew Vernacchia, Solid Rocket Propellant Combustion, Massachusetts Institute of Technology.
4. R.C. Farmer, S.D. Smith, B.L. Myruski, Radiation from Advanced Solid Rocket Motor Plumes, SECA-FR-94-18, NASA.

KEYWORDS: Solid Propellant, Reduced IR Signature, maintain thrust to mass ratio
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: Resolve restrictions of the Linux Kernel Virtual Machine (KVM) to enable control of the time stamp counter to keep software execution rate consistent with non real-time simulation time.

DESCRIPTION: This topic seeks to develop an accurate timing source for software execution on a KVM to enable non real-time simulations. The Linux KVM supports the use of physical computer cores to accelerate the execution of virtual machines. In this paradigm, peripheral hardware is simulated in a user space (ie. non-privileged space) process (ie. the allocation of memory and time) while streams of machine instructions to be executed by the virtual cores are supplied to the KVM module of the operating system, which executes those streams on real hardware. Timing accuracy is not as much of a concern as control of the time stamp counter instead of its intended virtualization use. Several aspects of this virtualization method prove challenging when the streams of machine instructions are intended to be executed as part of a simulation model rather than a virtualization tool. Among the most challenging are (1) determining how the KVM populates the time stamp counter register of the virtual core, and (2) accounting for the number of instructions to be executed by the KVM between returns to user space which cannot be controlled directly by the user space process. This impedes the use of the time stamp counter as a timing source because it cannot be matched to a non-real-time simulation and it prevents the presentation of a consistent rate of execution to the software hosted on the virtual machine for use in non-real-time simulations.

PHASE I: Develop the proposed approach to a sufficient level to demonstrate its viability and identify requirements for full development. The following are anticipated at the conclusion of Phase I: a) A demonstration/proof-of-concept of the viability of the proposed approach. b) An algorithmic/process description of the developed approach, to include use-case descriptions and demonstrations of output. c) A plan for the development of an initial working prototype capability, to include cyber security efforts to gain approval to operate on government computers.

PHASE II: Deliver an initial working prototype capability. The following are anticipated by the conclusion of Phase II: a) A demonstration of initial capability. b) Prototype software for
experimental trials by government users. c) Documentation, including software scan results, to support approval decisions to load software onto government computer systems. d) Documentation of the initial capability sufficient to support trial use. e) Documentation of the software architecture, its algorithms/processes, and output formats. f) A plan for development of a full operational capability.

PHASE III DUAL USE APPLICATIONS: Deliver phased incremental improvements to the prototype until a full operational capability is achieved. At each increment, the following are anticipated: a) Demonstrations of incremental additions/improvements. b) A software release for use/testing by the government. c) Documentation, including software scan results, to support approval decisions to load software onto government computer systems. d) Updated user documents. e) Updated architecture, algorithms/processes, and output format documentation. At the conclusion of Phase III, the final software and documentation should be delivered.

REFERENCES:

KEYWORDS: Simulation Time Management, KVM, non real-time, emulation
TITLE: Autonomous Missile Detection using Bio-Inspired Sensors

RT&L FOCUS AREA(S): Biotechnology, Microelectronics, Hypersonics, Autonomy, Artificial Intelligence
TECHNOLOGY AREA(S): Ground Sea, Sensors, Electronics

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 innovative designs for a bio-inspired sensor that is optimized for autonomously detecting, identifying, tracking, and reporting dim missile threats in cluttered and noisy scenes.

DESCRIPTION: This topic seeks innovative solutions for autonomously (i.e. without a cue from another sensor) detecting dim missile threats in cluttered and noisy scenes using passive sensors. An example application could be detection of a distant (e.g. 100 kilometers away) re-entering missile using a ground-based infrared search and track sensor. In addition to the background and sensor noise, the scene might be cluttered by moving sources to include (but not limited to) clouds, dust, precipitation, weapon effects, the sun, the moon, stars, meteors, satellite flares, auroras, birds, insects, and aircraft. Such a scene could be challenging for conventional detection approaches, and would require increased size, weight, and power (SWaP) in order to reject noise and clutter while increasing target sensitivity.

Biological vision systems are SWaP-efficient and well adapted for ignoring clutter and noise, detecting motion, and compressing visual information. A sensor that artificially emulates all or part of a biological vision system might outperform conventional sensors for detecting, identifying, tracking, and reporting dim missile threats in cluttered and noisy scenes.

This topic seeks innovative sensor designs that artificially mimic biological vision systems wherever feasible and are capable of overcoming the challenges described above. Offerors should propose complete designs, to include everything from the optics taking in the scene to the final processor putting out target reports. These designs should incorporate technologies that are projected to mature (preferably driven by commercial investments) within the next 10 years, and that would be available (as early prototypes) for experiments during Phase II.

The focus of this topic is not on the development of any one particular technology but rather the integration of multiple emerging technologies into a novel solution. The Research Institute partner should be a key member of the design team and a source of many of the innovative ideas, rather than supplying one or two services or subcomponents. Offerors may use the example
application described above or propose their own notional application and corresponding sensor configuration (e.g. waveband, field-of-view, etc.) as long as its feasibility and suitability for missile defense applications can be established.

In addition to performance, there are other considerations that determine the acceptability of a sensor concept for deployment. These considerations include manufacturability, ease-of-calibration, ability to handle multiple simultaneous targets, minimization of (or compensation for) non-linearities and non-uniformities, insensitivity to (or compensation for) vibration and temperature changes, hardening against radiation and EMP, ability to be programmed and trained, and system support requirements (e.g. cooling, data-link, and off-board processing requirements). The bio-inspired sensor design should address these considerations.

PHASE I: Develop an initial design for a bio-inspired sensor. Study the scientific and technical feasibility of the proposed approach. Estimate its performance using low-fidelity calculations, models, and simulations. Develop an initial plan for fabricating a prototype in Phase III. Assess the availability and maturity of enabling technologies and subcomponents within the next 5-10 years based on market projections. Identify risk areas and mitigation plans that would be implemented in Phase II. Complete a plan for Phase II and contact suppliers to verify the plan is executable.

PHASE II: Conduct integration, risk-reduction, and proof-of-concept experiments using early prototype subcomponents and subassemblies in order to inform models and increase confidence in the feasibility and benefit of the proposed design. Improve the design based on these experimental results. Conduct medium-fidelity calculations, models, and simulations to estimate sensor performance, behavior, and support requirements. Complete a detailed plan for fabricating a prototype in Phase III.

PHASE III DUAL USE APPLICATIONS: Fabricate and test a complete bench-top prototype of the bio-inspired sensor. Identify design modifications that could be made to serve other customers and applications. Complete plans for a transportable, ruggedized, and miniaturized prototype that could be field-tested.

REFERENCES:
KEYWORDS: Bio-inspired, Missile Defense, Sensor
TITLE: Inherently Radiation Hardened Microelectronic Components

RT&L FOCUS AREA(S): Space, Microelectronics, Hypersonics
TECHNOLOGY AREA(S): Sensors, Electronics, Space Platform

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OBJECTIVE: Develop radiation hardened electronic components capable of surviving and operating through exposure to radiation environments encountered in space.

DESCRIPTION: This topic seeks the design and fabrication of inherently radiation hardened microelectronic components. Electronic components and systems exposed to radiation in space may experience power resets, safing (de-arming), performance degradation, and/or temporary or permanent failure due to cumulative effects of long-term exposure or high energetic particle and/or photon fluence. Radiation sources in space include particles geo-magnetically confined in radiation belts (protons, electrons, heavy ions); particles from solar winds, coronal mass ejections (proton rich) or flares (heavy ion rich); omnidirectional free space particles (galactic cosmic rays, heavy ions); or particles and photons from man-made events (X-rays, Gamma-rays, neutrons, radioactive debris) as well as electro-magnetic pulse (EMP). Typically, systems employ a combination of methods for radiation protection: shielding, part redundancy, circumvent and recovery (C&R), rad-hard by design (RHD), and hardened parts. Using shielding and redundant parts imposes mass penalties. C&R places a system in a protective mode until a radiation event passes leaving the system vulnerable during the down time. RHD develops radiation tolerant circuits that minimize single point failures. The hardened parts approach involves design, fabrication, selection and screening of parts for radiation tolerance.

New manufacturing techniques and recent developments in nano-materials create an opportunity to develop electronic components that are inherently insensitive to radiation effects. In particular, vacuum field effect component technology (e.g. diodes, triodes, transistors) and functional devices made from these components (e.g. OPAMPs, simple logic devices) using high density three dimensional (3D) radiation hardened capability requiring minimal shielding and/or C&R.

Desire parts able to survive and operate through space radiation environments with recommended total ionizing dose (TID) >300 krad (Si), single event upsets (SEU) < 10-10 errors/bit-day, and immunity to single event latch-up (SEL) at linear energy transfer (LET) levels > 100 MeV cm2/mg. Development of a radiation hardened field-programmable gate array, with a technology node less than 45nm, is a specific government application for this technology.
PHASE I: Design radiation insensitive component(s), simple circuit(s), and/or 3D fabrication technique(s). Provide analysis substantiating proposed component(s), simple circuit(s), and/or 3D fabrication technique(s) can survive and operate through realistic radiation environments. Fabricate simple proof of principle prototypes and establish baseline performance parameters.

PHASE II: Optimize design(s) to improve baseline performance, increase survivability and level of operability in realistic radiation environments. Fabricate and test optimized parts in realistic radiation environments and against standard military temperature cycling specification. Work with a vendor/trusted foundry/fabrication house and/or military prime contractor on part(s) manufacturability/producingibility. Incorporate hardened parts in a representative space avionic subsystem/system application and test in realistic space radiation environments.

PHASE III DUAL USE APPLICATIONS: Team with a vendor/trusted foundry/fabrication house and/or military prime contractor to develop and space qualify radiation-hardened parts. Work with the transition partner to establish a pathway to insert technology into an existing or planned missile defense application.

REFERENCES:

KEYWORDS: Vacuum, Channel, Tube, Nanotechnology, Nanomaterials, Microelectronics, Transistor, Radiation, Hardening
MDA20-T005  TITLE: Advanced Particle Accelerators to Support Heavy-Ion Radiation Testing of Electronics

RT&L FOCUS AREA(S): Space, Microelectronics, Hypersonics
TECHNOLOGY AREA(S): Sensors, Electronics, Space Platform

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OBJECTIVE: Develop a new capability that transforms low energy accelerators to high energy accelerators or develops a brand new accelerator specifically designed for high energy heavy ion testing of electronics.

DESCRIPTION: This topic seeks a flexible testing facility capable of delivering high energy beams which can test electronics in a representative configuration and reduce the overall testing cost while fully characterizing the Single Event Effects (SEE) response of each part. The United States and its military are sending more, and increasingly complex, computer-run devices into orbit each year. Once in orbit, the circuits within these devices are bombarded by ionizing radiation that can lead to failure. Given the increasing expense of launching space based systems and the microelectronics which reside in them, the testing of these integrated circuits at heavy-ion beam facilities is essential to prevent costly losses due to radiation failure.

The increasing complexity of electronic circuits, with smaller feature sizes and larger overlayers, has made it harder to test at ion beam facilities as the circuits require expensive and difficult preparation for the low-energy ion beams currently in use. In space, high energy ionizing particles can easily traverse the overlayers to reach the sensitive volume where SEE occur. Accelerator facilities performing SEE testing use lower-energy ion beams, which have difficulty reaching these sensitive volumes. Therefore, costly de-lidding of parts is required which is a destructive process removing the outermost layers of a circuit and leaving the exposed circuit in a state that can be difficult to test (e.g. thermal properties are altered) and which is not representative of the on-orbit configuration of the circuit.

PHASE I: Develop a concept to improve existing low energy test capabilities (10 MeV/n or less ion accelerators) and increase their energy to 100 MeV/n or more. Or develop a concept to create a new accelerator that reaches 100 MeV/n or more and can fit into a standard shipping container. Standard ISO shipping container dimensions are: 8ft (2.43m) wide, 8.5ft (2.59m) high and 40ft (6.06m) (Threshold) or 20ft (12.2m) (Objective) long. Provide a detailed report documenting the concept design and its expected max energy levels. For new designs, provide a
phased plan of the critical elements to be prototyped if the entire design cannot be prototyped in one follow-on phase.

PHASE II: For designs enhancing current accelerators: Create and provide a prototype of the improved elements/subcomponents for upgrading or adapting a current ion accelerator design to reach the enhanced energy level documented in Phase I. Provide modeling and simulation to demonstrate a complete final design along with a documented approach for implementing these elements and enhancements on a current accelerator design. Identify potential accelerator facilities or manufacturers with which to partner for Phase III implementation.

For new designs: Create and provide a prototype of the new design. If the full prototype cannot be completed in this phase, create and provide prototypes of the critical parts/subcomponents of a new design that would be essential for meeting the increased energy benchmark of 100 MeV/n or more along with modeling and simulation of the final design to demonstrate the capability to fit into a standard shipping container.

PHASE III DUAL USE APPLICATIONS: Build an operational, improved, or new design ion accelerator that can reach 100 MeV/n or more and operate for 2,000 hours per year. For a design that is an improvement on existing accelerators, if necessary, partner with existing ion testing facilities and/or a manufacturer of current accelerators to demonstrate implementation of the improved design. For new designs, build the final accelerator to fit within a standard shipping container.

REFERENCES:

KEYWORDS: Ionizing radiation, testing, SEE, Heavy-ion, accelerator, microelectronics
TITLE: Radiation Hardened By Design (RHBD) Technologies Designed Using On-Shore 22nm FinFETs

RT&L FOCUS AREA(S): Space, Microelectronics, Hypersonics
TECHNOLOGY AREA(S): Sensors, Electronics, Space Platform

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OBJECTIVE: Develop RHBD products and Intellectual Property (IP) based on on-shore 22nm FinFET technology to meet long term performance and availability needs for defense applications in natural and hostile radiation environments.

DESCRIPTION: This topic seeks to leverage the current 22nm on-shore production capability and its inherent Total Ionizing Dose (TID) hardness by:

1. Developing RHBD mitigation approaches to known susceptibilities to low energy particle exposure to allow for long term design solutions across platforms.
2. Developing U.S. based IP for the RHBD designs which allows for easy modification by various government programs depending on the intended application.
3. Conducting additional hardening and testing of the RHBD 22nm FinFET technology for performance in hostile environments to provide an even greater depth of its use across platforms and applications.

It is critical to the development and sustainment of defense programs to identify, invest in, and advance secure, on-shore manufacturing and packaging of RHBD technology and IP, including characterizing the technology in radiation environments. 22nm FinFET technology is a proven commercial technology with current on-shore production, allowing for advanced size, weight, and power considerations in new designs.

PHASE I: Design radiation insensitive component(s), simple circuit(s), and/or 3D fabrication technique(s) using 22nm FinFET technology. Provide analysis substantiating proposed component(s), simple circuit(s), and/or 3D fabrication technique(s) can survive and operate through realistic radiation environments (both natural space and weapon induced). Fabricate simple proof of principle prototypes and establish baseline performance parameters. Conduct initial operational and evaluation testing in prompt dose-rate radiation environments. Characterize survivability and operability in realistic natural space and prompt dose rate radiation environments, and against standard military temperature cycling specification environments.

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PHASE II: Optimize design(s) to improve baseline performance and increase survivability and level of operability in realistic natural space and weapon-induced radiation environments. Fabricate and test optimized parts in realistic natural space and prompt dose rate radiation environments and against standard military temperature cycling specification environments. Work with a vendor, trusted foundry, fabrication house, and/or military prime contractor on part(s) manufacturability and producibility. Incorporate hardened parts in a representative space avionic subsystem/system application and test in a realistic radiation environment.

PHASE III DUAL USE APPLICATIONS: Team with a vendor, trusted foundry, fabrication house, and/or military prime contractor to develop and space qualify the radiation hardened parts. Work with the transition partner to establish a pathway to inserting the technology into an existing or planned missile defense application.

REFERENCES:

KEYWORDS: Radiation, RHDB, 22nm, microelectronics, state-of-the-art, foundry, on-shore, defense, sensors

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