The DoD Manufacturing Technology Program (ManTech) SBIR Program seeks small businesses with strong research and development capabilities to pursue and commercialize technologies.

Broad Agency Announcement (BAA), topic, and general questions regarding the SBIR Program should be addressed according to the DoD SBIR Program BAA. For technical questions about a topic during the pre-release period, contact the Topic Author(s) listed for each topic in the BAA. To obtain answers to technical questions during the formal BAA period, visit https://www.dodsbirsttr.mil/submissions.

**PHASE I PROPOSAL SUBMISSION**

Follow the instructions in the DoD SBIR Program BAA for program requirements and online proposal submission instructions.

ManTech SBIR Phase I Proposals have four Volumes: Proposal Cover Sheets, Technical Volume, Cost Volume and Company Commercialization Report. **Please note that the ManTech SBIR will not be accepting a Volume Five (Supporting Documents) as noted at the DOD SBIR website.**

The Technical Volume has a 10-page limit including: table of contents, pages intentionally left blank, references, letters of support, appendices, technical portions of subcontract documents (e.g., statements of work and resumes) and any other attachments. Do not duplicate the electronically generated Cover Sheets or put information normally associated with the Technical Volume in other sections of the proposal as these will count toward the 10-page limit. Only the electronically generated Cover Sheet and Cost Volume are excluded from the 10-page limit. Technical Volumes that exceed the 10-page limit will be reviewed only to the last word on the 10th page. Information beyond the 10th page will not be reviewed or considered in evaluating the offeror’s proposal. To the extent that mandatory technical content is not contained in the first 10 pages of the proposal, the evaluator may deem the proposal as non-responsive and score it accordingly.

Note: The Company Commercialization Report (CCR) will NOT be available during the 20.3 BAA cycle. No Commercialization Achievement Index (CAI) will be generated. The CCR will be available for future DoD BAA cycles. If the CCR is available at the time of the Phase II submission for any awarded Phase I efforts resulting from this BAA, the proposing firm is required to submit the CCR for its Phase II proposal.

Companies submitting a Phase I proposal under this BAA must complete the Cost Volume using the online form, within a total cost not to exceed $167,000.00 over a period of up to twelve months.

Proposals not conforming to the terms of this BAA, and unsolicited proposals, will not be considered. Awards are subject to the availability of funding and successful completion of contract negotiations.

**EVALUATION CRITERIA**

Proposals will be evaluated based on the criteria outlined below. 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.
d. Potential of utilization and/or collaboration with a Department of Defense sponsored Manufacturing Innovation Institute and/or their component members

Cost reasonableness and realism shall also be considered to the extent appropriate.

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

TECHNICAL INQUIRIES

During the Pre-release Period of the DoD 20.3 SBIR Broad Agency Announcement (BAA), any questions should be limited to specific information that improves the understanding of a particular topic’s requirements. All questions must be submitted in writing either by email to the TPOC listed or posted in the online SBIR/STTR Topic Q&A portal (formerly SITIS) – all questions and answers will be released to the general public. All inquiries must include the topic number in the subject line of the e-mail.

During the Open Period, all questions must be posted in the online Topic Q&A portal. Please follow the instructions in section 4.13.d of the DoD 20.3 SBIR BAA Instructions.

PROPOSAL SUBMISSION

In order to participate in the ManTech SBIR Program, all potential proposers should register on the DoD SBIR/STTR Web site at https://www.dodsbirsttr.mil/submissions as soon as possible. This site contains step-by-step instructions for the preparation and submission of the complete proposal. It is required that all proposers submit their proposal electronically through the DoD SBIR/STTR Proposal Submission Web site at https://www.dodsbirsttr.mil/submissions. For general inquiries or questions about the proposal electronic submission process, contact the DoD SBIR Help Desk at DoDSBIRSupport@reisystems.com (9:00 a.m. to 5:00 p.m. ET Monday - Friday).

Proposals shall be submitted in response to the specific ManTech topic identified in the topic description section following these instructions.

ManTech does not provide Direct Technical and Business Assistance (TABA).

ManTech SBIR Program Point of Contact:

General inquiries concerning the DoD ManTech SBIR Program should be addressed to:

Ms. Tracy Frost, OSD ManTech SBIR Program Manager
Tracy.g.frost.civ@mail.mil
<table>
<thead>
<tr>
<th>OSD 203-001</th>
<th>Improved Ablative Technology for the Reduction of Gun Bore Erosion</th>
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<tr>
<td>OSD 203-002</td>
<td>High precision liner manufacturing using exotic metals for enhanced shaped charge jet performance.</td>
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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 improved ablative technology that minimizes gun bore erosion for high-energy gun propulsion systems and gun propellants.

DESCRIPTION: The Gun Weapon System (GWS) requirements for increased muzzle velocity, extended range and enhanced lethality have led to the use of high-energy gun propellants that exhibit high flame temperatures. High flame temperatures typically cause excessive gun barrel bore erosion that limits the life cycle of a gun barrel. In addition, the mechanical wear caused by the frictional effects of the projectile rotating band on the bore surface can be significant, especially at very high velocity. Various methods have been employed to reduce the rate of gun barrel wear and erosion, including chromium plating of the bore surface, the use of ablative wear liners within the propelling charge, the development of gun propellants with nitrogen-rich components as well as the development of low mechanical wear rotating bands made of plastic or soft metals. The focus of this SBIR will be on thermochemical erosion of the gun bore caused by propellant combustion products and will not directly address mechanical wear due to projectile/bore surface frictional effects.

Chromium surface plating of the bore surface has been applied extensively to US DoD gun barrels and it has been shown to reduce the rate of bore surface erosion due to its refractory nature. However, after the first few shots are fired in a new gun barrel, cracks, initially present in the chromium coating from the manufacturing process, are exacerbated and create direct pathways for hot propellant combustion products to access and react with the gun steel. New, more rugged refractory bore surface coatings and coating processes are under constant development, however, these may not be available in the short or even mid-term.

Ablative wear liners usually consist of a thin sheet of a titanium dioxide (TiO2)/binder (wax or silicone-based materials) mixture placed along the inner wall of a charge or cartridge. During gun fire, the TiO2/binder mixture ablates and forms an insulating layer adjacent to the bore surface to reduce the gun wear rate. Wear liner technology has been extensively used within propelling charges and cartridges, however, with the advent of new more energetic gun propellants more effective ablative wear liners are required for use with in-service as well as new design gun propulsion systems and gun barrels. Improved ablative technology (in the form of liners or other novel means of application) would lengthen the useful life of existing gun barrels so that the barrels can remain in use for a greater number of rounds fired and reduce the expense of frequent barrel replacement. Developing ablatives that take advantage of the ‘dynamic nitriding effect’ theorized to occur for nitrogen-rich gun propellants could also be a viable area for research. For example, nitrogen-rich inert compounds could be combined with the TiO2/binder mixture to combine the insulating effect with a dynamic nitriding effect to enhance erosion reduction. Alternatively, other metals, metal oxides or combinations thereof might exhibit a greater insulating effect.
as compared to TiO2. Improvements to the ablative binder might also be possible. Wear liners appear to be the most effective means to deliver the ablative material to the bore surface, however, other more effective methods of ablative delivery may be possible.

Improved ablative technology would be relatively easy to implement and could serve as a stop gap measure until new bore surface coating technology becomes mature. It is cautioned, however, that the introduction of an excessive amount of inorganic material into a propelling charge could result in the undesirable effect of bore fouling in which excessive ash or other deposits form on the bore surface that could eventually constrict the bore to where it affects gun performance. In addition, inert ablative wear liners typically reduce the overall energy available from the charge for projectile propulsion because energy is consumed during gun fire, for example, in raising the temperature of the ablative and transporting ablative materials down-bore. As a result, the design of new ablative wear and erosion reduction technologies must take a careful approach to balance improvements in erosion reduction with limiting impacts to interior ballistic performance.

PHASE I: The objective of Phase I shall be to develop gun propulsion system prototype ablative wear liners or ablatives in more effective configurations consisting of new and improved materials and other technologies and to evaluate the viability of the proposed technologies in a laboratory environment. Phase I will initiate with an extensive literature search to define the state of the art with respect to ablative wear reduction technology as well as the identification of new materials that could be applied to improve the efficacy of ablative wear reduction technologies. Laboratory test apparatus shall be configured to emulate the gun bore environment and be assessed for erosion and heat transfer effects with and without the proposed technologies. A final report will document testing results and present the top level plan to continue development in Phase II.

PHASE II: The objective of Phase II shall be to scale-up and demonstrate those technologies developed under Phase I that show the greatest promise to reduce barrel wear and erosion in representative medium and/or large caliber GWS(s). The gun barrels shall be evaluated for barrel wear and erosion on a systematic basis with and without the prototype ablative materials/systems. In addition, barrel heat transfer data will be collected to complement the barrel wear data. Testing may occur at either private and/or government gun test ranges. Several ablative system designs shall be tested to determine which design is most suitable for the selected GWS(s) and gun propulsion system(s). The result of Phase II will be a prototype design, including applicable technical data, which will be integrated into current and future gun propulsion system designs for extended range/enhanced lethality.

PHASE III DUAL USE APPLICATIONS: Upon success of Phase II the proposed technologies would be transitioned to in-service gun propulsion systems and/or those currently under development.

REFERENCES:

KEYWORDS: gun barrel; gun tube; bore; bore surface; wear; erosion; ablative; wear liner; titanium dioxide; polydimethylsiloxane (PDMS); dynamic nitriding; high-nitrogen

TPOC-1: Michael Bonanno
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High precision liner manufacturing using exotic metals for enhanced shaped charge jet performance.

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

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: To develop high precision metal forming/liner manufacturing capabilities for liner manufacturing surge capacity and to enable more cost competitive government loading, fabrication, and testing of developmental shaped charge and explosively formed penetrator warheads using hard to machine, exotic materials.

DESCRIPTION: Manufacturing of metal liners for explosively formed penetrators and shaped charges can be a complicated and time-consuming process to do with the required precision. There are generally two phases of this process, manufacturing the preforms from raw material, billets, plate, or sheet, and machining the preforms to the desired shape. There are only about 4-5 companies that currently do this in the entire continental United States.

To manufacture liner preforms for large diameter liners, heavy forges are necessary to forge billets of raw material into near net shape preformed blanks. For smaller applications, deep drawing operations may be used and although somewhat less complicated than the heavy-duty forges required to manufacture larger liners, still require specialized skill and expertise to produce high tolerance, precision parts necessary to achieve high performance warheads.

Precision liner machining requires not only extremely high precision and tolerance, often around .0005 inch for a liner that may be 6 inches or greater in diameter, but unique expertise in machining all surfaces of somewhat conical shaped liners in addition to warhead loading techniques. Shaped charge liners are generally manufactured using vacuum fixtures that allow precise location and machining of each of the surfaces. Through wall thickness, liner profile, transverse wall thicknesses, and surface finish requirements all require extreme precision. Finally, specialized skill at machining exotic materials is often required. These types of materials may either have high densities, e.g. greater than 10 g/cc and may be as high as approximately 19 g/cc. Some of these exotic materials may also be pyrophoric in nature and may require machining under specialized fluids with particular feed and speed rates for safety purposes.

PHASE I: The objectives of phase I are for the liner manufacturer to evaluate 1) whether they currently have the capability to manufacture precision liners to government specified tolerances 2) if they do not currently possess this ability, to calculate the feasibility and cost of procuring all necessary hardware, including ancillary fixtures and devices, in order to stand this capability up. The final, and most important objective of this effort would be to provide an estimated unit production cost, based on machining delivered preforms for a typical quantity of liners, materials, and geometries so that the government could measure their cost against larger, more traditional liner manufacturers. Their findings will be documented in a final report and shall include plans, if warranted, for continuing into Phase II.
PHASE II: In phase II the contractor will either begin manufacturing the necessary ancillary hardware determined previously in phase I or they will procure the hardware if the government determines that it is warranted and cost effective. After this, they will then manufacture a limited number of liners, up to approximately 12 liners of 3 different designs for comparison to known metallurgy, geometric tolerance, and ultimately performance against baseline charges.

PHASE III DUAL USE APPLICATIONS: If an additional source of cost competitive, high quality liner manufacturing can be developed, there are a variety of systems to which this technology might be transferred. These include, but are not limited to, TOW2A/B, Hellfire, Javelin, DPICM, and shoulder fired systems among others.

REFERENCES:

KEYWORDS: shaped charge liner, liner materials, liner manufacturing, explosively formed penetrator liner, high precision machining, dense metal machining

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