SON Number: WPSON-15-02 **November 7, 2013**

Strategic Environmental Research and Development Program (SERDP)

FY 2015 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

STANDARDIZED TEST METHODOLOGIES FOR LOW OBSERVABLE COATING DURABILITY

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to develop standardized test methodologies capable of realistically recreating aircraft environments in order to accurately assess material durability for Low Observable (LO) coating systems. Standardizing these durability testing methodologies across the Department of Defense (DoD) and Original Equipment Manufacturers (OEMs) will result in a realistic understanding of the service life of LO coatings. The current non-standardized testing has resulted in failure of LO coatings long before the end of their predicted life. The removal and reapplication of LO coatings requires the use of large quantities of Hazardous Air Pollutants (HAPs) and Volatile Organic Compounds (VOCs) compared to conventional aircraft coatings. A realistic life prediction for LO coatings through standardized testing would lead to reduced hazardous waste over the lifecycle of DoD aircraft while increasing aircraft availability.

Coatings of interest include loaded urethane materials such as radar absorbing materials (RAM), conductive paints, and loaded gap fillers used on the Outer Mold Line (OML), as well as primer, topcoat, and rain erosion coatings. Testing methodologies will need to account for an entire stack-up in order to accurately predict the system's life. While the primary weapon systems of interest are fielded "stealth" aircraft and weapons such as the B-2, F-22, F-35, and JASSM, the test methodologies and associated coating life understanding will have potential use on all other DoD weapon systems using LO coatings, such as legacy aircraft like the B-1, F-16, F/A-18, and Unmanned Aerial Vehicles (UAVs).

SERDP is interested in technological approaches for improving the quality of test equipment and creation of durability testing standards to provide a better understanding of breakdown mechanisms of LO material systems. Testing will be carried out on surrogate LO stack-ups and unclassified LO materials to eliminate classification restrictions for this effort. A list of appropriate, unclassified surrogate materials is located at the end of this document. The deliverable will be test standards that recreate breakdown mechanisms realistically in a laboratory environment at an accelerated rate.

The proposed capability should:

- Consider OML material systems as multiple layer stacks as they are employed on aircraft
- Quantify material system degradation mechanisms using computational modeling when appropriate
- Utilize existing DoD facilities or require minimal retrofit to existing facilities
- Realistically age OML materials based on expected mission profiles
- Include after-exposure durability measurements

2. Expected Benefits of Proposed Work

Standardized test methodologies that accurately assess the durability of LO coatings have the potential to reduce the environmental impact of LO maintenance over the lifecycle of multiple DoD weapon system platforms. Accurate understanding of breakdown mechanisms of LO material systems that are reflected in testing standards will establish realistic life and durability expectations for LO coatings. LO material systems that do not fail unexpectedly, along with appropriate planned maintenance, will directly lead to reductions in the volume of hazardous waste and air emissions from LO system stripping and application while improving material durability and reducing platform lifecycle cost.

3. Background

Recently, multiple LO material systems have been found to be significantly less durable in the field than predicted, even though all of these materials individually passed qualification tests by the OEM. These unexpected failures have proven that the fundamental degradation of specialty coatings as a multi-layer stack-up, has not been correctly understood. Even prior to these system failures, LO platforms have required significantly more planned (depot) and unplanned (field) maintenance than conventional aircraft. These maintenance actions result in significant downtime and high non-mission capable (NMC) rates for the most valuable assets in the fleet.

LO coating systems contain significant amounts of VOCs/HAPs, such as MEK, MIBK, toluene, and xylene. In addition, the dry film thickness of a typical LO coating system is between 10 and 15 times greater than standard coatings on legacy aircraft, which average 3 to 5 thousandths of an inch thick. Current methods of stripping LO coating systems yield large amounts of hazardous waste. The physical blast media associated with stripping the B-2 generates 80,000 lbs of hazardous waste per aircraft, along with 400 gallons of chemical stripper. The physical hazardous waste generated for each F-22 is about 6,000 lbs of spent blast media, or 78,000 lbs annually.

The current B-2 process is to strip and re-coat LO treatments every seven years. In addition to the aforementioned hazardous waste generated through both stripping and application, the aircraft is not available to the warfighter during the lengthy 1.2-year depot process. While these depot processes are necessary, the frequency and extent of such depot maintenance could be reduced with accurate knowledge of LO coating durability. With improved test capability, the B-2 weapon system could, with confidence, extend the period between depot maintenance events.

4. Cost and Duration of Proposed Work

The cost and time to meet the requirements of this SON are at the discretion of the proposer. Two options are available:

Standard Proposals: These proposals describe a complete research effort. The proposer should incorporate the appropriate time, schedule, and cost requirements to accomplish the scope of work proposed. SERDP projects normally run from two to five years in length and vary considerably in cost consistent with the scope of the effort. It is expected that most proposals will fall into this category.

Limited Scope Proposals: Proposers with innovative approaches to the SON that entail high technical risk or have minimal supporting data may submit a Limited Scope Proposal for funding up to $150,000 and approximately one year in duration. Such proposals may be eligible for follow-on funding if they result in a successful initial project. The objective of these proposals should be to acquire the data necessary to demonstrate proof-of-concept or reduction of risk that will lead to development of a future Standard Proposal. Proposers should submit Limited Scope Proposals in accordance with the SERDP Core solicitation instructions and deadlines.

5. Point of Contact

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP web site at www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations.

6. Appendix

The following is a list of unclassified surrogate materials that can be used in the development of a test methodology for the durability of LO coatings:

- Non-chrome Primers: Deft 44GN098-
- Chromated Primers: Deft 02Y40A
- Flexible Primers: Deft 09Y10
- Conductive Coatings: Chomerics CHO-SHIELD 4994
- Non-Conductive Gap Filler: SAE AMS3276 (any sealant on the Qualified Products List)
- Conductive Gap Filler: PPG PR-2200
- Low Temperature Sprayable Absorbent Coating: CAAP FP-220
- Moderate Temperature Sprayable Absorbent Coating: Cumings Microwave Silicone C-RAM Paint VHP
- Low Temperature Sheet Absorbent Material: PPG PR-2416
- Moderate Temperature Sheet Absorbent Material: PPG PR-2416
- Topcoats: Deft 03W127A

- Rain Erosion: CAAP FP 500
- Extrudable Material: Arc Technologies, WT-2010