SON Number: WPSON-21-C4 **24 October 2019**

Strategic Environmental Research and Development Program (SERDP)

FY 2021 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

STRUCTURAL REPAIR OF DEFENSE ASSETS

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to identify and develop sustainable field repair technologies for damaged or corroded materials in advanced generation 5 and future aircraft composite and metallic structure and components. The proposed repair technology must restore component strength without compromising chemical and mechanical properties. An ideal structural repair would return the component to its original operational dimensions and performance (including strength, fatigue, stiffness, corrosion resistance). Repair technologies developed in response to this SON could be used in the depot, in the field, or in-situ on the defense asset. Specific parameters of interest are described in more detail below:

- Capability: Repair technologies of interest include methods for repairing components made of alloys, composites, or other structural materials. Repairs that can be made in a timely manner in the field and in difficult-to-reach locations on the weapon system are of high interest to the DoD.
- Performance: The mechanical and chemical performance characteristics of the repaired area should ideally be equivalent to that of the original material, but repairs that restore a significant proportion of the original properties would be acceptable. Repaired areas should therefore have minimal knock-down in strength and fatigue life, and acceptable corrosion and stress corrosion cracking performance, all of which may require additional coatings and surface treatments after repair. The repair technology should show environmental savings while restoring the original dimensions of the component.
- Hazardous Materials: The repair technology should not introduce new hazardous materials or create hazardous wastes, unless the hazards can be properly contained. Neither the repaired area nor repair technology should create additional operational or maintenance risks beyond those currently baselined.

Proposals should include an estimate of the environmental benefits as well as the maximum strength/fatigue debit target for typical repairs, a proposed quality assurance approach, and a task to conduct a lifecycle Sustainability Analysis that can mature as the technology advances through the acquisition process. This approach aims to develop and document a data set at each stage of research and development, which can be used to make informed decisions and streamline transition into an acquisition program. The Sustainability Analysis must include data to inform the user

community: the goal and scope of the analysis; the relevant inputs and outputs; and an estimate of life cycle impacts and costs.

2. Expected Benefits of Proposed Work

Program Managers, installations, and warfighters across all services would benefit from improved structural repair processes through faster turnaround time and a higher readiness level. Minimizing or eliminating the need for replacement reduces repair schedules and costs, and eliminates environmental impacts of removing, manufacturing, and replacing entire weapons systems. A key metric that the DoD is working towards is to improved mission availability of weapons systems.

3. Background

Defense assets are often unavailable for extended periods of time in depots because of the need for structural repair, frequently due to corrosion. Corrosion can be removed and material can often be replaced; however, few technologies can restore both component dimensions and strength.

Most repair methods involve removal of damaged material, which reduces cross section and hence strength and fatigue. Strength can sometimes be recovered by welding methods, but those usually involve re-heat treating to remove the heat-affected zone, while most coatings and fillers restore only the dimensions, not the mechanical properties. Mechanical properties can be restored by extra layers of reinforcement, usually to provide stiffness or strength for fastening (as with doublers), but this increases weight and impacts center of balance and other critical operational characteristics. Most coating technologies and adhesives restore the material, but not its strength, because the adhesive strength of the added material is lower than the cohesive strength of the original material. Welding and laser treatments often damage the material's heat treatment, reducing its fatigue strength. Joining additional material to recover dimensions, stiffness, or fatigue strength typically increases weight.

Component removal and replacement is often very time-consuming and expensive, making the asset unavailable for an extended period of time. Replacement also means that a new component must be manufactured, with all of the Environment, Safety, and Occupational Health (ESOH) issues that entails.

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 $250,000 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

Robin A. Nissan, Ph.D.
Program Manager for Weapons Systems and Platforms
Strategic Environmental Research and Development Program (SERDP)
4800 Mark Center Drive, Suite 16F16
Alexandria, VA 22350-3605
Phone: 571-372-6399
E-Mail: Robin.A.Nissan.civ@mail.mil

For Core proposal submission due dates, instructions, and additional solicitation information, visit the SERDP website.