SON Number: WPSON-23-C4 **28 October 2021**

Strategic Environmental Research and Development Program (SERDP)

FY 2023 STATEMENT OF NEED

Weapons Systems and Platforms (WP) Program Area

RECYCLING AND REUSE OF REFRACTORY ALLOYS FOR ADDITIVE MANUFACTURING

1. Objective of Proposed Work

The objective of this Statement of Need (SON) is to develop methodologies to reuse and recycle strategic refractory metals utilized for additive manufacturing (AM). Refractory alloys of concern include tantalum, niobium, molybdenum, vanadium, tungsten and rhenium, or a combination thereof. We seek projects to explore one or more of the following issues related to AM metal powders:

- Feasibility of using recycled refractory metals
- Changes in the metal powder chemical composition
- Metal powder morphology and microstructure
- Flowability/rheology of metal powders
- Mechanical properties
- Internal defects (i.e., porosity)
- Surface roughness of AM builds utilizing these recycled powders

Scrap refractory material for this work can originate from current AM waste streams (i.e., unused/remaining AM powders, support structures and/or unusable parts with defects), or from scrap resulting from traditional manufacturing processes. Proposers should highlight how they intend to condition the scrap material to control the formation of oxides and hydroxides in the resultant AM powder, to enable high quality AM builds with minimized defects.

2. Expected Benefits to the Department of Defense (DoD)

Research supported under this SON may lead to optimized additive manufacturing processes using recycled refractory metals, while creating less reliance on the ore deposits of politically volatile nations. This work will benefit the environment in the long run due to less mining of minerals critical AM and the associated reduction in pollution.

3. Background

The use of refractory metals has been steadily increasing worldwide, with various applications in the aerospace, electronics and nuclear industries. However, traditional manufacturing using these alloys is limited due to high cost, a limited supply of commercial shapes, and difficulties in fabrication. For this reason, AM shows promise in increasing the use of these alloys for these many diverse applications. Although recycling is an on-going research area for many of the

materials used in AM, only limited research has been undertaken involving use of recycled refractory metals.

Recycled metal scrap may be oxidized, and not be of a uniform or homogenous composition. In addition, methods used to turn scrap metals into AM powders may result in defects that result in downstream structural issues. Whereas many of these issues have been resolved concerning aluminum alloys and or steel, this is not the case for refractory metals.

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

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For Core proposal submission due dates, instructions, and additional solicitation information, visit the Funding & Opportunities page on the SERDP website.