

Topic: N142-125

Sciaky, Inc.

Affordable Manufacturing of Refractory Metal Components

Starting from a 3D model, Sciaky Electron Beam Additive Manufacturing (EBAM™) technology uses an electron gun to deposit wire feedstock, layer by layer, until the near net shape “preform” is complete. Sciaky’s primary business is selling precision EBAM and welding systems. EBAM shows great promise for refractory metal applications on the Trident D-5 missile program. SBIR testing results show elevated temperature tensile properties exceed OEM values by 150% and can allow both legacy and new components to be manufactured in a cost effective manner. Demonstrations to date have shown process capability to produce geometries common to actual hot gas valve assemblies. Sciaky’s goal for this project is work with the US Navy to fully qualify EBAM for use on the Trident D-5 missile programs.

**Technology Category Alignment:**

Materials & Manufacturing Processes

Propulsion and Extreme Environments

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**SYSCOM:** SSP

**Contract:** N00030-18-C-0226

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=N00030-18-C-0226](https://navystp.com/vtm/open_file?type=brochure&id=N00030-18-C-0226)

Department of the Navy SBIR/STTR Transition Program

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SSP: 14 Nov 2018

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WHO

SYSKOM: SSP

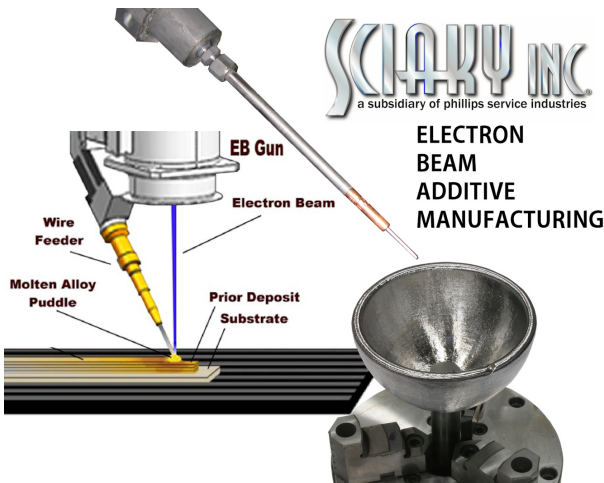
Sponsoring Program: TRIDENT II (D5), ACAT I

Transition Target: TRIDENT II (D5), ACAT I

TPOC: SSP.SBIR@ssp.navy.mil

Other transition opportunities: Low cost and rapid manufacturing of refractory metal components for strategic missile post-boost propulsion systems, hot gas valves, manifolds, and other DoD refractory metal parts.

Notes: The image shows an "as deposited" Tantalum hemisphere with outer diameter of approximately 3.5" (89mm) produced using the EBAM process. Future adaptation to other refractory alloys of interest to the warfighter are planned. This SBIR has developed processes for deposition of refractory materials, demonstrated subscale article fabrication and is conducting design and analysis of relevant hot gas valve and manifold components to be built with advanced additive manufacturing methods leading to full-scale component prototypes.



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WHAT

Operational Need and Improvement: To develop and demonstrate advanced Additive Manufacturing (AM) techniques for lower-cost production of refractory metal components for Navy strategic missile post-boost propulsion systems.

Specifications Required: SSP desires to reduce the cost and skill required to manufacture select refractory metal components through more efficient use of raw materials along with a reduction of machining, multiple setups, and labor hours.

Technology Developed: Sciaky developed Electron Beam Additive Manufacturing (EBAM) using an electron beam gun to deposit wire feedstock, layer by layer, until the near net shape preform is complete. Initial efforts targeted aerospace structures; this efficient in-vacuum process is well suited for reactive refractory metals. For many parts, EBAM will result in lower cost and faster lead times compared to legacy refractory component manufacturing methods. Sciaky demonstrated that a low cost substrate could be used to initiate EBAM deposition. Since all EBAM systems have 100% EB Welding capabilities, Sciaky also demonstrated welding EBAM preforms together.

Warfighter Value: EBAM processing has the potential to improve support of existing Trident II (D5) missile components and allow greater design and manufacturing choices for future missile programs, e.g., "light weighting", having better properties than existing material inputs. Potentially significant cost and lead time reductions can be accomplished requiring only some basic material inputs be maintained in stock. Compared with legacy production methods, material waste will also be reduced which is important as refractory materials are very expensive.

WHEN

Contract Number: N00030-18-C-0226 Ending on: May 6, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I SBIR - EBAM Affordable Manufacturing of Refractory Metal Components	Low	Key performance metric - elevated temperature mechanical properties excellent	4	August 2016
Phase I Option - EBAM Refractory Materials - Properties confirmed	Low	Elevated temperature properties confirmed excellent, Cost effective substrate verified	4	June 2017
Phase II SBIR Design Review Complete	Low	Sciaky, USN, and key industrial team members aligned	4	December 2017
Phase II SBIR Hot Gas Testing and materials assessed	Med	Verify we are meeting or exceeding design values?	5	January 2019
Phase II Demonstrator Component Fabrication	Med	Does EBAM demonstrator meet geometry and metallurgical requirements?	5	May 2019

HOW

Projected Business Model: Sciaky's current business model is to sell EBAM and Electron Beam Welding systems. Leading to the systems sales, Sciaky has developed the EBAM process technology, and we take on a wide range of critical EBAM development programs for both commercial and government programs. Our success on these development efforts leads directly to machine quoting and sales opportunities.

Company Objectives: The company objectives relating to this SBIR are to succeed through the process development with the refractory material EBAM process development to a point where we can sell EBAM systems into the supply chain, the end user / OEM, or both. It remains possible that one of our SBIR team members on this program; Lockheed Martin or ATI could recognize the value of EBAM processing and pursue a system for refractory materials.

Potential Commercial Applications: Refractory materials are utilized in a wide range of thermal barrier protection applications by several industries including rocket / missile / space propulsion, oil / gas, jet engine, etc. Additional refractory alloys are planned to be incorporated into the SBIR Phase II Option, and could open up other markets and opportunities.

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