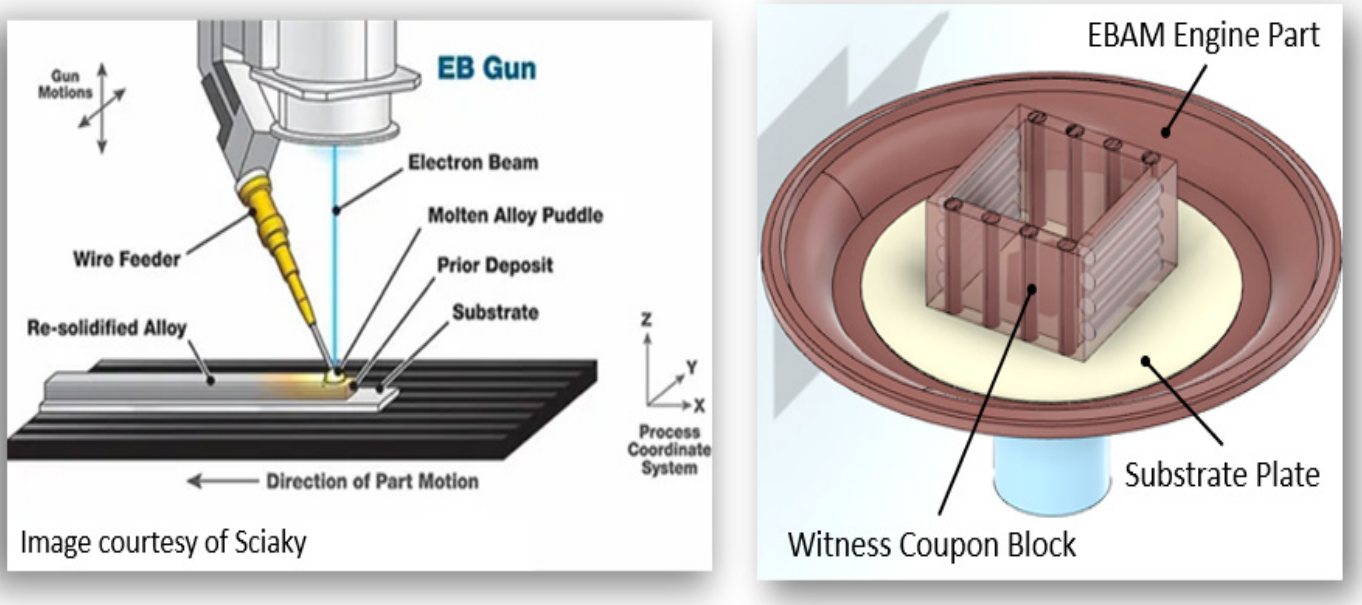
PROJECT SUMMARY 5523

Electron Beam Additive Manufacturing (EBAM) Engine Part Manufacturing and Testing



Sciaky EBAM print head (left). Proposed engine part print setup, including witness block (right).

PROBLEM

Legacy military engine systems frequently encounter supply chain challenges in the procurement of sustainment parts. These challenges can come in the form of lost or damaged tooling, supplier de-prioritization due to small lot sizes, or high prices generated by special set-ups. Besides being expensive, these issues can cause delays in returning key equipment to the field. Viable alternative methods of part production are necessary to meet replacement part requirements in a timely and cost-effective manner.

OBJECTIVE

This project seeks to understand if electron beam additive manufacturing (EBAM) could be developed into a viable, alternative means of sourcing engine hardware and other ground vehicle sustainment needs, particularly for low volume legacy parts. The specific aim of each iteration is to improve the microstructure as well as minimize the size, quantity, and distribution of process-related defects. The objective is to explore the degree to which the material properties generated from the EBAM process can meet the product requirements of the part being studied, as well as similar part families.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

DESIGN

ASTM PROCESS CATEGORY
Directed Energy Deposition

EQUIPMENT
Sciaky EBAM 150

MATERIAL
Inconel 718

TECHNICAL APPROACH

The team proposes to design and evaluate an EBAM-based manufacturing process for an Inconel 718 component from the Honeywell AGT1500 gas-turbine engine used on the M1 Abrams family of military battle tanks. Beginning with an initial CAD model for the hardware and a definition of the product requirements delivered by Honeywell's AGT1500 engineering team, the project team is procuring feedstock, identifying machining, heat treat, and hot isostatic pressing (HIP) suppliers, and then proceeding into a series of three development builds utilizing the EBAM 150 system operated by FAMAero. The product of each EBAM build undergoes an inspection to characterize the quality of the surface and the bulk material. The data gathered during each build and inspection informs design improvements for the next build that FAMAero performs. In addition, mechanical test samples accompany each build lot to evaluate the mechanical properties of EBAM Inconel 718 against the Honeywell AGT1500 engineering requirements for the hardware. The Honeywell engineering team plans to use the data and observations of the development process to grade the suitability of EBAM as an alternative manufacturing method for the component under evaluation and other possible future applications.

PROJECT START DATE

September 14, 2021

EXPECTED END DATE

September 30, 2022

EXPECTED DELIVERABLES

- Part production report
- Physical parts for inspection and evaluation
- Final report

FUNDING

$221,674 total project budget
($221,674 public funding)

PROJECT PARTICIPANTS

Project Principal:
Honeywell Aerospace

Project Participants:
U.S. Army Ground Vehicle Systems Center
FAMAero Inc.

Public Participants:
U.S. Department of Defense