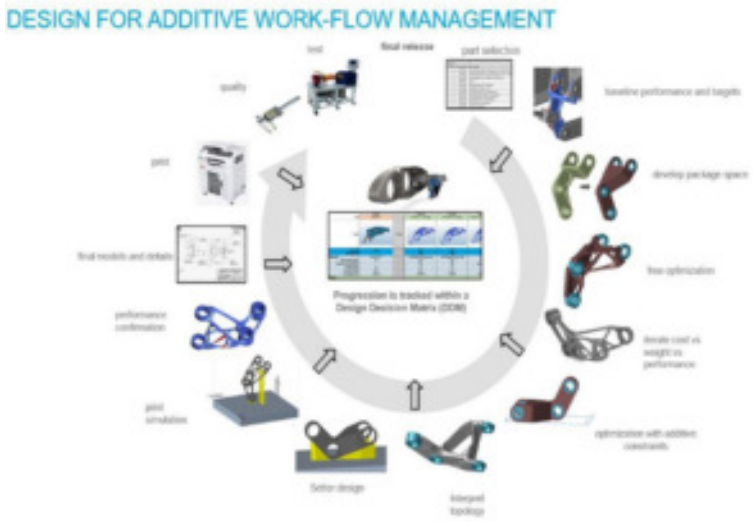
PROJECT SUMMARY 5519.001

Metal Additive Manufacturing & Topology Optimization of Self-Propelled Howitzer System Selected Components



Design for additive manufacturing (DFAM) offers weight savings and the potential for improved performance and sustainment costs for Howitzer self-propelled components.

PROBLEM

The Product Manager Self-Propelled Howitzer Systems (PM SPHS) manages the M109 Family of Vehicles (FoV), a premier fighting system with critical battlefield capabilities. The FoV is comprised of the M109A7 SPH Paladin weighing 86,000 pounds, M992A3 Carrier Ammunition Tracked (CAT) weighing 78,000 pounds, and the XM1299 Extended Range Cannon Artillery (ERCA). The weights of these current fielded vehicles demonstrate the need for minimizing the weight growth of future platforms to prevent affecting vehicle performance, sustainment costs, and the lack of weight space for upgrades.

OBJECTIVE

The objective of this project is to leverage advanced optimization methods, materials, and manufacturing processes to identify SPH parts that can be redesigned for topology optimization and weight reduction. In addition to the weight reduction, a further objective is to provide a viable means of production and improve assembly and quality issues related to current part designs. The successful results for the redesign of these parts could convince the PM SPHS to further invest in a broader effort for associated SPH parts or other ground vehicle parts.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

DESIGN

ASTM PROCESS CATEGORY
Powder Bed Fusion
Binder Jetting

EQUIPMENT
ExOne Sand Printers
Laser Powder Bed Fusion Systems

MATERIAL
Sand Printed Molds

TECHNICAL APPROACH

ALTAIR is working with Army Ground Vehicle System Center (GVSC) to strategically select two parts for topology optimization and weight reduction by utilizing a matrix of various components identified by GVSC that includes parameters such as part size, material, complexity, functionality, interaction with other neighboring components, etc. The parts are being redesigned to meet performance criteria requirements of the traditionally manufactured parts.

The two parts identified as preliminary target parts are the variable recoil assembly-cradle and the trunnion mounting bracket. Additional parts may be considered, investigated, and compared per a down selection process. Baseline technical data packages for the target parts are obtained from Picatinny Arsenal for components within the turret system (above turret ring) and BAE Systems for any component below the turret ring. ALTAIR is leveraging the current data for the parts such as 3D CAD models and mating components, finite element models for relative loads and boundary conditions, 2D drawings, component test reports, and baseline piece and tooling costs with manufacturing times to optimize the redesigned parts. Prototypes of the two parts sufficient to support development testing are being manufactured, but no physical testing is planned. Virtual testing is occurring for part performance with the possibility of simulation testing dependent on the AM process used. Training and training guides outlining DFAM workflows are being developed.

PROJECT START DATE

June 25, 2021

EXPECTED END DATE

September 25, 2022

EXPECTED DELIVERABLES

- Part selection report for each part
- Design decision matrix (DDM) with baseline vs. target part performance
- Prime concept materials and manufacturing study
- Feasibility assessment of redesigned parts
- Redesigned parts concept with cost/weight performance
- Technical data package prototype release
- Final report

FUNDING

$345,426 total project budget
($289,926 public funding/$55,500 private funding)

PROJECT PARTICIPANTS

Project Principal:
ALTAIR Engineering, Inc.

Other Project Participants:
U.S. Army DEVCOM-GVSC
Picatinny Arsenal
BAE Systems Inc.

Public Participants:
U.S. Department of Defense