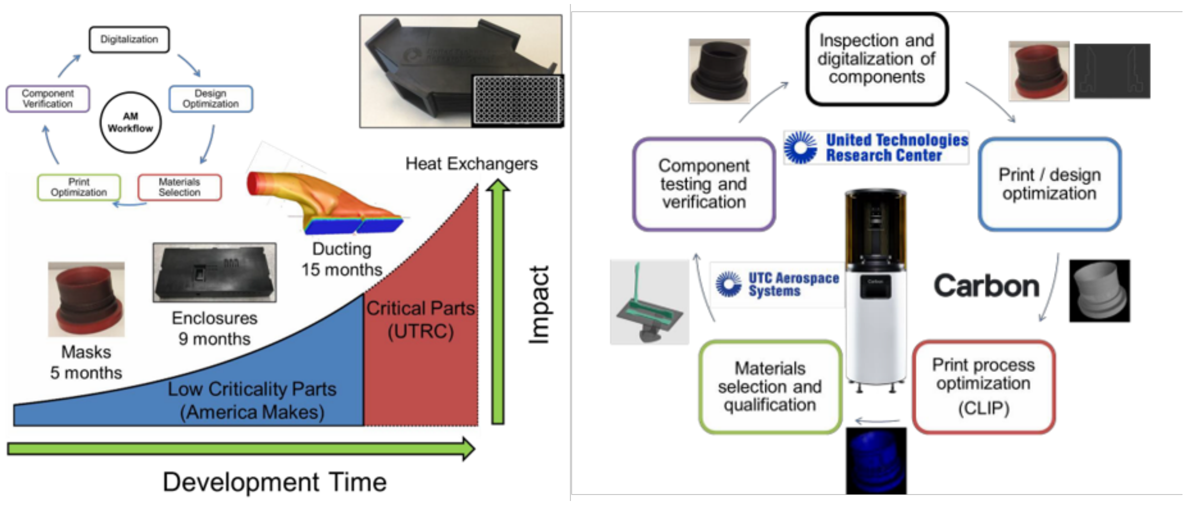
PROJECT SUMMARY 3016

MAMLS Additive Manufacturing of Low Criticality Part Families via Continuous Liquid Interface Production (CLIP)



Production of low criticality parts such as shot peening masks, electrical enclosures, and duct manifolds using Carbon's CLIP process.

PROBLEM

There is substantial opportunity for direct part replacement of low criticality components with additive manufacturing (AM) techniques offering cost savings, faster development-to-deployment, and significantly reduced lead times. The development and certification times of flight or mission critical components can be lengthy due to the vital functions that these components must perform. Current AM processes are limited in their ability to consistently produce parts that adhere to both geometry and performance specifications.

OBJECTIVE

Under the Maturation of Advanced Manufacturing for Low-Cost Sustainment (MAMLS) program, efforts are being conducted to address direct part replacement of flight or mission critical components. Among the newest advancements for polymer AM is the emerging continuous liquid interface production (CLIP) process developed by Carbon. The objective of this project is to assess the feasibility of this emerging technology and suite of materials to enable fabrication of low criticality components that satisfy shape, function, and performance by the DoD supply chain. The project also seeks to demonstrate and document a representative digital AM workflow from identifying a part through the key process steps of final fabrication and validation of a functional component.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

PROCESS

ASTM PROCESS CATEGORY:
VAT Photopolymerization

EQUIPMENT:
Carbon M1/M2 CLIP

MATERIAL:
Carbon EPX, Various polyurethane & Elastomer materials by Carbon

TECHNICAL APPROACH

Three part families are planned to explore the capability of Carbon's CLIP process and material technologies for low criticality AM component fabrication (shot peening masks, electrical enclosures, and duct manifolds). Shot peening masks are being used to investigate the various polyurethane and elastomer material offerings. Most of the aerospace systems require electrical enclosures to protect vital instrumentation from contamination, debris, heat, or other environmental conditions. These enclosures are more complex and require tighter geometric tolerances than masks to accommodate accurate mounting of hardware and an environmental seal. The more rigid carbon materials including polyurethane, epoxy, and cyanate ester materials are being explored in the electrical enclosure family of parts. Finally, the production of duct manifolds is planned to evaluate Carbon's build volumes versus component complexity in relation to the typical sizes of the manifolds.

PROJECT START / END DATE

June 2018 - December 2019

EXPECTED DELIVERABLES

- Print files and printed articles:
  - Shot peening mask
  - Electrical enclosure
  - Duct manifold
- Test data on materials and component performance
- Report on best practices and standard operating procedures for:
  - Digitizing parts and optimizing designs for printing
  - Printing masks, enclosures, and ducts
- Report on assessment on how lessons learned can be expanded to other similar parts within the same family or possibly different families of parts

FUNDING

$900K total project budget
($600K public funding/$300K private funding)

PROJECT PARTICIPANTS

Project Principal:
United Technologies Resarch Center

Other Project Participants:
Carbon

Public Participants:
U.S. Department of Defense
National Science Foundation
U.S. Department of Energy

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