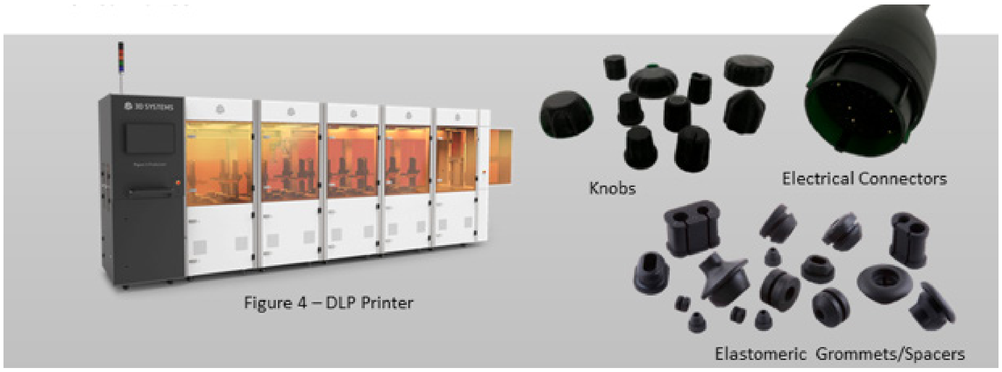
SUCCESS STORY 3017

Program allows for material progression for photo-initiated resins made through Digital Light Processing.

Introduced Materials Lead to More Readily Available Parts



DLP using 3D Systems' Figure 4 system for rapid part replacement for low-critical part families such as knobs, electrical connectors, wire grommets, and spacers.

PROBLEM

One of the biggest challenges for the sustainment community is the need for parts not readily available due to unforeseen replacement demand, lack of suppliers, and cost or lead time of required tooling. In many cases, the return on investment to develop an approach to replace simple low-criticality plastic parts like knobs, connectors, and spacers does not warrant the investment in traditional manufacturing means. Efforts to relieve some of this pressure via fused deposition modeling (FDM) technology have been initiated on MAMLS Phase I and at the air logistic complexes (ALC). The lack of speed, resolution, density, and process controls, however, has limited the parts that are able to be addressed by FDM alone, resulting in lower productivity at the ALCs.

OBJECTIVE

The objective of this project was to evaluate and advance the ability of emerging DLP technology to supply low-criticality components that fulfill sustainment part functions for rapid, custom, and robust parts to reduce stock level requirements and product lead times. The vision was that the technology would supplement existing AM technologies at the ALCs where higher resolution, smoother surfaces, elastomers, or increased volumes are needed. The goal was to quickly scan and print these parts in real-time (hours not days) for just-in-time inventory control of small polymer parts critical to ALC efficiency.

TECHNICAL APPROACH

The University of Dayton Research Institute led the program effort which included 3D Systems Corporation, Northrop Grumman, Orbital ATK, and Lockheed Martin. The Figure 4™ platform by 3D Systems was used to address the need for low-criticality part replacement. The project team demonstrated the utility and benefits of Figure 4™ (DLP) technology; identified and overcame technological and material science challenges associated with DLP through part family-specific testing, characterization, and post-processing; demonstrated rapid part replacement for low-criticality parts of immediate need to ALCs; and established a clear technology development, vetting, and transition pathway for emerging AM technologies like the Figure 4™ model.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP	This project aligns to: PROCESS	ASTM PROCESS CATEGORY	EQUIPMENT	MATERIAL
		VAT Photopolymerization	Figure 4 (3D Systems)	Photopolymer

ACCOMPLISHMENTS

This program was successful in showing how DLP can be used for rapid part replacement. Detailed readiness status and recommendations were collected for several parts according to the following categories: opportunity, material readiness, printability readiness, post-processing readiness, and transition recommendation. Significant progress was made in the manufacture of parts that previously had no avenue for cost-effective sustainment. UDRI and project partners now have more knowledge of DLP and the areas of sustainment or research where this technology would be beneficial. This project also allowed the partners to share drawings, requirements, parts, and other details openly, which enabled quick iterations of parts and opinions from various perspectives.

UDRI worked with project partners throughout the program to develop a transition plan for the parts and technology. Several parts grew from an idea or general need to current applications where the technology is being applied. The backlit panel part family required material that was not yet in the DLP space. Through this program, UDRI was able to communicate to 3D Systems the specific needs of this part family. Because of the work done on this program, the transition of other backlit panels will be more apparent. For example, a partner of Northrop Grumman was having similar issues replacing backlit panels and knobs. Now there is an available material that is suitable for this purpose, and the geometry is proven to be printable with DLP.

PROJECT END DATE

May 2020

DELIVERABLES

- Landscape review article
- ROI and readiness impact summary
- 6X representative prototype parts
- Summary sheets highlighting all known dimensions, materials, and part requirements for all ALC-driven candidate electrical connectors
- 3X base resins that address primary part requirement with corresponding data and safety sheets
- Print parameters for each deliverable resin
- Printed test specimens in accordance with test plan
- Final parts for each family printed at two locations
- Print guide for each part family and resin combination
- Test matrix
- Data and summary reports from performed tests
- Part specific performance testing data
- Down-selection of appropriate post processing treatment for each resin
- Technology transition requirements for innovation centers and ALCs
- Transition pathway consensus review
- Final report

FUNDING

$920,110 total project budget
($600,000 public funding/$320,110 private funding)

PROJECT PARTICIPANTS

Project Principal:
EWI

Other Project Participants:
3D Systems Corporation
Northrop Grumman
Orbital ATK
Lockheed Martin

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