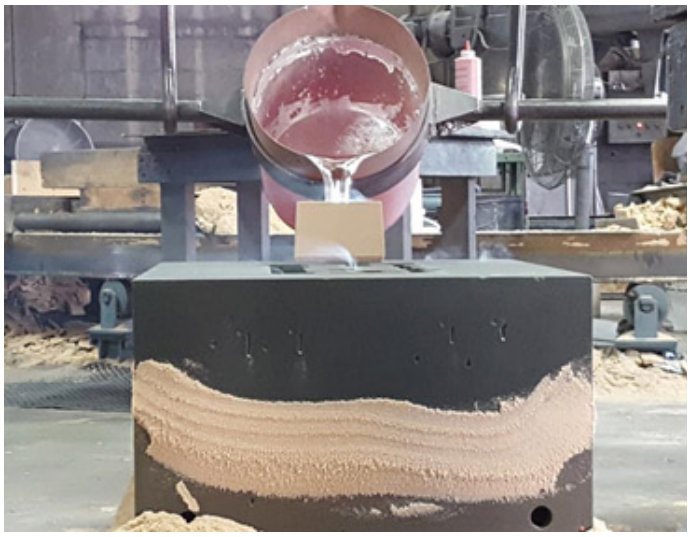
Success Story 3010.001

DoD realized annual cost savings through improved access to AM training

Project increased mission readiness and enhanced sustainment infrastucture for additively manufactured tooling for metal castings



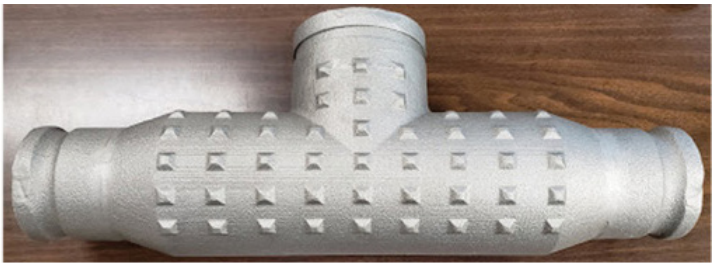


Image of T-Step Pipe cast in aluminum using 3D sand-printed mold and core.

PROBLEM

The U.S. Air Force (USAF) is tasked with sustaining legacy aircraft with an average age of 27 years to continue to operate on their designed missions where many of the suppliers are not in business, out of production, or cannot produce low quantities at an affordable cost and lead time.

OBJECTIVE

This additional Phase 1 work was to continue, transition, and close out effort on the America Makes project "Maturation of Advanced Manufacturing for Low-Cost Sustainment" (MAMLS), Phase 1. The objective of this program was to enhance and improve USAF sustainment operations through the development, demonstration, and transition of additive manufacturing and related advanced manufacturing technologies. The program was aimed at improving the efficiency of the factory and Air Logistics Complex (ALC) for rapid part replacement for legacy and other aircraft, focusing on metal castings and non-critical interior aircraft parts.

TECHNICAL APPROACH

Youngstown State University (YSU) was focused on two main tasks based on the Phase 1 program to continue to transition sustainment solutions to Air Force ALCs and operational unit levels:

- Additive Manufactured Metal Casting Tooling
- Enabling AM for Non-Structural Interior Parts and Operational Level Maintenance

The castings project investigated further improvements in 3D printing sand casting molds and cores to strengthen the tools, reduce the surface roughness in the poured part, and increase the efficiency of this process. The non-structural interior parts project investigated using AM for pattern fabrication in various materials, developed improved shell fabrication options, and compared the parts created using investment casting and sand casting processes. YSU created workshops and training to transition these techniques to the Air Force ALC and operational units.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

VALUE CHAIN

ASTM PROCESS CATEGORY
VAT Photopolymerization
Material Jetting
Binder Jetting
Material Extrusion

EQUIPMENT
ExOne S-Max Sand Printer, Fortus 900-mc, ProJet 2500, Voxeljet, Formlabs Form2

MATERIAL
Sand, Wax, Polymethacrylate, Polylactic acid

ACCOMPLISHMENTS

This program successfully developed additively manufactured solutions for sustainment needs focused on metal cast and non-critical interior parts for USAF and DoD customers, identified and worked with supply chain partners, and transitioned solutions so that the Reserve Units and ALCs use these on legacy aircraft.

As a result of YSU's efforts to develop and demonstrate best practices for additively manufactured metal cast tooling, cost savings and reduced lead times were realized.

Through additively manufacturing sand molds on an S Max sand printer a C–130 step pipe was reduced from seven pieces that needed to be welded together down to a one-piece casting. This resulted in a 7-week lead time reduction and substantial cost savings through eliminating labor costs that resulted from welding. Another focus of this project was to enable additive manufacturing for non-structural interior parts and operational-level maintenance. YSU developed unit-level training and 3D printing capabilities for the USAF which allowed for the ability to print training aids and tools, as well as to increase mission readiness and enhance maintenance sustainment infrastructure. Due to improved access to training, an annual cost savings between $3M-$5M was also attained.

PROJECT END DATE

October 2018

DELIVERABLES

- Transition plan supporting the OC-ALC microfoundry
- Transition plan supporting 910th AW
- Data management plan
- Operational-level workshop
- Best practices for 3D sand printing
- Best practices for Additive Manufacturing Investment Casting Expendable Patterns (AMICEP)
- Best practices for operational-level employment of 3D printing
- Final report with technical data

FUNDING

$1,480,931 total project budget

($1,181,955 public funding / $298,976 private funding)

PROJECT PARTICIPANTS

Project Principal:
Youngstown State University (YSU)

Other Project Participants:
University of Northern Iowa
Youngstown Business Incubator
Humtown Products
BasTech
Lockheed Martin
Boeing

Public Participants:
U.S. Department of Defense