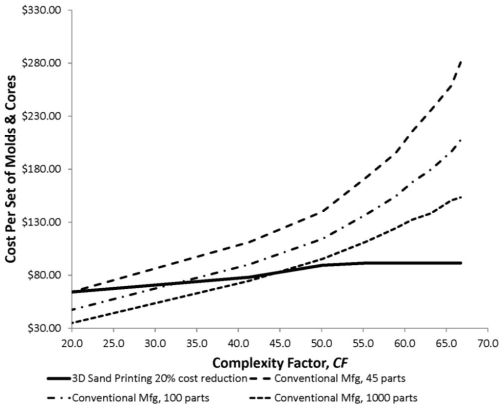
SUCCESS STORY

Improving the Competitiveness of the U.S. Metal Casting Industry with a Mature Additive Manufacturing Technology

Significantly Reduced Time to Market — from Months to Weeks



Humtown Products and University of Northern Iowa Metal Casting Center personnel evacuate the job box from an ExOne S-Max sand printer. This mature technology enables the production of complex castings. The graph on the right depicts findings form Youngstown State University research quantifying the role of part design complexity in using 3D sand printing for molds and cores.

PROBLEM

Metal castings often present a barrier to platform innovation because of long lead times for tooling and associated costs that must be amortized over a platform's life. If our nation desires innovation in the transportation sector and sustained supply chain support for strategic defense platforms, it is important to spur technology integration into the U.S. metal casting sector.

OBJECTIVE

This project focused on accelerating additive manufacturing (AM) technology integration into the U.S. metal casting industry. This project featured training and technology awareness efforts where metal casting organizations could learn about the technology in American Foundry Society (AFS) events, leverage private sector or consortium print services to assess the value proposition of printed tooling and assess the value proposition of participation in regional development of AM enabled metal casting business. Collectively these aspects facilitated industry focus and discussions regarding personnel and capital investments required to fully leverage AM technology to gain market share.

TECHNICAL APPROACH

To accelerate the adoption of AM technology within the foundry industry, the project team led by the Youngstown Business Incubator, followed a disciplined engineering methodology to establish a structured business process to achieve the project objectives.

This project leveraged two academic partners, the University of Northern Iowa (UNI) and Youngstown State University (YSU), to conduct objective research on the technology application advantages of 3D sand printing (3DSP) in concert with the AFS developed case studies and other industry valued workforce and educational outputs to rapidly inform the domestic industrial base regarding printed tooling.

The project team promoted print services from private and public assets for specific industry applications in the defense, equipment, automotive, and aerospace sectors. These industry driven applications were driven by either a need for increased speed to market or the ability to reduce tooling amortization schedules or the ability to print tooling for difficult part geometries as well as platform light weighting efforts.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to:

PROCESS

ASTM PROCESS CATEGORY:
Binder Jetting

EQUIPMENT:
ExOne S-Max

MATERIAL:
High quality Oklahoma sands, Furan binder systems

ACCOMPLISHMENTS

This project resulted in a pivot in the U.S. metal casting industry regarding the integration of sand printing technology to rapidly create tooling for the development of subcomponents like novel car and truck engine designs, space vehicle components, hydraulic assemblies on aircraft, valves for the power & energy community, and difficult to source parts for legacy defense platforms.

As a result of this project the American Foundry Society's industrial members have created an enduring technical committee titled Additive Manufacturing for Metal Casting

(AM4MC) to further transition efforts of the America Makes project and move towards production integration and part design optimization in the U.S. metal casting base.

Key project outputs include focused applied research regarding new printer technology development and more cost effective consumables (binder, regional sands) to enable cost efficiencies required for production application of the technology.

Several industrial OEMs have procured sand printing assets however more defense OEMs and defense managers may benefit from this AM tooling approach to enable legacy platform operational availability and lower sustainment costs.

Key workforce outputs occurred through our partnership with the American Foundry Society and thus education at local, regional and national venues continues to accelerate commercialization discussions.

PROJECT END DATE

March 2016

DELIVERABLES

- Several hardware manufacturers entered the market-place in 2015 resulting in reduced hardware cost and orders of magnitude in printing efficiency
- Best Practices and process specifications disseminated to the supply chain and OEMs
- AFS Ad Hoc Committee to facilitate ongoing knowledge management:
- Complexity Factor Information for Industry
- Academic curriculum for higher education

All downloadable deliverables are available to America Makes members via the Digital Storefront

FUNDING

$1.5M total project budget
($587K public funding/$860K private funding)

PROJECT PARTICIPANTS

Project Principal:
Youngstown Business Incubator

Other Project Participants:
The ExOne Company
XL Pattern Shop
Product Development & Analysis
American Foundry Society (AFS)
Humtown Products
Danko Arlington Foundry
Hoosier Patterns
Caterpillar
Albco Foundry
University of Northern Iowa (UNI)
Trumbull Metals
REFCOTEC

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

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