

GENERAL MOTORS COMPANY

Additive Manufacturing Network Development

STUDENT TEAM:

Benjamin Grogan – Master of Business Administration
Amine Moussaoui – Master of Business Administration

PROJECT SPONSORS:

Ron Daul – Director Global Polymer Center and
Additive Manufacturing
Dominick Lentine – Additive Manufacturing Engineering
Team Lead Faculty

FACULTY ADVISORS:

Jeff Alden – College of Engineering
M.S. Krishnan – Ross School of Business

Additive Manufacturing (AM) represents an opportunity for General Motors (GM) to come closer to realizing the vision of zero crashes, zero emissions, and zero congestion by increasing manufacturing flexibility and agility, improving operational efficiency, reducing supply chain costs, and shortening lead time, all while shrinking the ecological footprint of General Motors' manufacturing facilities around the world.

In 2018, organic innovation by an ad-hoc network of volunteers across the Global Manufacturing organization yielded \$1.6 million in savings by designing and printing over 1100 different tooling solutions and assembly aids. However, great opportunity remains to move the organization from one with a siloed culture characterized by limited communication and capped innovation potential, to a collaborative enterprise that has the intellectual and machine horsepower necessary to reimagine automotive manufacturing processes. The team developed the long-term AM industrialization strategy necessary to change the manufacturing status quo while increasing value capture in three areas: cost savings and operational efficiencies, safety and ergonomic improvements, and shortened lead time to address tooling issues during launch. In an environment where a single vehicle program's tooling costs can run north of \$5 million per week during launch, time is paramount. This strategy encompasses elements of human development, network design, and hardware commonality while reaping the supply chain and capital investment benefits presented by a hub and spoke model.

Human development efforts focus on building a dedicated network of Additive Manufacturing Coordinators (AMCs) across 29 GMNA manufacturing facilities. These AMCs focus on identifying operational issues where AM provides a value-added solution and allow the organization to move upwards along the social adoption curve, transitioning from an enterprise where only distributed early adopters capture value to an enterprise full of operators leveraging this technology to transform the way manufacturing operations are executed. The team's deliverables included the candidate profile required to drive this change, and a training plan, based on industry and Department of Defense personnel development best practices, that will develop the skillset necessary to drive organizational change.

The team's network solution is the conduit of shared knowledge, designs, and innovation necessary to achieve industrialization. It sets forth a scalable manufacturing execution system that utilizes existing and planned capabilities to manage the life cycle process including; order entry, tracking, reprinting, costing, archiving, addressing bottlenecks, optimizing utilization, and improving user experience. Additionally, the team proposed a single-source hardware platform and tailored equipment packages to reduce the corrupting influence of variation across the enterprise while allowing GM to realize the disproportionate value and time savings present during vehicle launch operations (decreasing the time from problem identification to solution implementation from 4-8 weeks to 1-4 days).

This strategy contributed to the approval of a \$26 million investment in GM's Additive Industrialization Center at the Warren Technical Center, which will serve as the company's additive engine. By concentrating capital intensive industrial-level equipment at this central location where it can achieve optimal utilization rates, pairing this with a network that facilitates shared designs and enables on-demand ordering, and distributing the human capital necessary to identify and design AM enabled solutions, the team maximized the company's ability to capture the value opportunity presented by this technology.