



Desktop Metal™

[E-BOOK]

Case Study: **Eaton Corporation**

www.desktopmetal.com



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Overview

Founded in 1911, the Eaton Corporation is a worldwide leader in power management solutions spanning a diverse range of markets, from aerospace to mining to healthcare to automotive. With more than 97,000 employees, Eaton today does business in 175 countries around the globe and boasts annual revenues of more than \$21 billion.

01

The Challenge

Part of Eaton's Industrial Sector, the Vehicle Group produces a wide array of parts intended to improve the overall efficiency, performance and power of everything from passenger cars to commercial vehicles.

Like many other automotive suppliers, Eaton needs to minimize the downtime on their manufacturing lines in order to keep up with the rapid iteration in vehicle design and the massive, world-wide demand for parts.

In addition to tooling and fixturing for mass production, Eaton also produces one-off, custom solutions for customers around the globe.

For Eaton, the question was twofold: How can they quickly re-tool manufacturing lines to reduce downtime, and how can they develop and prototype custom parts for unique transportation challenges?

To find answers, Eaton engineers turned to Desktop Metal and the Studio System™.

02 From Tooling to Replacement Parts

The Studio System™'s impact at Eaton was immediate.

With the ability to quickly print a wide variety of tooling and fixtures - from a complex set of pneumatic jaws used in a gear chamfering process to relatively simple press tools - engineers were able to cut the lead time for tooling by more than 60 percent, from three to four weeks to just five to 10 days.

“The Studio System™ is a key part of our Industry 4.0 additive manufacturing strategy and...is becoming part of the workflow for our global Manufacturing Engineering and tool room teams. (It) is used daily to support our operations globally.

One of the top benefits of the Studio System™ is the ability to produce the manufacturing devices we need at a lower cost and with greatly reduced lead times.

It's opening our minds to completely new design possibilities. Additive manufacturing is challenging our teams to think differently when designing or addressing an issue, opening different design possibilities, allowing us to address issues more quickly, and launching products faster by reducing the lead time needed to set up our internal manufacturing processes.

One of our Senior Engineers in this space said, “Before additive manufacturing I was afraid to fail, after additive manufacturing if you fail it happens quickly and you can also correct the error more quickly.”

—

Alexandre Georgetti

Director, Manufacturing Strategy
Eaton Corporation

At the same time, the system has helped the company significantly reduce tooling and fixturing costs for mass-produced parts - depending on the size and design complexity, printed tools are, on average, between 40 and 80 percent less expensive.

That ability to quickly produce tooling at far lower cost than traditional manufacturing not only enables Eaton to produce a vast range of automotive parts, but also allows the company to quickly retool manufacturing lines as needed, significantly reducing downtime.

In addition to reducing downtime, additive manufacturing has allowed Eaton's designers to explore new levels of design complexity and create parts - like an oil fill nozzle - that include internal channels, allowing for faster testing of parts.

In addition to tooling and fixturing for mass production, the Studio System™ also proved to be an ideal tool for producing custom fixturing. In one case, Eaton engineers used the system to create a custom fixture for testing product development prototypes in Italy.

When it came to printing parts on the Studio System™, Eaton engineers didn't stop at tooling and fixturing.

As with other manufacturing facilities, Eaton must constantly maintain their equipment, and replace parts - like door brackets or chain guides - as they become worn or broken.

To avoid extended periods of downtime while waiting for replacement parts, the company must either keep a large number of replacement parts on hand or pay a premium to have the parts made quickly via traditional methods.

The Studio System™, however, offered a third option.

Using 3D scans of parts, Eaton engineers were able to reverse engineer models of several parts where drawings were not available and adapt existing designs for printing.

Using the Studio System™, they were then able to produce replacement parts in just days - far faster than traditional manufacturing - allowing Eaton to return the equipment to service faster. The printed parts were also significantly cheaper - in some cases by more than 90 percent - than their traditionally-manufactured counterparts.

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Why Desktop Metal?

Though Eaton had years of experience using polymer printers, the company last year began searching for a metal 3D printing system that could support their shop floor.

The company chose to invest in the Studio System™ due to its ability to significantly reduce the cost and lead time to produce tooling and other parts, as well as its ease of use and office-friendly design. Since it uses no loose metal powders or dangerous lasers, operators don't need personal protective equipment.

With the ability to address customer needs faster and iterate on parts quickly, the system is now a standard part of the workflow for both the Engineering and Tool Room teams, and is used daily to support operations around the globe.

The system has become so successful that Eaton is now exploring the idea of investing in binder jetting technology for production parts.

04

Part Fabrication & Comparison

The parts Eaton has printed thus far fall into four broad categories - gripping components, testing fixtures, tooling and replacement parts. While many of the benefits of additive manufacturing - lower lead times and costs, greater complexity, internal features - apply to both, each also benefits from 3D printing in specific ways.



Part Fabrication & Comparison

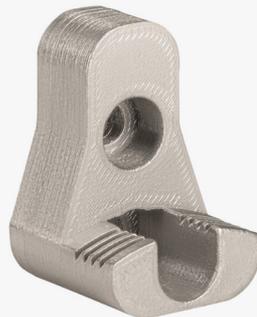
Gripping Components

Since many of their traditional manufacturing machines run around the clock, Eaton engineers strive to increase their productivity. One approach has been to automate some processes, including using robotic arms and custom grippers to hold workpieces during loading and unloading. Printing grippers resulted in dramatically reduced manufacturing lead time, part cost, while simultaneously reducing the logistical and operator burdens of traditional manufacturing methods.

[Part Example]

Robot Gripper

This gripper is used to automatically load a gear hobbing machine so it can perform a gear chamfering operation.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

90%

[Part Example]

Gear Tooth Chamfer Chuck Jaws

This is a pneumatic jaw for a gear tooth chamfering machining operation.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

79%

[Part Example]

Main Shaft Gear Robot Gripper Pads

Wear contact pads used on load / unload automation devices.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

89%

Part Fabrication & Comparison

Testing Fixtures

Before shipping products to customers, Eaton conducts regular tests to ensure their products meet stringent standards and work as intended. Many of those tests demand unique fixturing which is almost always produced in low volume. Printing those fixtures using the Studio System™ has proven to be a significant value-add, allowing Eaton to save both time and money, and to significantly reduce the logistical burden associated with traditional manufacturing methods and supply chains.

[Part Example]

Product Testing Fixtures

Testing fixture device for product development prototypes

Printed with Studio System™



[Material]

17-4 PH Stainless Steel

[Part Example]

Gear Lab Coupling Fixture

Fixture to allow parts to be measured at gear lab measurement machines

Printed with Studio System™



[Material]

17-4 PH Stainless Steel

[Cost Saving]

84%

[Part Example]

Test Stand Oil Fill Nozzle

Assembly end of line tester component to faster fill oil to product during tester process

Printed with Studio System™



[Material]

17-4 PH Stainless Steel

[Cost Saving]

94%

Part Fabrication & Comparison

Tooling Components

Many high-volume manufacturing processes rely on hard tooling, which are generally among the expensive parts - both in money and time - parts to produce. By printing that tooling using the Studio System™, Eaton has greatly reduced manufacturing lead times and costs for these tools.

[Part Example]

Gear Stamp

Stamp used for parking marking during the gear manufacturing processes



Printed with Studio System™

[Material]

H13 Tool Steel

[Cost Saving]

92%

[Part Example]

Assembly Bearing Press Tool

Assembly press tooling to press bearings into gear box housings



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

86%

[Part Example]

Shaft Press Plate

This fixture is used to assist during the pressing of a shaft into the inner race of a bearing



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

66%

Part Fabrication & Comparison

Replacement Parts

Like any other manufacturer, Eaton faces a challenge in dealing with the replacement of maintenance, repair and operations (MRO) parts. As parts wear out or break, they must be replaced quickly to get manufacturing processes back up and running. Printing those parts allows Eaton to produce parts in days that would otherwise take weeks, reducing manufacturing downtime. This accelerated manufacturing lead time, reduced part cost, and reduced logistical burden for Eaton's employees is essential to their MRO work, getting machines back up and running faster and more efficiently.

[Part Example]

Furnace Chain Guide

This part is used for guiding a chain on a conveyor belt that is used for loading and unloading of a furnace.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

65%

[Part Example]

Furnace Door Bracket

Furnace door bracket which attaches to a rotating cylinder. Used to open / close the furnace door.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

77%

[Part Example]

Furnace Door Stop

A doorstep for one of Eaton's industrial furnaces.



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

84%

Part Fabrication & Comparison

Replacement Parts

[Part Example]

Buss Box Safety Device

Engage buss box switch arm to turn buss box on and off



Printed with Studio System™

[Material]

17-4 PH Stainless Steel

[Cost Saving]

94%

04 Evaluation

At Eaton, the Studio System™ has been a disruptive technology, allowing the company to address customer needs faster, iterate on new designs and improve operations, all while reducing cost.

Beyond cost savings and reduction in lead times, though, the Studio System™'s impact is being felt at Eaton locations around the globe.

Already a key part of the company's Industry 4.0 additive manufacturing strategy, the system is helping Eaton expand their 3D printing capabilities globally.

For Eaton engineers and designers, the impact has been even more profound.

The new capabilities of metal 3D printing has challenged teams to think differently when designing parts, and has opened new design possibilities that allow the company to address issues more quickly and launch products faster.

Said Senior Engineer Alex Abernethy: "Before additive manufacturing I was afraid to fail. After additive manufacturing if you fail it happens quickly and you can also correct the error more quickly."

About Desktop Metal Inc.

Desktop Metal, Inc. is accelerating the transformation of manufacturing with end-to-end metal 3D printing solutions. Founded in 2015 by leaders in advanced manufacturing, metallurgy, and robotics, the company is addressing the unmet challenges of speed, cost, and quality to make metal 3D printing an essential tool for engineers and manufacturers around the world. In 2017, the company was selected as one of the world's 30 most promising Technology Pioneers by the World Economic Forum, and was recently named to MIT Technology Review's list of 50 Smartest Companies. For more information, visit www.desktopmetal.com.

About Eaton Corporation

Eaton Corporation works to improve the quality of life and the environment through the use of power management technologies and services. The company provides sustainable solutions that help customers effectively manage electrical, hydraulic and mechanical power more safely, more efficiently and more reliably. With customers in more than 175 countries, Eaton's 2019 revenues were \$21.4 billion. Worldwide, Eaton has more than 97,000 employees.