Benefits of Additive Manufacture

Carl Gregg
Product and Process Design Specialist

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Additive Manufacture

Parts built by process of adding layers of material as opposed to stock removal in more traditional manufacturing processes such as CNC milling.

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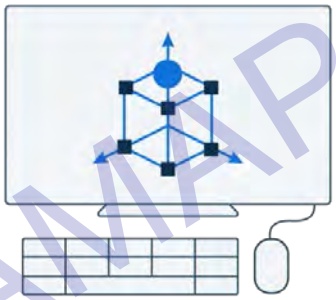

CAD Model

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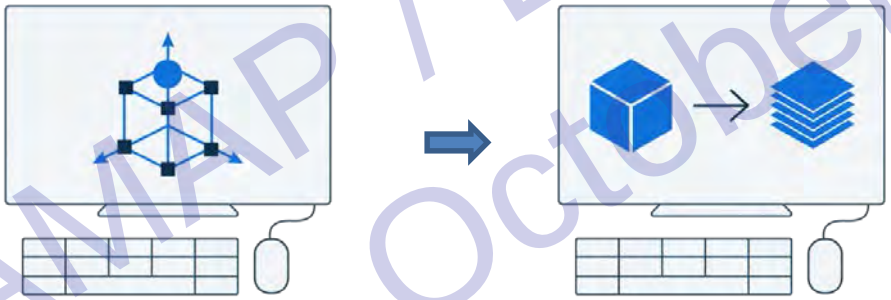

CAD Model Slicing Software

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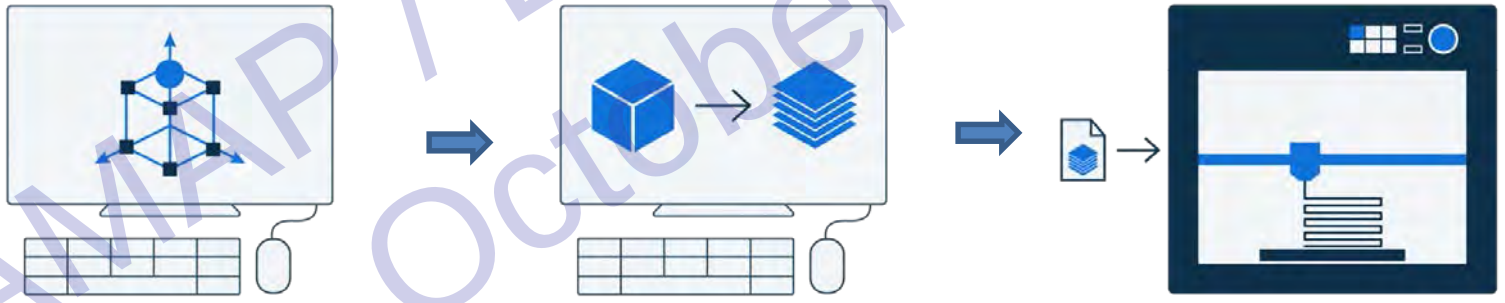

CAD Model Slicing Software 3D Print

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3D Printing at SAM

formlabs

Ultimaker

Markforged

Presented at AMAP AEMCON Forum October 2018

3D Printing at SAM

formlabs

Models: **Form 2**

Technology: **SLA**

Build Volume: **145 × 145 × 175 mm**

Layer height : **24-100 microns**

Benefits: **Very fine details possible**
Range of materials available

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3D Printing at SAM

Ultimaker

Models: **s5 and 2+ Extended**

Technology: **FFF (FDM)**

Build Volume: **330 x 240 x 300 mm**

Layer height : **20-600 microns**

Benefits: **Extensive materials available**
Option of low cost materials
Dual Extruder

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3D Printing at SAM

Markforged

Models: **Mark Two**

Technology: **Composite**

Build Volume: **320 x 132 x 154 mm**

Layer height : **100 microns**

Benefits: **Nylon with chopped CF**
Continuous fibre:
Carbon Fibre, Kevlar,
Glass Fibre

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3D Printing at SAM

Markforged

Models: **Metal X**

Technology: **ADAM**

Build Volume: **300 x 220 x 180 mm**

Layer height : **50 microns**

Benefits: **Prints end use parts in metal.**
Stainless Steel, Inconel, Titanium
Tool Steel, 6061, 7075

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3D Printing at SAM

Two main purposes of 3D printing as part of the project:

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Prototyping parts

As part of a design process, parts are produced to test for fit and function or produced as end use pieces.

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3D Printing at SAM

Two main purposes of 3D printing as part of the project:

Prototyping parts

As part of a design process, parts are produced to test for fit and function or produced as end use pieces.

Prototyping processes

As part of a process review, 3D printers could be tested for use in a workflow e.g. a company is looking to purchase a 3D printer for producing 3D printed jigs in-house.

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Potential uses for 3D Printing

High Fidelity Prototyping

Paralenz

Details at formlabs.com

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Potential uses for 3D Printing

High Fidelity Prototyping

- 20-25 high-quality housing iterations produced in-house in just a few months.
- Paralenz even used the prototypes for tests in a pressure tank and real-life tests diving in the sea. The 3D prints were tested to 150 m in salt water without any problems.
- Estimated over $10,000 saved in outsourcing costs.

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Potential uses for 3D Printing

End Use Part (in consumer product)

Black and Decker

Details at markforged.com

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Potential uses for 3D Printing

End Use Part (in consumer product)

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Potential uses for 3D Printing

End Use Part (in consumer product)

- Redesign of actuator part for 3D printing.
- 20x faster to produce, reducing lead times by 95% indicating overall lead times for annual output cut by 69%
- 12x cheaper than machining, cost for single component reduced by 92%

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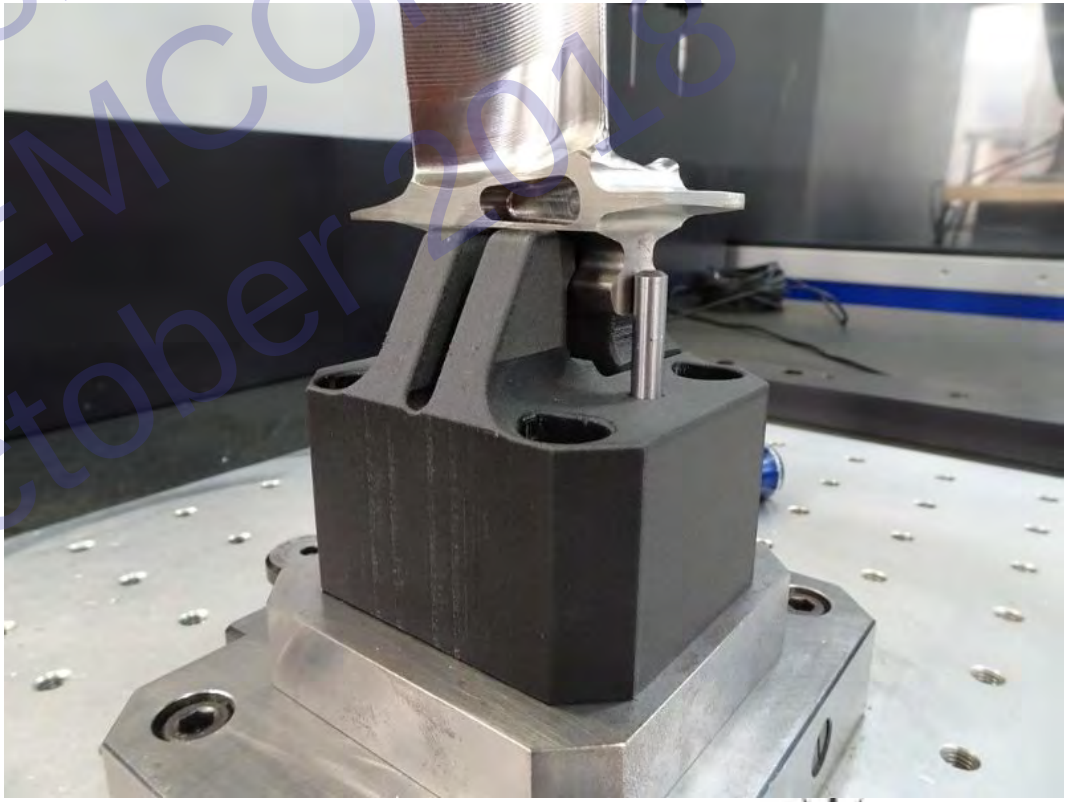
Potential uses for 3D Printing

Jet Turbine CMM Fixture

JJ Churchill

Details at markforged.com



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Potential uses for 3D Printing

Jet Turbine CMM Fixture

- Previous methods used high precision, custom machined fixtures.
- Switch to 3D printed fixtures (MarkForged Onyx with Carbon Fibre reinforcement) produced functionally equivalent parts with added bonus of been none marking.

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Potential uses for 3D Printing

Jet Turbine CMM Fixture

- Typical previous machining costs were $1590 with a 10 day turnaround.
- Typical 3D printed equivalent cost are $330 with a 3 day turnaround.
- Saving 70% time and 80% cost.

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Potential uses for 3D Printing

Manufacturing Aids

Volkswagen Autoeuropa

Details at ultimaker.com

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Potential uses for 3D Printing

Manufacturing Aids

- Previously, the design, prototyping and manufacture of aids was outsourced.
- Process was expensive and slow and did not fit with the necessary trial and error approach VW used to develop new tools.
- e.g. Liftgate Badge Jig: previously €400 per part lead time of 45 days compared to €10 per part with 4 day lead time.

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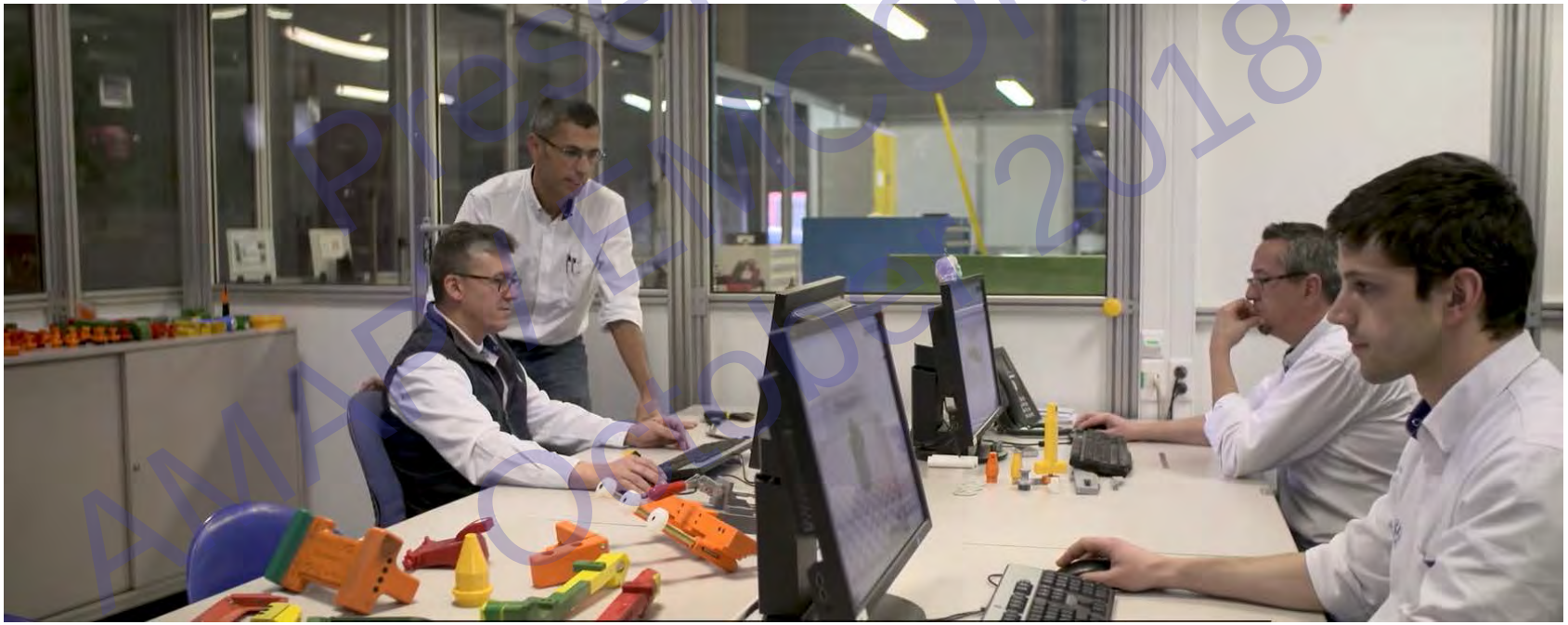
Potential uses for 3D Printing

Manufacturing Aids



In-house team at Pilot Plant in Volkswagen Autoeuropa, Portugal

Presented at AMAZE/EMCON Forum October 2018

Potential uses for 3D Printing

Manufacturing Aids

- After initial trial of a single desktop printer, VW plant now has a seven machines that are used to produce items in-house.
- Transition to 3D printing has reduced development time by 95% and costs by 91%.
- 2017 savings circa €325,000.

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More Info

Manufacturer Websites (used for case studies):

www.MarkForged.com

www.Ultimaker.com

www.FormLabs.com

Other industry resources:

www.ge.com/additive/additive-manufacturing

www.3dprintingindustry.com

www.all3dp.com

www.3ders.org

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