

CREAT3D CASE STUDY

**3D PRINTING
BECOMES PART
OF PRODUCTION**



> CHALLENGE

How to optimise faster manufacturing of the highest quality fasteners for the Aerospace industry, whilst maintaining stringent standards and produce at a lower cost across multiple variants.

> WHY CREAT3D

CREAT3D have helped to shape LISI's Additive capabilities through applications engineering and advice. Introducing the Markforged technology through a series of prints, the team were able to test and validate.

> SOLUTION

Introducing Markforged Composite 3D printers into LISI AEROSPACE's Additive Manufacturing capabilities.

> RESULTS

"3D Printing is becoming a part of everyday production" Kamil Domski, Production Engineer

- > Direct ROI in just 6 months
- > Zero scrappage costs through using 3D printed components
- > Set up of Supply Point Systems with approved 3D printed tooling and components
- > Better performing, cross-functional teams with an ability to identify and fix issues earlier in the production process
- > Fast problem solving for productive and agile production lines, reducing down time and scrappage

> ABOUT LISI AEROSPACE

LISI AEROSPACE, headquartered in France, is in the top 100 companies in the global aerospace value chain and specialises in the design and manufacture of high-tech metal components to enhance aircraft safety and performance. LISI AEROSPACE is a recognised player in metal components for aircraft engines and airframes, and the parts produced by LISI feature in the majority of the world's aircraft and at every stage in their life cycles, serving more than 300 customers in 30 countries.

LISI AEROSPACE's manufacturing plant at Rugby, UK, specialises in the manufacture of fasteners for the aircraft industry, providing fasteners for key clients including Airbus and the Civil Aircraft market. Key criteria for the manufacturing team are performance excellence, safety and innovation.

The manufacturing unit produces numerous variants of fasteners every day, split into 3 core departments: Feeder (raw materials), Manufacturing, Plating Testing and Dispatch.

Having started with Ultimaker FFF printers, the teams in Manufacturing and Plating have recently enhanced their Additive capabilities with the addition of multiple Markforged Composite 3D printers.

Here we share the story of the Manufacturing department's successes with Additive Manufacturing.

> MEET THE LISI MANUFACTURING TEAM

Daniel Bostridge

Production Manager High Volume 1 and High Volume 2

"When you can so easily see the improvements from applying Additive, it just makes you want to drive forward and change everything! There is so much more we can do, and applications we aren't even aware of yet"



Kamil Domski

Production Engineer

"3D Printing is becoming a part of everyday production. We will never go back to operations without Additive. We are just going to use it more and more, identifying more parts and applications that can be 3D printed"



> THE CHALLENGES

The plant produces various types of fasteners. Typically, between 95-98% of fasteners are produced in Titanium, however, a small percentage of parts are made in Steel. Producing a range of fasteners, LISI AEROSPACE have a huge challenge, with a high number of variants within each product category.

> Challenge 1: High volume of variants

To reduce the number of change overs required, the production lines are set by the diameter of the fastener. However, there are a huge number of variants of products and in addition bespoke and fast-track batches are often ordered by clients at short notice, requiring agility and fast problem solving.

> Challenge 2: Safety

Due to the nature of the Aerospace industry, the manufacturing unit operate to very tight tolerances and stringent testing, so any processes must meet these standards.

> Challenge 3: Timely delivery

Time is of the essence! Delivery to the customer on time is very important. As a Tier 1 Supplier to Aerospace and Civil Aircraft markets, LISI must be able to deliver on production schedules to ensure manufacturing at their clients' sites is not impacted. Keeping the production lines running effectively is essential.

> THE SOLUTION

Having worked with LISI for over 5 years, CREAT3D have helped to shape LISI's Additive Manufacturing capabilities through applications engineering, training and advice, tailoring their Additive solution across multiple departments, resulting in immediate savings and cross-functional team benefits.

Having started with Ultimaker FFF printers, in 2020 the teams in Manufacturing and Plating enhanced their Additive capabilities with the addition of multiple Markforged Composite 3D printers.

The Ultimaker machines have been used for prototyping and product development.

The Markforged range of machines using the continuous fibre reinforcement technologies, are needed to produce tooling for the production lines.

Additive Manufacturing Equipment include:

- > 5x Ultimaker 2/2+ FFF machines
- > 4x Markforged Desktop Composite machines
 - 3x Onyx Pro
 - 1x Mark Two



> THE RESULTS

To meet the requirements of the 3 key issues of High Volume of Variants, Safety and Timely Delivery, LISI AEROSPACE have embedded Markforged 3D printers within the department to produce bespoke and replacement tooling and components for the production lines, as well as functional prototypes for design development and testing.

- > The result?** The team using Additive have enabled:
- Fast problem solving and higher productivity, with less damage, wastage and downtime
 - The ability to identify and fix issues earlier on in the production process
 - Improved preventative maintenance for reduced stoppages

Here's how...

> Cross-Functional Teams = Faster Problem Solving

The Manufacturing Team at LISI AEROSPACE are a central point to all teams at the plant, with daily requests for tooling, components and functional prototypes.

The Process Development Department has an ongoing requirement for 3D printed tooling. From jigs and fixtures and stability jaws for use in machining operations, through to 3D printing accurate prototypes before they are manufactured in metal.

The Manufacturing Department are adapting and improving the performance of the production lines with 3D printed jaws, separators and jigs.

This sharing of designs, feedback, collaboration and cross department communication has enabled fast problem solving and improved productivity across the whole business.

> 3D Printed Tooling in Supply Point Systems

"3D printing is part of everyday production, especially for jaws across the lines", explains Kamil Domski, Production Engineer.

The Markforged machines, with the use of the non-marring Onyx material (Nylon with micro carbon fibres) and the ability to produce wear resistant and high-strength parts is the success behind the development of such a breadth of 3D printed tooling.

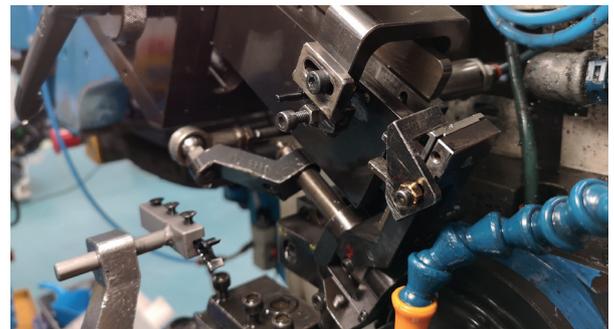
Such is the reliance and demand on 3D printed tooling and components, the team have set up Supply Points in each of the departments. These "vending machines" control a stock of 3D printed components and tooling that technicians can freely access including bespoke jaws, separator fingers, jigs and end of arm effectors.

The Supply System will advise the Manufacturing team when stock is low and re-prints are then printed on demand. This system enables not only an immediate and continuous supply of essential components to keep production running, but also enables consolidation and control over approved designs and parts, ensuring stringent quality controls are met.

> Huge Savings on Quality (Scrappage Costs)

An unexpected benefit of moving to 3D printed separators, is huge cost savings from a reduction in scrappage (reduction in non-quality parts). A change to 3D printing one separator, resulted in scrappage costs dropping to £0.

SEPARATOR FINGER



COMPONENT USE

Separator to move fasteners in the groove process

PROBLEM

1. Metal finger had a high risk of causing damage to fasteners, resulting in £000s scrappage costs
2. Supplied only by the original machine manufacturer, in Stainless Steel. Not readily available as spare part

OUTCOME OF USING ADDITIVE

1. Solution

Separator finger re-designed and 3D printed in Onyx on the Markforged, at a cost of just £0.05

2. Outcome

Since replacing the line with the 3D printed finger:
 > **£0 scrappage costs** and **zero damage**

> ROI IN LESS THAN 6 MONTHS

The number of 3D printed applications that the Manufacturing Team are discovering at LISI AEROSPACE is constantly rising. The commonality across all applications is the immediate benefits in terms of cost and lead time savings. Bringing this AM in-house has realised huge savings with LISI, already seeing return on investment on two printers in under 6 months.

STANDALONE SAVINGS

TOOLING

£4,700 manufacturing costs saved across 40 parts in just 3.5 months



HOLDING JAW



COMPONENT USE

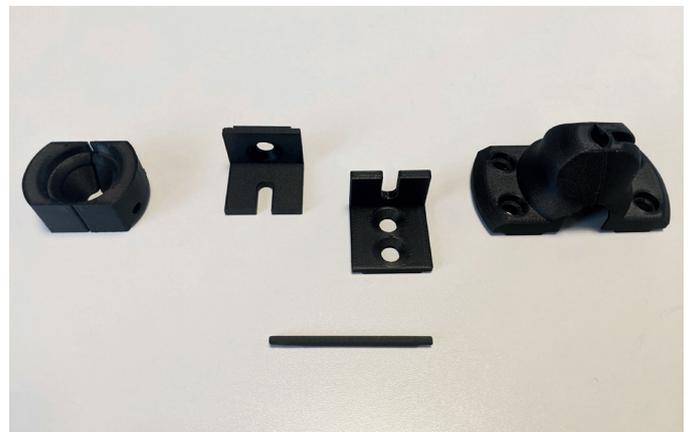
Supporting jaws to hold fastener during the DPB process

PROBLEM

1. Fast rotation of metal jaws causes damage to fastener
2. Produced by the original machine manufacturer in Stainless Steel. Approx. cost to machine £180
Lead time to source from supplier 2-3 weeks

OUTCOME OF USING ADDITIVE

- Switched away from metal, to 3D print in Onyx:
- > Part is more lightweight (longer term operation)
 - > Jaws no longer damage fastener (Onyx is non-marring)
 - > Cost to **3D print £4.15 = cost saving 97.7%**



Although the 3D printed components have a shorter lifespan than the original metal jaw, the cost-benefits of using Additive outweigh the original part function.

> FUTURE OF ADDITIVE AT LISI AEROSPACE

"We will never go back to operations without Additive. We are just going to use it more and more, identifying more parts and applications that can be 3D printed. Tooling is a key area which will just keep expanding" enthuses Kamil. We like to ask ourselves "Where can we use our 3D printers where we are not currently using them?"

Additive Manufacturing is valued not only on the shop floor, benefiting daily tasks and performance, but also at a strategic level by middle and senior management due to the cost and time savings, with more agility and higher productivity.

LISI's future with Additive highlights the company's approach to being the very best through constant innovation. With further Additive applications expanding through continuous improvement, and the awareness and benefits of using the technology growing within LISI, Additive technologies will continue to be used by the teams as the go-to for solving engineering problems.

We asked LISI, what life would be like without Additive?

"You can't take them away! We would have a big hit on tooling. We'd need to start ordering from metal suppliers, which is very expensive and slow. Plus we'd see quality issues come back" explains Daniel, Production Manager.

"We'd spend more on designing and prototyping. If we don't have 3D printers to verify designs, then we will see a big impact on costs and have to re-order components when wrong" adds Kamil, Production Engineer.



> FIND OUT MORE

CREAT3D Ltd
Additive Manufacturing Solutions Provider

CREAT3D offer Additive Manufacturing end-to-end solutions including: business consultation, independent buying advice, provision of 3D printers and related equipment, tailored training packages, ongoing technical support, servicing and maintenance, repair & business continuity programmes.

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