

CREAT3D CASE STUDY

BESPOKE 3D PRINTED  
TOOLING DELIVERED DIRECT  
TO THE PRODUCTION LINE

CURTISS-WRIGHT ACCELERATE WITH ADDITIVE  
MANUFACTURING IN AEROSPACE



> CHALLENGE

How to create a flexible and agile production line to manufacture bespoke, high quality components in Aerospace.

> SOLUTION

Replacing machined tooling with 3D printed tooling using Markforged Composite 3D printers.

> RESULTS

*"The cost savings have been huge. If we no longer used Additive, Senior Management would immediately ask us why we are spending so much on tooling, and why's it taking so long!"* explains Andy Mainstone, Senior Manufacturing Engineer.

- ROI on a 3D printer in just 2 months
- Lead times cut from 2-3 weeks to same or next day
- Bespoke tooling delivered direct to the production line, without delay to manufacture



## > ABOUT CURTISS-WRIGHT

Curtiss-Wright Sensors UK forms part of the Curtiss-Wright Corporation. Listed on the NYSE, Curtiss-Wright Corporation was formed in 1929, through a merger of companies founded by Glenn Curtiss, the father of naval aviation, and the Wright brothers, renowned for history's first flight. Today, the integrated, global, industrial company is divided into three sections of Aerospace & Industrial, Defense Electronics and Naval & Power.

One of Curtiss-Wright's key business objectives is in driving technology leadership, in particular to become a key indispensable partner to their customers, through providing market leading technologies that reduce their risk and enable their long-term success.

Curtiss-Wright Sensors UK sits within the Aerospace and Industrial division and is based in Christchurch, Bournemouth. With a legacy

dating back to 1903, Curtiss-Wright Sensors UK specialises in the design and manufacture of flight critical components for Aerospace. A broad portfolio of components, found from the nose to the tail of the aircraft, includes precision position sensors, hot air valves used on advanced engine propulsion systems, and a wide range of other solenoids, valves and sensors.

Curtiss-Wright Sensors UK provide high accuracy, critical components for Commercial and Defence Aerospace sectors, Business & Helicopter and Ground Defence. Long-standing clients include OEMS such as Airbus, Boeing, Lockheed Martin and Bombardier.

Here we share the success story of Curtiss-Wright Sensor UK's Operations department with Additive Manufacturing.

## > MEET THE OPERATIONS TEAM

The Operations Team design and produce technical documentation and tooling to support Production and NPI departments. A fast-paced, demanding environment with daily tooling requests coming direct from operators and design engineers, the Operations Team have to be agile and responsive to provide creative, low cost and fast solutions to an array of engineering problems.

### Andy Mainstone

Senior Manufacturing Engineer

"Additive makes such a huge difference to our manufacturing capabilities. One of the biggest benefits is the speed of turnaround using Additive. It gives us flexibility to produce bespoke, complex products for our clients, and fast."



### Pete Netherton

Senior Manufacturing Engineer

"The speed at which we can solve problems is superb. We are made aware of the problem in the morning, and by lunchtime the operator has bespoke tooling to use. It enables us to keep Production moving. I don't know how we managed before Additive!"

## > THE CHALLENGES

Curtiss-Wright have a long-standing reputation for the pedigree of their product, excellent reliability and proven performance in supplying the Aerospace sector. Given the nature of the industry and equipment to which the sensors are fitted, Curtiss-Wright face three key every-day challenges:

### 1. Sensors are made to order

All sensor products are made to order, with design and performance requirements specific to each individual client. An order may consist of a single component.

### 2. Small batch volume needs flexible manufacturing

Curtiss-Wright have to adapt their manufacturing processes regularly to manufacture small batches of sensors, typically from 1 – 50.

### 3. The tooling required for each job differs every time

As each project is bespoke, the tooling needed in production and assembly must also be bespoke. In addition, there are legacy products and one-off product requests that require more complex production processes.

Encompassing all these challenges, is that Curtiss-Wright need to deliver the high-quality end product to their client, and quickly.

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## > THE SOLUTION

Using the Mark Two composite 3D printer from Markforged to produce 3D printed tooling on demand. Printing in Onyx (Nylon with micro carbon fibres), a non-marring material, with the option to add reinforcing Carbon Fibre, the team are able to produce robust, high strength, quality tooling, within hours of the original request.

The team's 3D printer is dedicated to producing on-demand tooling, which has freed up resource in the onsite Machine Shop, which also houses subtractive manufacturing technologies, including CNC machines, laser welders and vacuum forming machines.



## > THE RESULTS

### Bespoke Tooling Delivered “Just in Time”

*“The speed at which we can solve problems is superb! We are made aware of the problem in the morning, and by lunchtime the operator has a bespoke tooling to use. It enables us to keep Production moving, I don’t know how we managed before Additive!”*

explains Pete Netherton, Senior Manufacturing Engineer.

In just over 2 ½ years of owning the Markforged Mark Two, the Operations Team have designed and printed over 600 different pieces of tooling. Ranging from assembly aids, jigs, brackets, orientation and locator jigs, holding nests, blocks, covers, tools, clips, clamps, racks, trays and moulds, the applications are vast and forever expanding.

*“Production now request more tooling because they know we have the Markforged, so we can design and print it immediately, whilst the line is still in operation”*

highlights Pete Netherton, Senior Manufacturing Engineer.

As the demands for 3D printed tooling have multiplied, the Operations Team now has implemented a Tooling Request System that Production can submit their requirements to. In addition, once tooling has been printed, the CAD and print files are categorised and stored, so that they can be easily accessed for repeat jobs or in the future for legacy products. Furthermore, if a tool is lost or broken, it can be quickly reprinted from the system, reducing production line downtime and saving hundreds of pounds in using external CNC contractors.

### Costs Savings Generate ROI in Under Two Months

*“The cost savings have been huge. If we no longer used Additive, Senior Management would immediately ask us why we are spending so much on tooling, and why’s it taking so long!”*

explains Andy Mainstone, Senior Manufacturing Engineer.

The savings achieved from 3D printing tooling in-house resulted in Curtiss-Wright seeing a return on investment on their printer in less than two months.

TEST JIG T216803	
Component use	Jig to hold sensor in place during final testing
Traditional manufacture	CNC Stainless Steel £200-£300 per part 3 weeks lead time
Problem	Sensor is a legacy component, produced in small quantities but requires unique hold for final testing during quality control
Outcome of using Additive	Jig is 3D printed in Onyx (Nylon with micro carbon-fibres) • Print time 13 hours • Cost per jig £33.60 Results in 88.8% cost saving and 97.4% time saving



## Printing Tooling for Improved Functionality

*“With Additive, we can produce more complex parts than machining. We have a real added advantage in design freedom – this is particularly important when we are producing legacy components in really small batch quantities”* highlights Andy, Senior Manufacturing Engineer.

One additional benefit of 3D printing tooling versus traditional machining is that the tooling can be designed to be an exact fit to the shape of the component. Often, tooling has elements such as radiuses that are hard to machine. By 3D printing the tooling, the assembly or production line operator can be assured of an exact fit, reducing error, wastage and resulting in a faster operation.

## Advancing Applications

The quality and accuracy of parts 3D printed on the Markforged, combined with the speed of turnaround and low cost to produce, has resulted in the Operations Team expanding Additive applications to solve problems outside of tooling;

TRANSPORT COVER P216771	
Component use	Protective measure: fitted cover to protect sensor during transit
Traditional manufacture	Not readily available. Product is bespoke to sensor so would be costly and timely to produce via injection moulding
Problem	Risk of sensors coming into contact with FOD (foreign objects and debris), causing damage
Outcome of using Additive	<p>Bespoke blanking plate designed and 3D printed. Each cover fits precisely over sensor product for protection from FOD.</p> <ul style="list-style-type: none"> <li>• Batch of 15-20 3D printed</li> <li>• Cost of 73p per cover</li> <li>• Print time 1 hour 25 minutes</li> <li>• Elimination of transportation damage = reduction in scrappage</li> </ul> <p>Transport cover is 3D printed with instructions engraved during print for batch identity and providing instructions for removal to the recipient.</p>

WIPER REMOVAL TOOL T217172	
Component use	Removal tool provided to end customer to aid in removing sensor from packaging
Traditional manufacture	No alternative available
Problem	Small sensors are fragile and can be damaged during removal from packaging
Outcome of using Additive	<p>Bespoke wiper tool designed and 3D printed to aid customer in easily removing sensor from packing tray</p> <ul style="list-style-type: none"> <li>• Cost of 30p per tool</li> <li>• Removes risk of damage and waste</li> </ul>

## ADDITIVE FULLY EMBEDDED

*“The shop floor is constantly surprised by the quality and speed at which our team can 3D print their requests”* explains Andy. *“Previously, tooling requests may have gone unanswered, or slow to resolve, because they were cost prohibitive, or there was too much demand on the internal Machine Shop. Now, using our Markforged 3D printer, we can deliver solutions to Production the same or next day, whilst manufacturing is underway”*

The speed of turnaround to Curtiss-Wright from the result of integrating Additive into their production processes is incomparable to traditional manufacturing methods.

Previously, using sub-contractor machinists or the internal Machine Shop meant a long lead time (weeks), and high costs (hundreds £ per part). In addition, the amount of additional work required was tying up key resource. In life prior to Additive, designs would have been drawn in CAD, then transferred to drawing sheets with dimensions and tolerances applied. Once submitted to a machinist, they would then interpret a drawing uniquely, or delay manufacture to clarify dimensions.

With the Markforged 3D printer, the Operations Team complete the design in CAD and then send it to the printer. *“This gives us exactly what we want, and faster,* explains Andy, Senior Manufacturing Engineer. *“We’ve learnt to design for Additive so we are getting the best result in the fastest and most economical manner”.*

This streamlining of internal processes as a result of Additive, enables Curtiss-Wright Sensors UK to be even more agile and responsive to the customer demands to manufacture bespoke and complex sensor products, at low volume. Combined with additional benefits of reduced costs, reduced production line down time and improved end product, means that Additive Manufacturing continues to become an indispensable engineering tool.

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### > 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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