

## **HYPER AM:** RAPID TOOLING FOR COMPOSITE MANUFACTURE



### **RAPID TOOLING FOR COMPOSITE MANUFACTURE**

Working with Hybrid Manufacturing Technologies Ltd., MTC used a large flow rate polymer extrusion head integrated with a CNC machine to produce an autoclave composite tooling. A case study part from Meggitt demonstrated the use of the hybrid additive and subtractive manufacturing technology, producing a tool with a significantly reduced lead time and cost.



This revolutionary approach enables lightweight tooling with low thermal mass to be manufactured in a fraction of the time required for conventional manufacturing methods.

**David Wimpenny, Chief Technologist, MTC**



### **THE CHALLENGE**

Composite tooling can be time consuming and expensive to manufacture using conventional manufacturing techniques. This slows product development and prevents an agile response.

Large Format Additive Manufacturing (LFAM) uses material extrusion (MEX) to deposit significant quantities of polymeric material to rapidly build large parts and tools. When combined with a secondary finishing process, such as machining, an excellent surface finish can be achieved.

The most common materials for LFAM are not suitable for high temperature autoclave cycles and therefore new materials needed to be explored to enable a wide range of composite tooling applications.

### **A COLLABORATIVE APPROACH**

- ▶ The polymer extrusion head [AMBIT™ XTRUDE] from Hybrid Manufacturing Technologies Ltd, was selected by the MTC for these trials, as it can be configured to fit most CNC platforms, providing a high degree of flexibility. The relative low cost of the extruder compared to other systems provides a unique solution to produce large parts with minimal outlay.
- ▶ Integration with an existing CNC machine enables a hybrid additive and subtractive approach. Large parts are rapidly produced to near net shape then the working tool surface can be machined back to an excellent finish.
- ▶ Exploring new high temperature materials enables a greater breadth of composite tools to be manufactured for different applications.

## THE OUTCOME

- ▶ The MTC demonstrated the ability to rapidly develop and manufacture composite tooling through using LFAM hybrid additive and subtractive manufacturing.
- ▶ A range of polymer material options were tested for a variety of potential composite manufacturing methods.
- ▶ The MTC produced a high temperature autoclave mould tool using Arnite®, a high performance polymer from DSM, which combines PET and chopped glass fibre.
- ▶ Deposition and machining of the tool was completed in a single set-up on a conventional milling machine fitted with the AMBIT™ XTRUDE head, significantly streamlining the manufacture of composite tooling.

## BENEFITS TO THE CLIENT

- ▶ Using the new approach, composite tools can be manufactured in days rather than months. This enables faster response to new or updated part designs. In addition, this route enables for rapid replacement of tooling which has been damaged.
- ▶ LFAM offers flexibility to use a range of materials to address the needs of different composite manufacturing methods. Specifically of interest is the use of high performance polymers capable of being used in high autoclave cycles.
- ▶ Low capital investment when integrating onto an existing compatible CNC machine.
- ▶ Material usage can be minimised through using this near net shape approach. There is also the potential to recycle material back into feedstock.



Expanding our LFAM material capability to include advanced materials has enabled the MTC to produce elevated temperature autoclave tooling. The streamlined hybrid manufacturing approach has demonstrated the potential reduction in lead time and cost.

**Ollie Hartfield, Project Lead, MTC**



4hrs  
Print time

5hrs  
Machining time

90%  
Potential lead time reduction

Machining stage produces a high quality finish

**IN PARTNERSHIP  
WITH**



MEGGITT

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