

CASE STUDY

Arrowsmith Engineering

DRAMA helps Arrowsmith Engineering find its niche in additive manufacturing

THE CHALLENGE

Arrowsmith Engineering has built a strong reputation as a supplier of high precision machined parts in the aerospace, military and energy industries. In aerospace, it supplies parts to Tier 1 companies and historically has been a preferred supplier for specialised development and small batch parts. The company has invested heavily in CNC machine tools and robotics to keep it at the forefront of subtractive machining technology, and allow it to secure additional higher volume business. Arrowsmith has also been considering how it might grow its portfolio to include additive manufacturing [AM].

In common with many precision manufacturing companies, Arrowsmith was concerned that the high AM capital costs, coupled with the challenges of acquiring the necessary expertise and uncertainties over process validation for aerospace, made it difficult to construct a viable business case. It appeared to Arrowsmith that the payback on any investment in AM would need to be long term, and the speed at which AM technology is changing made such investment decisions extremely difficult. Fortunately, DRAMA was able to bring some clarity to the company's growth plans in a way which allowed it to build on existing skills.

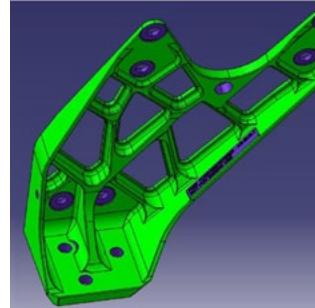


THE OUTCOME

National Centre for Additive Manufacturing (NCAM) engineers visited Arrowsmith to gain an appreciation of the products currently manufactured and the manufacturing processes involved. The visit revealed that the majority of the parts manufactured by Arrowsmith do not have the typical characteristics of good AM components and are more suited to the traditional subtractive machining methods for which they were designed. In parallel with this Product Suitability support package, Arrowsmith attended a DRAMA Business Case training course, and this inspired the company to set out a staged approach to adopting AM, which in the short/medium term would concentrate on the finish machining of AM parts, thereby building on its core strength.

Discussions between NCAM, Arrowsmith and a major Aerospace OEM Prime from the DRAMA Industrial Steering Board (Rolls-Royce Plc) identified an Inconel 718 bracket which, if created using AM, would make an ideal part for Arrowsmith to extend their core machining expertise into AM. In a second Process Development support package, the project team set about developing a finish machining strategy for the bracket. NCAM engineers used AM process simulation to reduce distortion and improve accuracy of the bracket build, and manufactured polymer brackets to aid Arrowsmith with fixturing design. Simulation was used to predict the resultant machining stresses and validate the proposed finish-machining fixturing strategy. NCAM also helped Arrowsmith understand the complete part finishing process chain, to offer a broader commercial proposal.

Using the knowledge gained through this engagement, Arrowsmith were able to finish machine AM brackets produced on two builds, and gain valuable experience in the machining of AM components. Arrowsmith are now confident they have the capability and business offering to move forward with AM.



CAD model of bracket



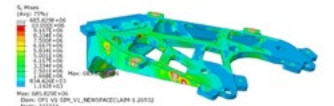
Polymer bracket colour-mapped showing predicted distortion



Feature from fixturing design



AM bracket as built



Fixture simulation showing machining stresses



AM bracket as built



Bracket mounted in fixture



The DRAMA programme provided us with a unique opportunity to develop a sound business strategy for entering the world of AM that allows us to build on our strengths. Working in partnership with a Tier 1 company and AM experts from NCAM has been truly game-changing.

Jason Aldridge, Managing Director, Arrowsmith Engineering Ltd



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DRAMA - a collaboration of eight partners
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