**AMRC**
Design and Prototyping Group

Case Study

The University Of Sheffield.
Advanced Manufacturing Research Centre
BOEING

# Additive manufacture cost comparison to traditional methods for example part

CATAPULT High Value Manufacturing

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# 1 Summary

When the AMRC Design & Prototyping Group (DPG) needed to quickly and accurately manufacture a number of diablo rollers, approximately300mm in diameter, it rejected the idea of using additive manufacturing (AM) because it would not be cost effective, compared to traditional machining methods.

However, a detailed investigation and careful re-design has shown using AM methods could achieve an overall net benefit.

# 2 Background

More than 30 diablo rollers, varying in size and shape, needed to be made as part of a contract secured by DPG to design and manufacture bespoke machinery.

The possibility of making the rollers on DPG's Fortus 900c machine was ruled out because of the potentially high cost, but it was decided to examine the costs and practicalities of making a single diablo roller.

**Figure 1 – Typical diablo roller form**

# 3 Investigation

The lead time for in-house machining was such that it was possible to further investigate the use of AM, taking into account the following factors, unique to the process.

1. **Part requirements and internal structure**

The design parameters were reviewed and it was discovered that there were no significant loads on the roller during service. Consequently, it was possible to alter the roller's solid internal structure to one with a 6mm wall thickness and a 4mm sparse spacing, which was better suited to AM.

**2. Machined part material**

Initial machining costs assumed free issue of material, while the AM costings included material. It was also initially assumed that the correct diameter nylon bar could be sourced, making machining of the rollers easier, but this was not the case. An additional roughing operation was therefore required in order to produce the machined rollers.

**3. Personnel time**

Personnel costs were significantly lower for AM as direct digital manufacturing meant less personnel time was needed during manufacturing, there was no need to produce drawings or arrange part holding discussions etc. Additionally AM could run continuously while traditional machining processes could only be performed during the working day.

**4. ALM and bed size**

Printing several diablo rollers at once using the Fortus 900c machine could lead to additional cost and time savings. Although no cost or time savings are possible when using traditional manufacturing methods to make several non-identical parts concurrently, with AM, both set-up time and overall machining time are reduced.

The table below summarises the timings and costs for traditional and ALM methods:

| | **Traditional Machining** | **AM** |
|---|---|---|
| Original relative cost estimate | - | 545 % |
| Relative cost after optimisation | - | 300 % |
| Relative cost after additional material cost and material processing costs | - | 210 % |
| Machining time estimate total | 22 Hours | 26 Hours |
| Machining time adjusted | Three working days | One working day |
| Additional Engineer time (drawing creation and machining operator support) | One working day | - |
| Relative cost after additional engineer time is factored in | - | 111% |

Table 1 – Summary of production costs and time for ALM and Traditional machining (updated)

# Conclusion

Following careful investigation, the AMRC DPG was able to reduce production time by two working days per roller at a cost premium of just 11%. As 30 rollers needed to be manufactured, this represented and very significant time saving over the course of the project.

This investigation shows that although the cost of using AM to produce parts may initially seem high, the gains in material saving and personnel time often offset this additional cost and considerable time savings can be achieved for a small cost premium.

# Contact

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