

Rolls-Royce Hydroforming

Customer challenge

Hydroforming is a manufacturing process where high pressure hydraulic fluid is used to form material into a complex die shape at room temperature.

Although it is recognised as an established method of manufacture to produce lower strength steel and alloy parts, the full economic benefits for manufacturing large, high strength material aerospace components were uncharacterised.

Rolls-Royce was interested in the possibility of using hydroforming as a lower cost alternative to existing methods of manufacture for high strength aerospace components.

How did the AFRC help?

Working collaboratively with Rolls-Royce the AFRC engineers and researchers devised a project to investigate the benefits of hydroforming.

We used cost modelling techniques to compare hydroforming against existing methods of manufacturing.

Material characterisation data was generated and used as part of a finite element analysis (FEA) model. The model was developed to represent the hydroforming process and aid the manufacture of trial parts.

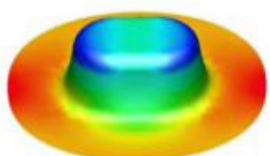
To validate the model, physical process trials were carried out. These trials produced defect free parts with challenging geometry features and form. The trials demonstrated good correlation between the model and the final manufactured part proving the model to be accurate.



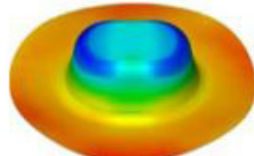
FEA of part



Experimental part formed



FEA of part
thickness distribution



Experimental part
thickness distribution

Business impact

Cost modelling highlighted the potential for a significant reduction in production cost by using the hydroforming process when compared to alternative methods of manufacture.

The project has enabled Rolls-Royce to demonstrate how lower cost, alternative manufacturing processes could be used in the production of increasingly complex aerospace components.

"This project has increased our understanding of the geometric and economic opportunities for hydroforming processes as applied to our aerospace parts. We were impressed by the level of feature definition that was achievable and the benefits of securing accurate and reliable process models were clear from this project."

Dr Steven Halliday
Rolls-Royce Partnership Manager at AFRC

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