CASCADE
ENGINEERING

DEPENDABLE ENGINEERING,
CERTIFIED SOLUTIONS

PROJECT SPOTLIGHT

CLIENT:

PALL®
PALL CORPORATION

Long-term support across multiple projects for Pall Corporation

Having a reliable outsource partner on call has proved invaluable to Portsmouth-based filter specialists Pall Aerospace. With our particular skills and expertise, we have supported the company across projects of all sizes, allowing them to deliver complex systems to a range of customers.

"Our significant experience in aerospace composites makes us a natural partner for this client," says Ben Barrass, MD at Cascade Engineering. "We add value to their projects with our specialist skills – particularly in stress analysis, materials knowledge, modelling and certification capability. This means we are ideally placed to provide additional capacity and expertise when Pall needs it."

Over the past 10 years, we have worked with Pall Aerospace on several projects. These range from full stress analysis for a helicopter turbine inlet air filter system to putting together manufacturing guidelines for composite materials aiding 'build-to-print' companies who may take over the manufacture of these parts.

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Ben Barrass
Managing Director, Cascade Engineering

PROJECT: Complete stress analysis

Cascade was involved in this project over several years and provided the complete set of static stress analyses for a helicopter turbine inlet air filter system. The project included metallic and composite parts of the filter system, fittings to the roof of the helicopter and part of the roof itself. We brought expertise in structural design, finite element modelling and load case development, wrote a formal stress report and made the stress justification to satisfy statutory FAA and EASA regulations.

PROJECT: Component stress analysis

"We were asked to perform a stress analysis of three composite fairings which were being upgraded to a more advanced and reliable method of manufacture," says Rob Harborne, Cascade's Technical Director. "The Finite Element Model was created to model only local regions of the system and we needed to consider the various failure modes of the composite laminates as well as every single fastener joint. Interestingly, the analysis showed a region that was unsatisfactory, but we were able to demonstrate that only one extra fastener joint was needed as a remedy."

PROJECT: Birdstrike and dynamic analysis

Birdstrike poses a significant risk for helicopter air filters. The analysis here needed to assess whether parts could break off or be ingested by the engine in the event of a birdstrike. Pall Aerospace turned to Cascade to build the requisite dynamic Finite Element Model and assess the outcome. Our work also allowed the client to minimise their requirements for physical testing.

PROJECT: Silicone rubber duct

This project involved the use of a silicone rubber material for a duct within an aircraft cockpit cooling system. The material was a novel type of silicone rubber for which material characteristics suitable for modelling did not exist. Cascade developed a certification plan, then commissioned a set of tests of the material from a world-leading test organisation and rose to the challenge of creating a Finite Element model that was thoroughly checked and validated. The detailed report also addressed adverse factors affecting rubber such as durability, creep and ageing.

PROJECT: Guidelines for composite design

For this project, Pall Aerospace asked Cascade to produce a set of guidelines for aerospace applications of composite materials. This was particularly to aid 'build-to-print' type companies that might take over the manufacture of composite parts of their filter systems. The guidance covered design principles, particularly about optimum lay-ups, locating ply boundaries away from critical features and maintaining strength at ply boundaries. It also included a complete range of structural and non-destructive test techniques to ensure detection of manufacturing defects and achieved strength properties. All this was based on our considerable experience of composites: our Technical Director, Rob Harborne, was an Airbus delegated stress signatory for composites on the A350 wing programme for many years.

PROJECT: Stress support for manufacturing programme

"We were asked to support a change of manufacturer for composite parts for another helicopter air filter system," explains David Lewis, Stress Engineer. "We appraised the original stress reports, and the challenge was to maintain their validity despite a change of manufacturer and potentially different material properties. Some of these parts were large and complex in shape, so we needed to consider carefully planned ply boundaries that were away from high stress regions. We devised a strength test programme and analysed the test results, with a successful outcome. At the client's request, we also initiated and managed a set of independent strength tests of the composite materials."

> *"I thoroughly enjoyed working with David and Rob. I would highly recommend Cascade and they were excellent, proactive, engaging and a pleasure to work with."*
>
> **Matt Barber**
> **Senior Aerospace Project Manager, Pall Corporation**

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