Composite Engineering
Project management, design and engineering

Case Study

UAV Aircraft carbon fibre composite components

Project assisted the inventor of the Hoverwing UAV; John Coakley to reduce the weight of this small electric aircraft by incorporating carbon fibre composite structures.

Fig 1. The Hoverwing UAV aircraft

The Hoverwing is a unique remote-controlled camera platform which can hover and swoop in and out of the action to help films like the Bourne Identity, James Bond and Mission Impossible franchises become more real and less reliant on special effects.

The configuration of the aircraft is unique because unlike a normal aircraft, the slower it flies it actually become more stable. Even when it can't keep in level flight any longer, it doesn't stall or lose control, at this point the Hoverwing plays its trump card and switches to hover and that trick is still top secret.

John wished to explore the possibility of manufacturing several components of the aircraft from carbon fibre composite materials. To evaluate this, John turned to Composite Engineering, a design consultancy specialising in the design and development of advanced composite structures, for advice.

The company is assisting John with the project and helped secure DTI support for both a Product and Process review and a Feasibility Study.

Product and process review

During this phase of the project we examined the materials currently employed, these were basic aero modeller materials, balsa and wood construction. These materials were chosen as low cost solutions for prototype development, however they did not lead to an optimum configuration.

John now wished to develop a more representative aircraft utilizing advanced composite materials and he hoped to employ these materials for control surfaces, the fuselage, ducts and various other minor components. This would not only enable him to develop a lighter aircraft, it would also be more robust.

At the conclusion of this study John was supplied with a detailed report, this illustrated that carbon fibre composite components could indeed offer a substantial weight saving on the aircraft and provide more consistent dimensional tolerances on control surfaces; the wings of the aircraft.

Additionally this initial study came to the conclusion that following the necessary investment in moulds and tooling the components would not cost substantially more to produce; owing to a more efficient manufacturing process.

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Feasibility Study

The scope of this study was devoted to investigating relatively low cost advanced composite manufacturing technologies for the main wing and a propeller duct that would provide:

- Components dimensionally faithful to 3D CAD designs – having identical shape and aerodynamic profile
- Light weight components produced from advanced composite materials – having high levels of strength and stiffness
- Relatively low cost CNC machined moulds and tooling

To enable quotations to be sought from potential subcontractors components produced from prepreg carbon fibre composite materials were developed.

Additionally a relatively low cost mould/tooling system was developed, 3D CAD models of moulds and associated tooling were developed, together with 2D CAD detailed engineering drawings. Potential subcontractors were identified, relevant CAD data supplied and budget quotations were received from them.

Conclusion

The study illustrated that it is technically feasible to produce advanced composite components of high quality, faithfully representing 3D CAD data - close dimensional tolerances from relatively low cost moulds.

Additionally the report concluded that it would be possible to produce main wing and duct components from carbon fibre composite, a much more expensive material than currently employed, at a similar cost to the existing foam/balsa components. This would prove to be possible owing to the far more efficient manufacturing process we had developed.