

Since its inception, Great Western Research (GWR) has set about promoting collaborations between the highest quality research groups and the most forward thinking businesses in the South West, in order to support the growth of the region and to demonstrate just what is possible when academics and businesses collaborate.

## A Breakthrough in Aerospace Technologies

GWR's funding of over a dozen PhD studentships in aerospace related research has led to the creation of a progressive intellectual cluster which has stimulated new investment in academic/industrial collaborative research programs. This has also encouraged participation by other groups within the aerospace industry following on from the success of this investment programme.

***"GWR has fundamentally changed the landscape of research in the aerospace industry in the South West. The opportunities which have arisen have moved us into areas we would not have otherwise been able to reach. I can't speak highly enough of GWR."*** commented Dr. Richard Butler, University of Bath

With GWR and Airbus UK jointly sponsoring a total of 8 PhDs working in 4 carefully selected areas, the GWR aerospace research cluster has brought together novel materials and composites with aerospace research groups at departments in Universities across the South West. This research cluster has focused on specialisms spanning modelling, mechanics, actuators, structures and optimisation studies.

One of these partnerships, between Airbus UK, the University of Bath, the University of Bristol, the University of Exeter and GWR PhD students Peter Giddings and Alberto Pirrero, has focused on 'smart materials'.

Smart materials can radically change their shape on application of an electric field. Currently, the large changes in wing profile necessary during take-off, landing and high-altitude flight are generated by hydraulic systems within an aircraft's wing. This may not be the best way to proceed in future aircraft design, however, as smart materials can mimic different wing profiles through the application of a voltage to piezoelectric actuators embedded in these structures.

With some promising results already established, outcomes such as a reduction in weight and improved aerodynamics mean that economic and environmental benefits of reduced fuel burn and CO<sub>2</sub> emissions are possible. Airbus UK now has a firm foundation for research into the future of smart materials. Potential spin-off ventures into other industries may also be possible, with conference papers exciting interest in other areas such as fluid flow and valve design.

Airbus UK have also partnered with the University of Bath, the University of Bristol and GWR PhD student Andrew Rhead to establish a new understanding of how composite structures fail when damaged.

Airbus UK wanted to better understand the damage tolerance of composites to assess their suitability for replacing wing parts in their aircraft. Replacing metal components



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*Dr. Richard Butler*



with composites could lead to weight reductions of up to 40%. Indeed, minute adjustments could prove to be significant, as even a 0.5% reduction of total wing weight could substantially reduce fuel consumption.

This project is highly relevant to the aerospace industry as its findings will enhance the way the material is used, as well as establishing a model to predict the failure of composites in aircraft. Airbus UK have extended their funding of this work beyond the PhD by a further 6 months to encourage Andrew to develop a specific aircraft design concept which has come directly out his PhD research, and could create significant weight reductions within aircraft wing components.

Complementing Andrew's research, a project between Rolls-Royce and Agusta Westland in partnership with the University of Bristol, the University of Bath and GWR PhD student Michael May has also focussed on the fatigue life of components made from composite materials.

The project was based in the University of Bristol's Advanced Composites Centre for Innovation and Science (ACCIS) and outputs from this research are being integrated into Rolls Royce's design processes and will ensure they maintain a crucial technological lead in the market for the design and manufacture of engines and rotor blades.

***"Michael May has done some excellent work developing tools for the analysis of fatigue, more than satisfying my expectations and these will be incorporated into Rolls-Royce's methodologies and used in the analysis of engine components."*** said Adam Bishop - Technical Leader - Rolls-Royce plc

With papers published at several smart materials and aerospace conferences globally, as well as participation in an exhibition in the National Science Museum in London, the depth and range of this work has enhanced the reputation of the South West, bringing together specialist teams in structural composites, non-linear materials and piezo-electrics. The interaction of such varied disciplines within one topic has been piloted by GWR in order to encourage Universities to collaborate with one another alongside industrial partners.

The GWR funding for these PhDs at the University of Bath formed the intellectual foundation for a funding grant from the EPSRC for £250,000 to purchase specialist equipment to accelerate progress. The equipment purchased has, for example, enabled Peter Giddings to move his work forward dramatically by making use of state of the art imaging technology to automatically measure curvatures and shapes of the prototype structures he is investigating.

**The inspiration for the GWR concept is simple - *"The intention is that it should increase interactions between University research groups and business, and therefore build capacity and attract more money for research,"* said Prof. David Billington, Executive Director of GWR - *"It is about ensuring the sustainability of internationally excellent research in the South West and preparing the region for the technologies of the future, by investing in collaborative forward looking research programs."***

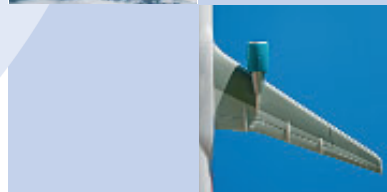
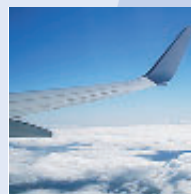


***"Schemes such as this are very important to Rolls-Royce, providing additional funding to allow this research"***

*Adam Bishop - Rolls Royce PLC*

***"It is about ensuring the sustainability of internationally excellent research in the South West"***

*Prof. David Billington*



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