Pioneering research takes to the skies

Lighter, faster, more environmentally friendly jet engines are being created as the result of a collaboration between researchers at the University of Oxford and Rolls-Royce design engineers.

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Despite growing awareness of environmental concerns, air travel continues to be popular, not least because of its increasing attainability for more people in countries like India and China. Fortunately, today's aircraft engines are becoming ever more efficient: over the past couple of decades, manufacturers have reduced their emissions by a factor of two over ten years.

These advances in technology are due in no small part to collaborative research with academia. In 1990 Rolls-Royce established its first University Technology Centre (UTC) at the University of Oxford. Researchers at the UTC in Solid Mechanics undertake strategic and applied research relevant to the company's technology base, providing valuable expertise at the cutting edge of research and developing a close working relationship with Rolls-Royce engineers.

Alexander Korsunsky, Professor of Engineering Science, is using facilities at the Diamond Light Source, the UK national synchrotron facility, to investigate exactly what is going on inside an aeroplane engine during operation. Diamond generates brilliant beams of light at wavelengths from 'soft' to 'hard' X-rays.

Professor Korsunsky and his colleagues are using 'X-ray vision' to examine in 3D the shape and stresses within components in an aeroengine, to a resolution down to about one-hundredth of the width of a human hair. As a rule, engines run more efficiently the hotter the combustion products within them are allowed to become. An engine's capability to reach high temperatures is, however, affected by how its component materials respond to heat – do they melt, crack, or fail in some other way? Research input in developing new materials and manufacturing techniques is paving the way towards designing the next generation of efficient 'green' engines.

'The interaction between Rolls-Royce plc and academia is critical in ensuring that our products remain competitive via the continual drive to reduce emissions whilst maintaining the levels of reliability that our customers expect from us. Our interaction with the University of Oxford is long term in nature and broad in scope, covering areas such as physically based modelling and assessment of material behaviour in complex load regimes including impact and fatigue. This is a very exciting area as much of the work is world leading and we are able to utilise this research to enhance our products and therefore competitive position.'

Professor David Rugg, Rolls-Royce Associate Fellow

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