



Carbon fibre recycling collaboration

Dr Stephen Pickering, Associate Professor in Mechanical Engineering
Department of Mechanical, Materials and Manufacturing Engineering

Led by Dr Steve Pickering, researchers at Nottingham have developed ways to recycle carbon-fibre composites (or carbon-fibre reinforced plastics). Boeing is investing \$1,000,000 a year in a strategic research collaboration, an inclusive partnership in which Boeing will collaborate with Nottingham in all its composites recycling activities.

Making planes more recyclable

First introduced into military aircraft 30 years ago, carbon-fibre composites are stronger and lighter than any other commonly available material.

This helps reduce fuel consumption and carbon emissions in aircraft making modern passenger planes more efficient and cheaper to fly. Advanced composite materials comprise half the empty weight of Boeing's **new 787 Dreamliner**.

Our research has been developing recycling processes for carbon fibre composites for over 10 years in projects funded by industry, UK Government and EU. In the strategic collaboration on composites recycling Boeing will provide funding of \$1,000,000 a year initially for three years, but with the intention to continue with a rolling programme.

The collaboration with Boeing will further develop:

- recycling processes
- technology to process recycled fibre into new applications
- and new products using recycled materials, in collaboration with other suppliers.

Boeing was a founding member six years ago of **AFRA, the Aircraft Fleet Recycling Association**. AFRA is a non-profit standards-setting association for the aerospace industry. Nottingham joined two years later, and a significant part of this agreement will involve working with several other AFRA member companies on the very difficult challenge of aircraft interiors recycling.

With the University, Boeing is a partner in the ongoing **Technology Strategy Board (TSB)** funded project **AFRECAR (Affordable Recycled CARbon fibre)**. Colleagues **Professor Nick Warrior** and **Professor Ed Lester**, and industrial collaborators including Boeing are developing high-value applications for recycled carbon fibre along with new recycling processes.



How it works

Nottingham's carbon-fibre composite recycling process uses a fluidised bed process to remove the polymer from composites waste, recovering good quality carbon fibre.

- Composite waste is shredded and fed into a 'fluidised bed'
- Heat in fluidised bed thermally removes the polymer
- fibres are then carried away in the hot gas stream
- fibres separated from the gas stream in a cyclone
- hot gases pass to a high temperature combustion chamber for clean up and energy recovery
- The process can deal with contaminated waste from end-of-life components: any organic materials (polymers/paints/foam cores) are oxidised and any metals (metal wire, fasteners or inserts) remain in the fluidised bed for recovery



Working in partnership with Boeing

Sir Roger Bone, President of Boeing UK, launched this major new collaborative investment in carbon-fibre recycling research involving Boeing Commercial Airplanes and The University of Nottingham's **Faculty of Engineering** when he visited Nottingham on Monday 24 October.

"Boeing wants to be able to recycle composite materials from manufacturing operations to improve product sustainability and to develop more efficient ways of recycling aircraft retired from commercial service. The ultimate aim is to insert recycled materials back into the manufacturing process, for instance on the plane in non-structural sustainable interiors applications, or in the tooling we use for manufacture. This work helps us create environmental solutions throughout the lifecycle of Boeing products" said **Sir Roger**.

Aerospace is a priority research area for this University. This recognises the sector's potential for growth and our ability to deliver influential world-class research and knowledge transfer to address global issues and challenges. The University's agreement formalises a long-term working commitment between Nottingham and Boeing. We have been working together for over six years on mutual R&D activities in aircraft recycling as well as new uses for power electronics. We both aim to improve environmental performance of aircraft and using materials more sustainably.

About the author

Dr Steve Pickering, Associate Professor and Reader in Mechanical Engineering, is an engineer with an interest in solving complex industrial problems in the area of thermofluids through experimental and modelling research.

His research interests cover: thermodynamics, fluid mechanics including two phase flow, combustion and heat transfer, where he combines experimental work with modelling, including the use of computational fluid dynamics. He teaches in the general area of thermofluids and has taught or currently teaches thermodynamics, fluid mechanics, heat transfer, energy efficiency, thermal power systems and engineering design.

Dr Pickering has significant experience of successful collaborations with industry and has worked closely with Boeing for six years.

e: stephen.pickering@nottingham.ac.uk

t: +44 (0)115 951 3785.

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**Dr Steve
Pickering**



At Nottingham we have been developing recycling processes for carbon fibre composites for over 10 years. As well as recycling processes, we are creating applications to reuse recycled material.

The Institute of Aerospace Technology

The Institute of Aerospace Technology (IAT) aims to consolidate our position as an internationally leading centre for aerospace, which is priority research for the University. We have a substantial research portfolio with projects valued in excess of £35m, including over £20m in EPSRC funding.

Main aerospace research themes are:

- Advanced materials and manufacturing
- Applied optics and NDE
- Electromagnetics, Thermodynamics and fluid mechanics
- Polymer composite
- Power electronics, machines and control
- Satellite navigation technologies
- Structural integrity and dynamics

IAT's research base is broad and involves over 50 academic researchers working in internationally recognised research groups, often in partnership with leading aerospace companies.

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