

A lighter way to fly

Replacing steel bearings with resilient titanium alloy means that aeroplanes can become significantly lighter; reducing fuel consumption and the impact on the environment.



The need

The aerospace industry is under pressure to reduce its carbon footprint and to make air travel environmentally neutral.

The industry is one of the most heavily scrutinised, largely because of the sheer volume of air traffic; in 2008 there were nearly 7,000 flights a day to and from UK airports.

The Advisory Council for Aeronautics Research in Europe has set ambitious targets for reducing emissions. It wants new aircraft entering service in 2020 to emit 50% less carbon dioxide than aircraft built in 2000.

The amount of CO₂ produced by an aeroplane engine is directly related to the amount of fuel burned, and one of the ways of reducing this is by making the aeroplane lighter.

The results

In this project, Cambridge-based Tecvac worked with Sheffield University, Airbus Operations and NMB-Minebea to refine a product that could significantly reduce the weight of new Airbus aircraft.

On each Airbus aircraft there are up to 2,772 steel bearings. Airbus was keen to find a lightweight substitute.

Titanium alloy was a potential solution. If all of the steel bearings could be replaced by titanium alloy this would save at least 400kg. But titanium alloy alone is not strong enough to take the weight of the aircraft. Bearings in critical parts such as landing gear would quickly wear out under the pressure.

Tecvac, a surface engineering company that deposits hard-wearing coatings onto surfaces to prolong their lifetime, refined existing technology to come up with a solution.

Researchers knew that simply adding a hard-wearing coating would not work. The coating would crack and the titanium would be compromised.

Through the project Tecvac developed a new treatment that makes the surface of the titanium itself much more resilient. They then added a hard-wearing coating to the improved titanium alloy bearings. Together these technologies provided the lightweight solution that Airbus was looking for.

The market

The market for the new technology is huge. Manufacturers around the world are eager to find new ways to reduce the weight of aeroplanes.

Airbus has already placed a £19m order for one type of wing structure bearing attaching the main landing gear for the new Airbus A350. Once these have been upgraded to titanium alloy, attention will turn to the thousands of other bearings on Airbus aircraft.

And the work won't be restricted to new planes. Bearings on working planes can be replaced too.



'This order is the tip of the iceberg. Airbus is exceedingly keen to replace steel bearings with titanium wherever possible, in both future builds and back catalogue refurbishment.'

DR JONATHAN HOUSDEN, TECVAC



Next steps

Tecvac is continuing work to make the titanium bearings capable of taking even more weight.

It is also scaling up its production capability to provide the new treatments

According to Department for Transport estimates, CO₂ emissions from UK aviation were 37.5 million tonnes in 2005 and predicted to rise to 60.3m tonnes CO₂ by 2050 so demand for this sort of technology should only increase.

Technology Strategy Board Driving Innovation

Collaborative research and development projects are one of the tools that the Technology Strategy Board uses to drive innovation in the UK. The Technology Strategy Board is a business-led executive non-departmental public

body, established by the Government. Its role is to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business, in order to increase economic growth and improve the quality of life. It is sponsored by the Department for Business, Innovation and Skills (BIS).

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Project partners

Tecvac, Airbus Operations, NMB-Minebea, University of Sheffield

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