Composite plane life cycle assessment shows lighter planes are the future

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Boeing Dreamliner 787

A global fleet of composite planes could reduce carbon emissions by up to 15 per cent, but the lighter planes alone will not enable the aviation industry to meet its emissions targets, according to new research.

The study, by the Universities of Sheffield, Cambridge and University College London, is the first to carry out a comprehensive life cycle assessment (LCA) of a composite plane, such as the Boeing Dreamliner 787 or Airbus 350, and extrapolate the results to the global fleet.

The LCA covers manufacture, use and disposal, using publicly available information on the Boeing Dreamliner 787 fuselage and from the supply

chain – such as the energy usage of the robots that construct the planes. The study compares the results to the traditional – and heavier – aluminium planes.

Emissions during the manufacture of composite planes are over double those of aluminium planes. But because the lighter aircraft use significantly less fuel, these increased emissions are offset after just a few international flights. Over its lifetime, a composite plane creates up to 20 per cent fewer CO2 emissions than its aluminium equivalent.

Professor in Advanced Materials Technologies at the University of Sheffield, Alma Hodzic, said: "This study shows that the fuel consumption savings with composites far outweigh the increased environmental impact from their manufacture. Despite ongoing debates within the industry, the environmental and financial savings from composites mean that these materials offer a much better solution."

The researchers fed the data from the LCA into a wider transport model to gauge the impact on CO2 emissions as composite planes are introduced into the global fleet over the next 25 years, taking into account other factors including population, economic prosperity, oil prices and speed of adoption of the new technology.

The study – published in the International Journal of Life Cycle Assessment – estimated that by 2050, composite planes could reduce emissions from the global fleet by 14-15 per cent relative to a fleet that maintains its existing aluminium-based configuration.

Professor in Energy and Transport at UCL, Andreas Schäfer, explains: "The overall emissions reduction for the global fleet is lower than the reduction for an individual plane, partly, because by 2050, not all the fleet will be of composite construction. New planes entering the fleet before 2020 could still be in use by 2050, but the faster the uptake of

this technology, the greater the environmental benefits will be."

Dr Lynette Dray from the University of Cambridge added: "Given that global air traffic is projected to increase four-fold between now and 2050, changing the materials used could avoid 500 million tonnes of CO2 emissions in 2050 alone, a value that roughly corresponds to current emission levels."

Professor Hodzic commented: "The industry target is to halve CO2 emissions for all aircrafts by 2020 and while composites will contribute to this, it cannot be achieved by the introduction of lighter composite planes alone. However, our findings show that composites – alongside other technology and efficiency measures – should be part of the picture."

Provided by University of Sheffield