

Leading the way in aircraft noise reduction

Aircraft noise threatens the growth of the important UK aerospace manufacturing sector. This is of particular concern to Airbus, with total annual revenues of €38.5 billion (in 2012), and to the civil aerospace division of Rolls-Royce, with annual revenues of £6.4 billion dominated by the sale and maintenance of large engines for commercial airliners.

The International Civil Aviation Organisation reports aircraft noise as the most significant cause of public opposition to the expansion of airports and growth of air transport. It is more than simply an annoyance to people living nearby. According to the World Health Organization, it is an 'underestimated threat' that can cause short and long-term health problems. Its overall financial impact is estimated by the European Commission to lie between 0.2 per cent and 2 per cent of GDP, £3.1 billion for the UK alone at the lower estimate.

Research at the University of Southampton's Airbus Noise Technology Centre (ANTC) and the Rolls-Royce University Technology Centre (UTC) in Gas Turbine Noise has given Airbus and Rolls-Royce tools to understand, predict and reduce noise pollution from commercial aircraft. This will help them make sure they are on track to meet the European Union's stringent noise reduction targets, and maintain their competitive edge. This is also good news for the millions of people who live near our busiest airports.

In 1999, Rolls-Royce set up the University Technology Centre (UTC) in Gas Turbine Noise at Southampton, consolidating a thirty year research collaboration with Southampton's Institute of Sound and Vibration Research (ISVR) on aircraft engine noise. Airbus went on to establish its own Aircraft Noise Technology Centre (ANTC), at Southampton, nine years later. These two centres have made the University of Southampton the largest provider of aero-acoustic expertise in the UK with a total of 10 academic staff and more than 30 researchers and doctoral students working on aircraft noise at any one time. Southampton is also the 'UK focal point' for the X-NOISE European aero-acoustic network bringing together industry and academic partners across the EU to collaborate on aircraft related noise research.

Fundamental research on turbofan noise has been undertaken in the UTC since 1999 by a team of academic and research staff led by Jeremy Astley, Professor of Computational Aero-acoustics, Phil Joseph, Professor of acoustical engineering and turbo-machinery noise and Dr Rod Self, Senior Lecturer in jet noise and installation effects. A complementary programme of research in aero-acoustics, focusing on airframe noise – the noise generated by the aircraft itself as opposed to its engines - was established in 2000 by Xin Zhang, Airbus Professor of Aircraft Engineering.

Specific causes of noise have been identified and research has been carried out to reduce their effect. Sound absorbing 'liners' placed on the inner surfaces of an engine in the intake and the exhaust are an important method for reducing fan noise, the largest single source of engine noise both at take-off and approach. There is growing interest in fuel efficient, advanced open rotor (AOR) powered aircraft. Bleed valves used in aero-engines

to manage air flow, mainly in the approach to landing condition, have been identified as important sources of noise. Landing gear are also a major source of airframe noise.

In summary, research at the University of Southampton's Rolls-Royce UTC and Airbus ANTC has transformed the way the aerospace companies tackle noise prediction and mitigation in the design of current and future aircraft. New methods mean that they are on track to meet the EU's tough noise reduction targets and enjoy a competitive edge in noise reduction over their competitors. However, a global market exists over the next 20 years for 27,000 new passenger aircraft worth £2.0 trillion; the UK will retain or expand its current 17 per cent share of this market only if can match or exceed noise reductions achieved by its competitors. Research in the UTC and ANTC at Southampton is already underway to meet this technical challenge.