

HSE science team helps power world-first hydrogen aviation breakthrough

Britain's health and safety regulator is part of a landmark project that could transform air travel, and shows how safety expertise drives innovation, not holds it back.

Scientists at the Health and Safety Executive (HSE) have helped deliver a major milestone in hydrogen-powered flight, in partnership with Rolls-Royce – after the successful test of the first jet engine to reach full take-off power running on 100% hydrogen.

The project was part of a world-first programme of hydrogen aviation research for Rolls-Royce, which demonstrates how Britain's science-led regulatory expertise is helping to unlock the technologies needed to achieve net zero flight.

HSE's specialist team of scientists at its state-of-the-art Science and Research Centre in Buxton worked with Rolls-Royce to design, manufacture and install high-flow, high-pressure hydrogen control and monitoring gas supply infrastructure. The program culminated in the Engine GH2 test – the first time in the world that work of this type has been performed.

At the heart of HSE's contribution was its support for Rolls-Royce's rig test programme. HSE's scientists provided rigorous safety analysis of the test design, combining deep technical knowledge with practical, hands-on experience of safe working with hydrogen in demanding environments. This enabled the programme to move from initial design through to commissioning and live testing at pace, without compromising on safety.

HSE's hydrogen research team has been at the forefront of hydrogen research across multiple sectors for over 20 years. The team has worked with major UK aerospace companies including Airbus and Rolls-Royce, supporting projects that work closely with the Aerospace Technology Institute and directly advance the UK Government's growth agenda.

This programme exemplifies HSE's ambition to enable industry to innovate safely – demonstrating that strong safety foundations are not a barrier to growth, but one of the essential conditions that makes it possible.

Dr Nigel A Moss, Aerospace Sector Manager at HSE's Science and Research Centre, said:

"Safety is always front and centre within the aerospace sector and the development of hydrogen as an alternative to hydrocarbon-based jet fuel presents challenges across many different technical fronts.

"Our team's work here is not about slowing innovation down – it is precisely what enables it to proceed at pace and with confidence. Getting the safety foundations right is what makes breakthroughs like this possible."

Adam Newman, Chief Engineer, Hydrogen Demonstrator Programme, Rolls-Royce, commented:

“This programme has given us the clearest understanding in the industry of how hydrogen behaves in a modern aero gas turbine. Through a collaborative, staged testing approach, we have validated combustion, fuel and control system technologies, and demonstrated the safe use of hydrogen through design, commissioning, maintenance and testing.

“We have explored a wide range of operating conditions, including fault scenarios, enabling operation at maximum power and across a full flight cycle. The pace of delivery has been critical, and the insights gained, many of which are fuel agnostic, will now be applied across our future programmes, including UltraFan®, strengthening our confidence that the gas turbine will remain at the forefront of sustainable aviation’s future.”

Further Information

- The Health and Safety Executive (HSE) is Britain’s national regulator for workplace health and safety. We are dedicated to protecting people and places and helping everyone lead safer and healthier lives.
- HSE’s Science and Research Centre is based in Buxton, Derbyshire. It is a world-leading centre for applied science, engineering and research in health and safety.
- Rolls-Royce plc is a world-leading industrial technology company. Its aerospace division develops and manufactures power and propulsion systems for civil and defence aviation.