Results in Brief

Engine noise of high bypass ratio engines: Installation, advanced modelling and mitigation

Engines for silent aircraft

An EU-funded project is advancing state-of-the-art research in jet noise reduction by not considering the jet noise source itself but the complete system of wing and engine. Project findings will mainly concern long-haul flights.

A quick scan on recent EU-funded projects reveals considerable progress in numerical tools for predicting aircraft noise. Conclusive answers to source mechanisms are required since the ability to further reduce noise may involve engine architectures and identifying complex flow conditions.

Understanding the source mechanisms of installed jet engine noise and appropriate design recommendations are necessary for successfully integrating an ultra-high bypass ratio (UHBR) engine in an aircraft. The EU-funded project 'Jet noise of high bypass ratio engine: Installation, advanced modelling and mitigation' (JERONIMO) is...
investigating the physical mechanisms driving the installed jet noise of UHBR engines with a bypass ratio larger than 12. Scientists are experimentally characterising jet noise of UHBR engines that are isolated or installed, considering also jet-wing interaction.

Through anechoic wind tunnel tests and numerical simulations, scientists will validate noise characterisation and prediction processes. Based on the results, they will derive low-noise design guidelines for future UHBR engines. A consistent database at a European level in major noise test facilities will provide improved measurement techniques. These include near-field pressure and particle image velocimetry complementing the far-field noise.

Project work will also include adaptation and validation of state-of-the-art computational fluid dynamic tools and development of methodology to predict flight stream effects. Investigation will focus on complex interaction mechanisms of jet stream flows and wings. Scientists will identify key flow features through detailed processing of the experimental data together with numerical data, correlating for instance steady or unsteady flow conditions with acoustics. Innovative nozzles will be developed and recommendations will be provided in terms of relative positions of the nozzle and the wing.

So far, project members have conducted important work with respect to characterising UHBR jet noise and performing numerical simulation for jet aeroacoustics. Furthermore, they have drawn up specifications for the nozzle model design, the test matrices and the wind tunnel tests.

JERONIMO should lead to quieter aircraft and reduced product development times and costs, allowing the European aeronautical industry to maintain a strong position.

Keywords

Jet noise, long-haul flights, flow conditions, ultra-high bypass ratio, jet-wing interaction
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Last update: 23 June 2015
Record number: 165066