LOSBA

Model Design and Manufacturing of the Turbofan Configuration for Low Speed Aerodynamic and Acoustic Testing

Funding: European (7th RTD Framework Programme)
Duration: Nov 2011 - Dec 2014
Status: Complete with results
Total project cost: €1,305,006
EU contribution: €978,754

Call for proposal: SP1-JTI-CS-2010-03
CORDIS RCN: 104825

Objectives:
A requirement was produced to design and manufacture an innovative new wind tunnel model to enable the acquisition of aerodynamic and acoustic data. Nacelles and pylons were included to accommodate two turbofan simulators which are to be supplied by DNW/ONERA. A set of wings were produced which will have removable leading edges and trailing edge flaps. This allowed a wide range of configurations to be investigated, including clean, take-off, landing and airbrakes on/off. A modular empennage was also be produced. These items will be designed to interface with the remainder of the model which was provided by a partner independent of this CFP. The resultant model was tested in a low speed wind tunnel at atmospheric pressure to investigate two topics. Firstly, the effectiveness of the empennage in shielding engine noise, and secondly the assessment of wing aerodynamic efficiency together with low speed take-off and landing performance and handling qualities. A large number of steady and unsteady probes were installed in the model. Kulites® were mounted in the thin nacelle and empennage. These were supplemented by gauges on the empennage to measure loads.

Aircraft Research Association (ARA) proposed to apply its extensive experience in wind tunnel model design and manufacture. ARA led the programme of work with manufacturing support provided by Future Advanced Manufacturing Ltd (FAM). ARA and FAM have worked closely on many wind tunnel model programmes, producing high quality models to exacting tolerances and demanding timescales. Over many years, ARA and FAM have established reliable working practices, innovative technical solutions to challenging requirements and effective project control and management processes. ARA and FAM applied this expertise to the requirements of this new call to ensure that all aspects of the model are achieved in the required timescale and budget.

Parent Programmes:
FP7-JTI - Specific Programme "Cooperation": Joint Technology Initiatives
Institute type: Public institution
Institute name: European Commission
Funding type: Public (EU)
Other programmes: JTI-CS-2010-3-SFWA-02-009 Model design & manufacturing of the turbofan configuration for low speed aerodynamic and acoustic tests

Lead Organisation:

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Executive Summary:

There is increasing concern about the adverse environmental effects of aircraft engine noise which has resulted in the need to identify methods for reducing or shielding noise for aircraft in flight. A number of research programmes have been undertaken to develop novel empennage configurations for a business jet and this LOSPA project will provide a new wind tunnel model to be used in a future wind tunnel test campaign to investigate the effectiveness of new aircraft geometry in promoting noise reduction; specifically a novel empennage design and laminar flow wing configuration.

The empennage comprised a ‘U-tail’ design, in which the horizontal tailplanes act as physical shields to reduce the noise detected on the ground arising from the rear fuselage mounted engines. Removable vertical tailplanes were developed to reduce the noise emanating laterally from the aircraft.

The key areas of progressive development of this model include the introduction of Turbine Power Simulators into the rear fuselage mounted nacelles to simulate the engine effects, adaption of the empennage design to produce a non ‘U-tail’ configuration, plus the introduction of steady and unsteady pressure measurement sensors into the nacelles and empennage components to measure both the aerodynamic and acoustic characteristics of the new design.

The new model design was of modular construction such that testing can be performed in a variety of model configurations including testing with vertical tailplanes removed and powerplant removed. From this progressive approach, the aerodynamic and acoustic characteristics of this novel design were fully-investigated to ascertain its effectiveness in achieving the perceived reduction in engine noise and the improvement in wing performance and low speed handling qualities.

The result of this work promoted the development of future aircraft designs with enhanced environmental characteristics (lower noise levels and improved efficiency of operation).

This Periodic Report relates to the entire project from 1 Nov 2011 until 31 Dec 2014.

Documents:

Final Report Summary - LOSPA (Model Design and Manufacturing of the Turbofan Configuration for Low Speed Aerodynamic and Acoustic Testing)

STRIA Roadmaps: Vehicle design and manufacturing

Transport mode: Air transport

Transport sectors: Passenger transport, Freight transport
Transport policies: aspects
Geo-spatial type: Other