

## Summary of CleanSky BLAME wind tunnel measurements in the DNW-LLF

In the framework of the CleanSky project designated with the acronym BLAME

Proposal reference number: 632417

Call identifier: SP1-JTI-CS-2013-02

Topic addressed: JTI-CS-2013-02-SFWA-03-013

Low-speed aerodynamic tests were carried out on a A340-300 aircraft model, designated as model 408DB1. The tests were performed in the closed 8 m x 6 m test section of the DNW-LLF low-speed wind tunnel. AIRBUS has adapted a 1:10.6 scale model of a A340-300 such as to represent the BLADE flying demonstrator. The BLADE aircraft is equipped with a natural laminar flow (NLF) panel. The tests were conducted in January and February of 2014.

### The main objectives for this test were as follows:

- Check the installation effect of the NLF panel on the A340-300 Airbus flying demonstrator:
  - Design study, ground effect, downwash and handling qualities (effect of flaps, aileron, spoiler, downwash, tails) in longitudinal and lateral direction.
  - Study of the wing flow and stall behaviour and obtain information on boundary layer transition (Infra-red thermography).
  - Establish the local attitude changes due to wing torsion.
- As reference for the aerodynamics BLAME results data was gathered for the A340 standard civil aircraft layout.



## Description of work performed and main results

Based on all relevant model information and the exact required test matrix as delivered by the partners, a wind tunnel test campaign description was written.

After delivery of the model and all related systems from the partners to DNW, the model was built up in one of the DNW model preparation halls where all necessary pre-checks were performed. The assembled model transported to the test section of the wind tunnel and after mounting and system check-outs in the test section (wind-on and wind-off), a review on total test readiness was held.

During test execution the test program (test matrix) was followed as agreed with the Topic Manager. Changes in this test matrix were mutually agreed upon and accordingly documented. During the test preliminary on-line data were provided and simultaneously all raw data were stored on local data acquisition storage disks. At the end of the test a complete set of preliminary data was provided to the Topic Manager.

After the test the data were corrected for several typical wind tunnel testing related phenomena in close consultation with the Topic Manager. The final deliverables consisted of corrected final data and a final test report.





German-Dutch Wind Tunnels

## **Expected final results and potential impact**

### Scientific results

To attain information about the transition location on the natural laminar flow panel Intra-Red Thermography was successfully applied in a large low speed wind tunnel under atmospheric conditions. Valuable knowledge on other measurement techniques (such as Stereo Pattern Recognition used for deformation measurements) was gathered in relation of the application of the techniques in large low-speed facilities.

### Technological results

Performance and handling quality assessment in a world class wind tunnel facility of the BLADE demonstrator aircraft.

### Impact

The tests formed a critical step in the flight clearance process of the BLADE demonstrator aircraft.