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In-flight evaluation of an optical standby air data system

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Within the NESLIE (New Standby Lidar Instrument) project, that is supported by the European Commission, an innovative air data system was developed, built and tested. The system applies the lidar technique to measure air speed in 4 different directions. The aircraft's TAS (true airspeed), AOA (angle of attack) and SSA (side slip angle) are calculated from these speed measurements. The development resulted in a first test system of a future generation stand-by instrument for commercial aircraft. This system has no probes protruding in the air contrary to traditional pitot-static air data systems. The laser-based instrument will have drastically different failure modes compared with traditional systems, reducing the probability of common failures, which increases flight safety. Furthermore, the size, weight and cost of the system can be small and will be further reduced in future by applying emerging optical technologies. The system was developed in the NESLIE consortium which consisted of following participants: THALES Avionics (coordinator, F), AIRBUS France (F), DASSAULT Aviation (F), EADS CRC (D), TEEM Photonics (F), IMEP (F), XenicS (B), ITI-CERTH (G) and NLR. The in-flight evaluation was performed in the NLR Cessna Citation II research aircraft in April and May 2009.

The system was evaluated in 17 flights covering 40 flight hours. During the flight hours, data of the NESLIE system were recorded, both in a raw format as well as in a format recording averages over 0.5 seconds time periods. Furthermore, data were recorded from the standard Citation air data system while additional flight test data was recorded using amongst others an inertial platform and a nose boom. Data were analysed to investigate

- the performance of the system as a function of the atmospheric conditions, for which the altitude, weather condition and the earth surface below (water, rural land, cities) were varied
- the correlation between the output of the system and the Citation air data, for which the air data were derived from the standard aircraft system or from specific flight test instrumentation

A large data set of measurements was created in the flight test campaign.

The paper will:

- describe the standby air data system under test as developed in the NESLIE project
- describe the integration of the system in the NLR Cessna Citation II research aircraft
- focus on an overview of the techniques applied during the flight test campaign
- present the results of the analysis of recorded data

Testing the flight-safety-increasing system in an already instrumented research aircraft is efficient and links therefore to the theme of the symposium.