AVERT

Aerodynamic Validation of Emission Reducing Techniques

**Funding:** European (6th RTD Framework Programme)  
**Duration:** Jan 2007 - Jun 2010  
**Status:** Complete with results  
**Total project cost:** €6,749,869  
**EU contribution:** €3,899,932  

**Call for proposal:** FP6-2005-AERO-1  
**CORDIS RCN:** 81480

**Background & policy context:**

AVERT delivered upstream aerodynamics research that enabled breakthrough technology deployment and innovative aircraft configuration development and a step change in aircraft performance. The project contributed to the need to improve the environmental impact of aircraft emissions and the drive to strengthen the competitiveness of European manufacturing industry.

**Objectives:**

AVERT aimed for a 10% improvement in cruise lift-to-drag ratio in addition to that promised by the 'pro-green' configuration. This could be achieved due to direct reductions in profile drag and by unlocking traditional design constraints to reduce vortex drag.

Several flow control technologies have emerged recently that are considered to show sufficient promise, which might be usefully applied to an aircraft in order to reduce drag, either directly or by enabling variations in design that would result in lower drag. AVERT will investigate this selection of devices further with the development focused closely on industrial application. This activity will link directly with the work on manufacturing and control technologies, and will be constantly reviewed by industrial partners. This industrial review will assess the viability and gross performance benefits of the devices when applied to full-scale aircraft.

The following describes the five technical objectives of the AVERT project:

- Exploration and development of flow-control technologies for high-speed application;
- Exploration and development of flow-control technologies for low-speed application;
- Development of manufacturing and control technologies for sensors and actuators;
- Industrial validation of flow-control technology; and
- Industrial assessment of flow-control technologies.

**Methodology:**

Devices suitable for high-speed application include active transition control, passive and active turbulent skin friction, drag reduction and active buffet control.

Devices suitable for low-speed application include those which produce oscillatory blowing in a flap gap, and synthetic and fluidic jets for controlling flow separation at the leading edge.

The successful industrialisation and application of arrays of flow-control devices onto an aircraft is highly dependent on the ability to manufacture and install them. Recent advances in MEMS technology (MEMS: microelectromechanical systems) have provided AVERT with the first real opportunity to assess and develop manufacturing processes for large volume production of flow-control devices. Additionally, by drawing on expertise from the field of structural health monitoring, optimisation of the type and distribution of the appropriate devices will be possible, together with the development of advanced means to control them such as open and closed loop systems.
Part of this process was the validation that the manufacturing processes can deliver arrays of devices in sufficient quantity, quality and durability for industrial application. The final step prior to the inclusion of any of these technologies in the product design process was a large-scale wind tunnel validation. This evaluated possible performance gains and provided the final and most rigorous set of performance data for industrial assessment.

**Parent Programmes:**
FP6-AEROSPACE - Aeronautics and Space - Priority Thematic Area 4 (PTA4)

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

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**EU Contribution:** €0

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Key Results:

The expected results were:

- Quantitative performance of each of the high-speed flow-control technologies;
- Identification of promising flow-control technologies for high-speed application through the use of the performance results in an industrial assessment process;
- Specification of the devices selected for industrial validation;
- Quantitative performance results for each of the low-speed flow-control technologies;
- Identification of promising flow-control technologies for low-speed application through the use of the performance results in an industrial assessment process;
- Specification of the devices selected for industrial validation;
- Feasibility studies concerning the manufacturing processes and costs of selected devices;
- Control laws for closed loop actuator systems;
- Optimisation tools for signal specification and array design for devices aimed at T-S instabilities;
- An array, or arrays, of selected devices manufactured to specifications resulting from the device development activity;
- Testing of these devices to measure their quality, performance and durability;
- Modification of one low-speed wind tunnel model and one high-speed wind tunnel model to incorporate selected devices;
- Test results from wind tunnel tests of the modified models;
- Validated performance characteristics of the selected devices.

Documents:

- Publication under AVERT Project (Other relevant documents)

STRIA Roadmaps: Vehicle design and manufacturing

Transport mode: Air transport

Transport sectors: Passenger transport, Freight transport

Transport policies: Environmental/Emissions aspects, Societal/Economic issues

Geo-spatial type: Network corridors