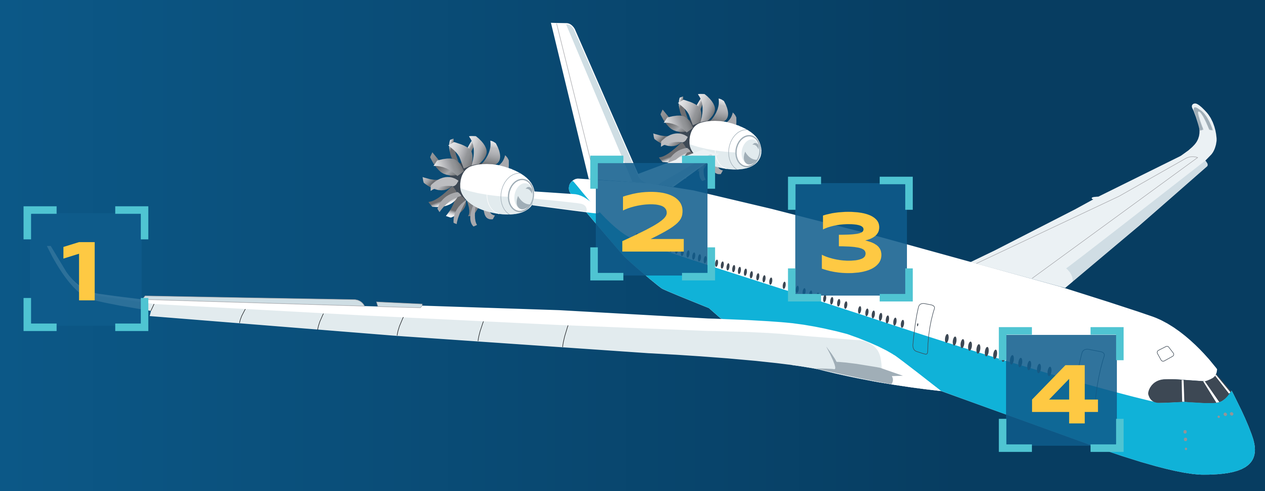
ACASIAS

Advanced Concepts for Aero-Structures with Integrated Antennas and Sensors

ACASIAS' objective is to contribute to the reduction of energy consumption of future aircraft by improving aerodynamic performance and by facilitating the integration of novel efficient propulsion systems such as contra-rotating open rotor (CROR) engines. ACASIAS intends to embed sensors and antennas into typical structures of aircraft (for instance fuselage panels, winglets and tails). The aerodynamic performance is improved by the conformal and structural integration of antennas. The installation of an Active Structural Acoustic Control system in the fuselage will reduce CROR engine noise in the cabin.

ACASIAS INNOVATIONS

The ACASIAS project focuses on challenges posed by the development of aero-structures with multifunctional capabilities. Four innovative aero-structures with integrated systems are developed and evaluated:



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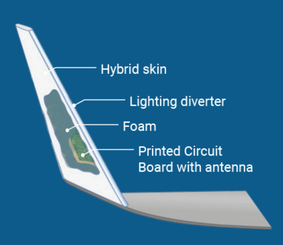
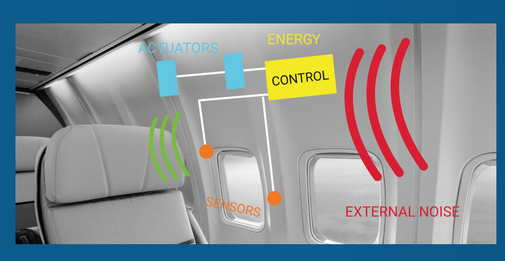


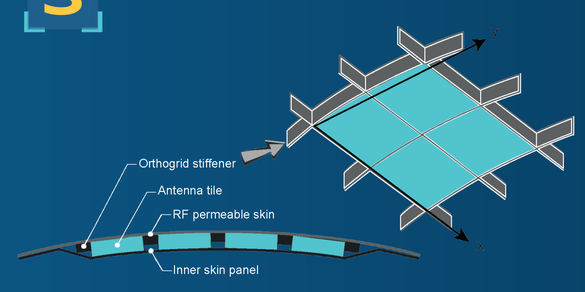
A smart winglet with integrated VHF antenna.

2



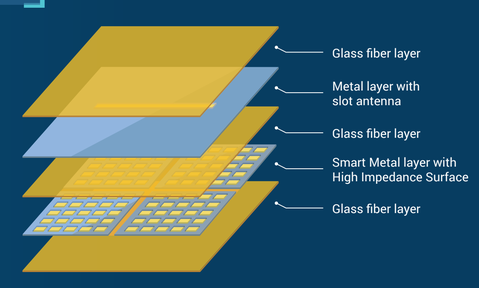
A fuselage panel with integrated system for reduction of CROR engine noise in cabin with minimal impact on weight.

3



A composite stiffened ortho-grid fuselage panel for the integration of a Ku-band SATCOM antenna array.

4



A Fibre Metal Laminate (FML) GLARE (Glass Laminate Aluminium Reinforced Epoxy) panel with integrated VHF communication antenna and GPS patch antennas.

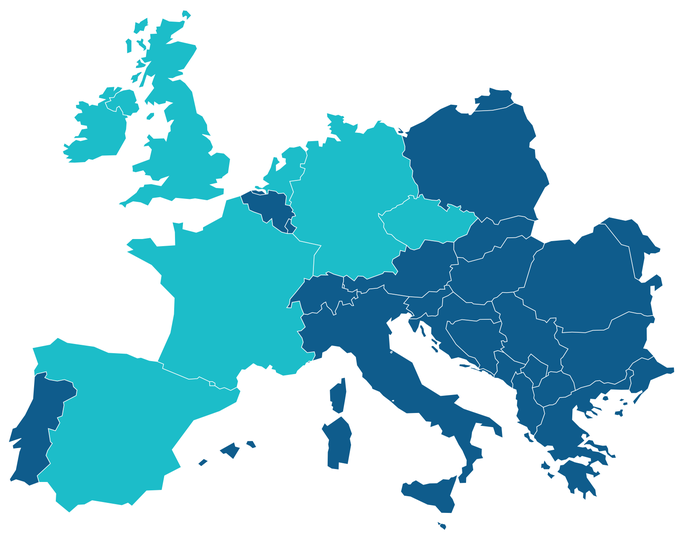
ACASIAS in a nutshell

- 11 partners
- up to 8dB cabin noise reduction
- total budget 5 800 000 €
- 4 innovative aero-structures
- up to 25% fuel and CO2 savings with the CROR
- total manpower 582 person-months
- 6 countries
- 36 months
- 3 main disciplines (composite) structures, advanced antennas and miniaturized sensors

Project timeline

Partners

- UNITED KINGDOM: TRACKWISE
- GERMANY: IMST, DLR, INVENT
- CZECH REPUBLIC: evektor, VZLU
- THE NETHERLANDS: nlr, Fokker
- FRANCE: L-up
- SPAIN: CIMNE



Multidisciplinary project

The integration of the additional functional capacities in the aero-structures requires multidisciplinary research, involving:

Mechanical engineering
Design and testing mechanics of fuselage panels and winglets,

Antenna engineering
Electromagnetic design of antennas to be integrated within the limitations coming from structural constraints,

Aeronautical engineering
Design of flightworthy structures within ACASIAS focus on direct lightning effects, aerodynamic loads and moisture resistance,

Aerodynamics
Calculation of aerodynamic loads on winglets, calculation of drag forces on classical protruding radomes and antennas,

Structural manufacturing
Manufacturing and assembly of light-weight and low-cost composite structures consisting of several materials and PCB layers,

Aero-acoustics and noise control
Design and smart acoustic control system,

Thermal engineering
Transport and dissipation of the heat produced by active elements in antennas.

Expected impact

Novel aero-structures will contribute to:

Reduce the CO2 and NOx emissions
by increased aerodynamic performance because structurally integrated antennas cause less additional drag, noise and turbulence than protruding antennas and by facilitating the use of CROR engines,

Reduce the overall airframe weight
by eliminating structural build-ups and support structures required for conventional antennas and by integrating and miniaturization of sensors and actuators which are required in future aircraft to reduce cabin noise due to CROR engines by up to 8 dB in the first five CROR frequencies,

Reduce the maintenance costs and operational delays
through integrated antennas, sensors and wiring (avoiding to protruding blade antennas caused by collisions with airport cargo cars), and through antenna apertures on fuselage panels with access to antennas from the cabin and trough increase robustness of integrated antennas.

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