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STS03: AERO-ACOUSTICS IN AERONAUTICS: ADVANCED METHODS AND INDUSTRIAL CHALLENGES

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Although considerable progress in reducing aircraft noise has been achieved over the years, further reduction is foreseen by means of innovative low noise component design practices taking advantage of an improved understanding of noise generating mechanisms and of widespread implementation of advanced aeroacoustic simulations. In this session an overview will be given of advanced methods for noise prediction in aeronautical applications, based on the EU projects VALIANT and IDEALVENT.

VALIANT focuses on broadband airframe noise (AFN) by tackling both landing gears and high lift devices as the two main contributors to AFN of an aircraft at approach.
Four specific flow configurations revealing the basic mechanisms of AFN were selected for a thorough investigation aimed at validating and improving the broadband AFN predictive tools: gap turbulence interaction, a flap+wing configuration, a slat+wing configuration,and a two-struts configuration.

One paper discusses a hybrid RANS/CAA approach for the simulation of broadband noise. The method rests on the use of steady Reynolds Averaged Navier-Stokes (RANS) simulation to prescribe the time-averaged motion of turbulent flow. By means of synthetic turbulence the RANS data (e.g. turbulent kinetic energy) are translated into fluctuations of turbulent velocity (or vorticity). The synthetic fluctuations are used to prescribe sound sources which drive linear acoustic perturbation equations. Acoustic sound generated by the stochastic source model is evaluated and compared to measurements on one of the VALIANT test cases..
Another paper details the joint numerical and experimental study of gap-turbulence interaction within the VALIANT project.

IDEALVENT focuses on Environmental Control System (ECS) used in order to provide equipment cooling and good thermal comfort for passengers in commercial aircrafts. One of the key elements of ECS units is the fan, operating in complex duct systems including bends, junctions and restriction diaphragms. For example, the tonal and broadband noise production by a fan-diaphragm configuration is investigated. Diaphragm obstructions are commonly found in complex ECS arrangements in order to balance the mass flow rate accross different branches of the network.

Finally, one paper discusses advanced computational methods applied to aircraft engine noise prediction to evaluate fan and jet noise of conventional engine architecture as well as propeller noise of the fuel-consumption-efficient Open Rotor concept.