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The Role of Computational Methods for a Multi-Fidelity Aerodynamic Characterization of Supersonic Aircraft

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The MORE&LESS (*MDO and REgulations for Low boom and Environmentally Sustainable Supersonic aviation*) project, funded by European Commission through Horizon2020 programme, aims at shaping global environmental regulations for future European supersonic aviation. Extensive high-fidelity modelling activities and test campaigns in different disciplines (aerodynamics, aeroacoustics, propulsion, emissions, noise, etc.) will merge into a multi-disciplinary optimization framework to assess the holistic impact of supersonic aviation, thus giving recommendations for future rules of supersonic civil flight.
In particular, numerical and experimental activities are foreseen to develop and validate, with proper wind tunnel test campaigns, reliable models for describing the aerodynamics of supersonic aircraft of some selected configurations (see Figure 1).

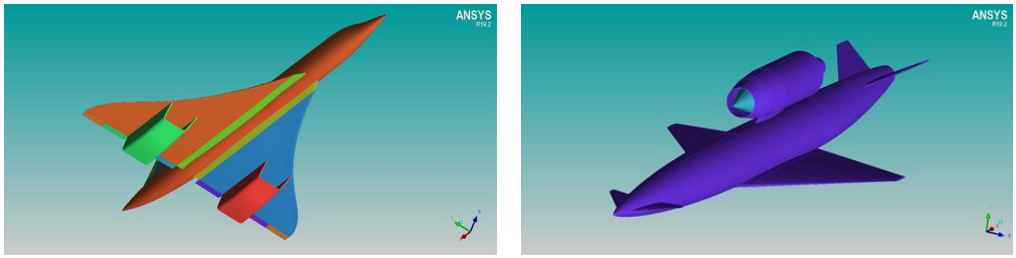

Figure 1. Configurations of supersonic aircraft: Mach=2 Concorde-like (left) and Mach=5 REL's hypersonic testbed (right).

A big amount of low-fidelity CFD simulations (in the hypothesis of inviscid flow) will be performed to build the aerodynamic databases of the aircraft configurations in terms of aerodynamic coefficients as function of Mach number, angle of attack, angle of sideslip, deflections of control surfaces, whereas viscous effects will be added by using engineering formulations. Some high-fidelity CFD simulations (Navier-Stokes turbulent flow) will be also performed on clean configuration only in order to verify the low-fidelity results. Simulations will be performed by CIRA, FICG and Politecnico di Torino by using as much as possible similar CFD software and computational grids. Moreover, experimental test campaigns are being designed and will be performed at INCAS trisonic wind tunnel for REL's hypersonic

testbed (see Figure 1) and MR5 configuration (not shown), and at VKI H3 hypersonic wind tunnel for REL's hypersonic testbed (see Figure 1) at Mach=5.
CIRA will then setup the aerodynamic databases of these configurations which will be built-up by gathering numerical results and experimental measurements, including properly derived uncertainty models for the aerodynamic coefficients. No engine-on effects will be included in these aerodynamic databases.

At the time of the ECCOMAS 2022 Conference first numerical results about the configurations of Figure 1 will be presented and discussed.

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