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Interaction of a Synthetic Jet Actuator with a Severely Separated Crossflow[1] KENNETH JANSEN, JOHN FARNSWORTH, MICHEL RASQUIN, Univ of Colorado - Boulder, NICK RATHAY, General Electric, MARIANNE MONASTERO, MICHAEL AMITAY, Rensselaer Polytechnic Institute — A coordinated experimental/computational study of synthetic jet-based flow control on a vertical tail/rudder assembly has been carried out on a 1/19th scale model operating at 30 degree rudder deflection, 0 degree side slip, and 20m/s free-stream flow. Under these conditions a very strong span-wise separated flow develops over the rudder surface for a majority of its span. Twelve synthetic jets were distributed across the span of the vertical tail just upstream of the rudder hinge-line to determine their ability to reduce flow separation and thereby increase the side force production; to extend the rudder effectiveness. Experiments were completed for the baseline case (i.e. no jets blowing) and for cases where 1, 6, and 12 jets were activated. RANS and DDES computations were completed to match these four experiments. While some experimental results for the same geometry have been previously reported, more detailed results concerning the experiments and their comparison to the DDES computations for the baseline and 1 jet active cases are reported here. Specifically, this effort focuses on the near-jet flow and the phase-averaged vortical structures produced by a single jet interacting with a severely separated, turbulent cross-flow.

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Kenneth Jansen
Univ of Colorado - Boulder

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