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Numerical Investigation of Actuators for Flow Control in Inlet Ducts KENNETH JANSEN, MANE, RPI, ONKAR SAHNI, SCOREC, RPI, MICHAEL AMITAY, MANE, RPI — For military applications, inlet designs are constrained by low observability requirements, which call for the use of an S-duct inlet. The inlets purpose is to limit the line-of-sight to the compressor and decelerate the incoming flow while minimizing total pressure loss, distortion, and unsteadiness. In addition, in unmanned aerial vehicles, the inlet length can determine the overall size of the aircraft. For this reason, aggressive inlets can have a large impact on overall system efficiency. Numerical simulations have been carried out which evaluate the effectiveness of steady and unsteady actuation for active flow control in an aggressive S-duct inlet, L/D = 1.5 (at flow conditions representative of flight conditions). These simulations were performed in close co-ordination with the experiments to be able to validate CFD predictions and further provide a complementary and detailed view of the flow field. Comparisons will be made between: steady and unsteady blowing from a single 2-D tangential slit. Evaluations criteria will include total pressure recovery, AIP distortion levels, and unsteady pressure fluctuations. It is noteworthy to mention that the agreement between the CFD predictions and the experimental measurements were found to be very good.

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