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Experimental Studies of Unstart Dynamics in an Inlet/Isolator Model JUSTIN WAGNER, KEMAL YUCEIL, NOEL CLEMENS, DAVID DOLLING, University of Texas at Austin — The dynamics of the unstart process in an inlet/isolator model mounted to the floor of a Mach 5 wind tunnel are investigated using PIV, high-speed (8 kHz) schlieren imaging and fast-response surface pressure measurements. The inlet section contains a 6-degree compression ramp and the isolator is a rectangular straight duct that is 25.4 mm high by 50.8 mm wide by 242.3 mm long. For the fully-supersonic flow, three ramp shock reflections are contained within the isolator. Unstart is initiated by a motorized flap that is located at the downstream end of the isolator section. Unstart proceeds with the formation of an unstart shock system that propagates upstream at an average velocity of about 37 m/s. The unstart process is seen to be associated with strong shock-induced separation that leads to large reverse flow velocities up to about 275 m/s. Both the schlieren imaging and PIV data suggest the dynamics of the unstart process are dependent on the initial reflected oblique shock system. Specifically, during unstart, boundary layer separation occurs near the impingement points of these initial reflected shocks. The separation of the isolator ceiling boundary layer appears to result in a decrease in propagation velocity of the unstart shock system. Since the initial oblique shock system appears to affect unstart dynamics, additional experiments will be conducted with different inlet geometries.

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