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Patterned Roughness for Cross-flow Transition Control at Mach 6[1] ALEXANDER ARNDT, ERIC MATLIS, University of Notre Dame, MICHAEL SEMPER, U.S. Air Force Academy, THOMAS CORKE, University of Notre Dame — Experiments are performed to investigate patterned discrete roughness for transition control on a sharp right-circular cone at an angle of attack at Mach 6.0. The approach to transition control is based on exciting less-amplified (subcritical) stationary cross-flow (CF) modes that suppress the growth of the more-amplified (critical) CF modes, and thereby delay transition. The experiments were performed in the Air Force Academy Ludwieg Tube which is a conventional (noisy) design. The cone model is equipped with a motorized 3-D traversing mechanism that mounts on the support sting. The traversing mechanism held a closely-spaced pair of fast-response total pressure Pitot probes. The model utilized a removable tip to exchange between different tip-roughness conditions. Mean flow distortion x-development indicated that the transition Reynolds number increased by 25% with the addition of the subcritical roughness. The energy in traveling disturbances was centered in the band of most amplified traveling CF modes predicted by linear theory. The spatial pattern in the amplitude of the traveling CF modes indicated a nonlinear (sum and difference) interaction between the stationary and traveling CF modes that might explain differences in Re_{trans} between noisy and quiet environments.

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