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Control of a Normal Shock Boundary Layer Interaction with Ramped Vanes of Various Sizes SANG LEE, Univ of New Mexico, ERIC LOTH, University of Virginia — A novel vortex generator design positioned upstream of a normal shock and a subsequent diffuser was investigated using large eddy simulations. In particular, "ramped-vane" flow control devices with three difference heights relative to the incoming boundary layer thickness (0.34δ 0.52δ and 0.75δ were placed in a supersonic boundary layer with a freestream Mach number of 1.3 and a Reynolds number of 2,400 based on momentum thickness. These devices are similar to subsonic vanes but are designed to be more mechanically robust while having low wave drag. The devices generated strong streamwise vortices that entrained high momentum fluid to the near-wall region and increased turbulent mixing. The devices also decreased shock-induced flow separation, which resulted in a higher downstream skin friction in the diffuser. In general, the largest ramped-vane (0.75δ) produced the largest reductions in flow separation, shape factor and overall unsteadiness. However, the medium-sized ramped vane (0.52δ) was able to also reduce both the separation area and the diffuser displacement thickness. The smallest device (0.34δ) had a weak impact of the flow in the diffuser, though a 10% reduction in the shape factor was achieved.

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