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Shock Boundary Layer Interaction Sensitivity to Upstream Geometric Perturbations LAURA CAMPO, DAVID HELMER, JOHN EATON, Stanford University — Shock boundary layer interactions (SBLIs) can have drastic effects on the performance of external aerodynamics and propulsion systems in high speed flight vehicles. In such systems, the upstream and boundary conditions of the flow are uncertain, and the sensitivity of SBLIs to perturbations in these conditions is unknown. The sensitivity of two SBLIs – a compression corner interaction and an incident shock interaction – to small geometric perturbations was investigated using particle image velocity measurements. Tests were performed in a continuously operated, low aspect ratio, Mach 2.1 wind tunnel. The shock was generated by a 1.1mm high 20° wall-mounted compression wedge, and various configurations of small ($h < 0.2\delta$) steady bumps were introduced upstream on the opposite wall. 100 perturbed cases were tested in order to generate a dataset which is well suited for validation of CFD codes. Both SBLIs were very sensitive to perturbations in a given region and insensitive to perturbations outside of it. Depending on the location of the perturbations, the compression corner interaction could be significantly strengthened or weakened. The position of the incident SBLI was also a strong function of both the location and size of the upstream perturbations.

Laura Campo
Stanford University

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