Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Direct Numerical Simulation of Mach 3 Compression Ramp Flow[1]

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— We present the direct numerical simulation (DNS) of a shockwave and turbulent boundary layer interaction (STBLI) generated by a compression ramp. The flow conditions are Mach 2.9 and $Re_\theta = 2900$, and the ramp angle is 24 degrees. STBLI flows are known to display low-frequency unsteadiness, typically at frequencies 1-2 orders of magnitude lower than that of the incoming undisturbed boundary layer. The presence of these low-frequency motions in the DNS data and their relationship with the upstream and downstream flow regions have been demonstrated (Priebe and Martin, AIAA paper 2010-108). The DNS data show that the low-frequency shock motion is significantly correlated with the downstream flow. A statistically significant but small correlation is also found with the upstream flow. In the present paper, we investigate the flow structure associated with the downstream flow regions and study the time-and-space resolved dynamics of the shock motion, shear layer and separated flow regions.

[1]This research is supported by AFOSR Grant Number AF 9550-09-1-0464.

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Date submitted: 06 Aug 2010 Electronic form version 1.4