Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Inflow Turbulence Generation and Oblique Shock / Turbulent Boundary Layer Interaction[1] BRANDON MORGAN, Graduate Student, Stanford, SOSHI KAWAI, Postdoctoral Fellow, Stanford, SANJIVA LELE, Professor, Stanford — Large-eddy simulation of an oblique shock impinging on a supersonic turbulent boundary layer ($M_\infty = 2.28$, $\varphi = 8^\circ$, $\mathrm{Re}_\theta = 1800$, 5100) is carried out with a high-order compact differencing scheme using localized artificial diffusivity for shock capturing. Solution sensitivity is investigated with regards to mesh resolution, spanwise domain, Reynolds number, and inflow turbulence boundary conditions. Through analysis of the spectral content of the wall pressure in the separation bubble, the expected low-frequency motion is identified with a time scale $\sim\mathrm{O}(100\delta/u_\infty)$. When using a standard recycling/rescaling method for inflow turbulence generation, it is shown that spurious correlations associated with the recycling frequency are introduced in the incoming boundary layer. We describe an improvement that eliminates spurious correlations in the inflow turbulence and the creation of an LES database which is used to investigate the high-frequency *flapping* and low-frequency *breathing* physics of oblique STBLI.

[1]This work has been supported by the NDSEG fellowship, PSAAP, and NASA.

Brandon Morgan
Graduate Student, Stanford

Date submitted: 06 Aug 2010 Electronic form version 1.4