Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Unsteady Effects in Shock/Turbulent Boundary Layer Interaction at M=2.25 SERGIO PIROZZOLI, FRANCESCO GRASSO, Università di Roma "La Sapienza", Dipartimento di Meccanica e Aeronautica — The interaction of a supersonic flat plate boundary layer flow at $Re_\theta \approx 4000$ with an impinging oblique shock wave ($M_\infty = 2.25$, $\beta = 32.7^\circ$) is analyzed by means of direct numerical simulation of the Navier-Stokes equations. Under the selected conditions the incoming boundary layer undergoes a mild unsteady separation and the incident shock undergoes a severe flapping motion due to the interaction with the large scale structures embedded in the boundary layer. The analysis of the unsteady flow properties indicates that such quantities as pressure are characterized by a broadband spectrum extending to high frequencies, superposed with low frequency oscillations associated with the large scale motion of the separation shock. The main contribution of the present work is to provide a link between the unsteady motion of the shock wave and the unsteady shedding of the large vortical structures generated next to the separation point; such structures are also shown to be responsible for the amplification of turbulence kinetic energy and shear stress across the interaction zone and for the slow relaxation of the boundary layer to an equilibrium state.

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Date submitted: 09 Aug 2005 Electronic form version 1.4