Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Reynolds number effect on drag reduction in a microbubble-laden spatially-developing turbulent boundary layer S. ELGHOBASHI, A. FERRANTE, University of California, Irvine — Direct simulations of a microbubble-laden spatially developing turbulent boundary layer (SDTBL) were performed to compare the amounts of skin friction reduction due to the bubbles' presence for two Reynolds numbers: $Re_\theta = 1430$ and $Re_\theta = 2900$. The results show that increasing the Reynolds number *decreases* the percentage of drag reduction. Increasing Re_θ *'squeezes'* the quasi-streamwise vortical structures toward the wall, whereas the microbubbles *'push them away'* from the wall. The net result of these two *opposing effects* determines the amount of skin friction reduction by the microbubbles. The displacement of the vortical structures by the microbubbles is a result of the local positive velocity divergence, $\nabla \cdot \mathbf{U}$, created by the bubbles' concentration gradients. Thus, the volume fraction of bubbles that is responsible for the reduction of skin friction in a SDTBL at a given Reynolds number is not sufficient to produce the *same* amount of reduction in skin friction at higher Reynolds numbers.

S. Elghobashi
University of California, Irvine

Date submitted: 04 Aug 2005 Electronic form version 1.4