Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Effect of bubble size on micro-bubble drag reduction XIAOCHUN SHEN, STEVEN CECCIO, MARC PERLIN, University of Michigan — The effect of bubble size on micro-bubble drag reduction was investigated experimentally in a high-speed turbulent channel flow of water. A variety of near-wall injection techniques were used to create a bubbly turbulent boundary layer. The resulting wall friction force was measured directly by a floating element force balance. The bubble size was determined from photographic imaging. Using compressed nitrogen to force flow through a slot injector located in the plate beneath the boundary layer of the tunnel test section, a surfactant solution (Triton X-100, 19ppm) and salt water solution (35ppt) generated bubbles of average size between ∼500 microns and ∼200 microns and ∼100 microns, respectively ($40 < \quad d^+ \quad < 200$). In addition hollow spherical glass beads (∼75 microns ($d^+ = 30$) and specific gravity 0.18) and previously prepared lipid stabilized gas bubbles of ∼ 30 micron ($d^+ = 12$) were injected. The results indicate that the drag reduction is related strongly to the injected gas volume flux and the static pressure in the boundary layer. Changing bubble size had essentially no influence on the measured friction drag, suggesting that friction drag is not a strong function of bubble size. [Sponsored by the Office of Naval Research.]

Xiaochun Shen
University of Michigan

Date submitted: 12 Aug 2005 Electronic form version 1.4