Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Effect of Surface Roughness on Polymer Drag Reduction with a High-Reynolds-Number Turbulent Boundary Layer BRIAN ELBING, DAVID DOWLING, MICHAEL SOLOMON, SHERRY BIAN, STEVEN CECCIO, University of Michigan — A recent experiment at the U.S. Navy's Large Cavitation Channel (LCC) investigated the effect of wall roughness on wall-injection polymer drag reduction (PDR) within a high-Reynolds-number (10^7 to $2x10^8$ based on downstream distance) turbulent boundary layer (TBL). Testing was performed in two parts: 1) PDR experiment on a 12.9 m long, 3.05 m wide hydro-dynamically smooth flat plate and 2) PDR experiment on the same model with the entire surface roughened. The roughness was produced by blowing glass beads into epoxy paint that was applied to the entire model. The roughened model had an average roughness height ranging between 307 and 1154 μm. Drag reduction was determined using six, stream-wise located integrated skin-friction balances. In addition to skin-friction measurements, sampling was performed at three stream-wise located ports. The sampling ports were used to determine the amount of degradation, if any, caused by the turbulent flow on the polymer. Both the skin-friction measurements and sampling analysis indicates that wall roughness in a turbulent boundary layer significantly increases degradation of the polymer solution.

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Date submitted: 02 Aug 2007 Electronic form version 1.4