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High-Reynolds-number flat-plate turbulent boundary layer measurements ERIC S. WINKEL, University of Michigan, JAMES M. CUTBIRTH, Mainstream Engineering Inc., MARC PERLIN, STEVEN L. CECCIO, DAVID R. DOWLING, University of Michigan — A set of experiments was conducted in the U.S. Navy's Large Cavitation Channel (LCC) into the characteristics of a liquid turbulent boundary layer at nearly zero-pressure-gradient. The hydraulically smooth, $k^+ < 0.2$, flat-plate test model measured 12.9 m in length and 3.05 m in span and was approximately centered in the LCC test section. Data was gathered at flow speeds up to 20 m/s to achieve downstream-distance-based Reynolds numbers up to 220 million. Static pressure, skin-friction, and laser-Doppler velocimetry (LDV) measurements are presented. Static pressure measurements along the plate surface show a mild favorable pressure gradient, less than 2.5% flow acceleration over the model. Skin-friction was measured at six stream-wise positions with 15-cm-diameter, flush-mounted drag-balances. Flow profiles of the mean and second-order turbulence statistics of stream-wise and wall-normal velocity components were measured using two-component LDV. When normalized with the measured skin-friction, mean velocity profiles agree with the accepted law-of-the-wall constants and the total near-wall shear stress approaches unity.

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