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The Turbulent Boundary Layer Near the Air-Water Interface on a Surface-Piercing Flat Plate[1] NATHAN WASHUTA, NAEEM MASNADI, JAMES H. DUNCAN, University of Maryland — Turbulent fluctuations in the vicinity of the water free surface along a flat, vertically oriented surface-piercing plate are studied experimentally using a laboratory-scale experiment. In this experiment, a meter-wide stainless steel belt travels horizontally in a loop around two rollers with vertically oriented axes, which are separated by 7.5 meters. This belt device is mounted inside a large water tank with the water level set just below the top edge of the belt. The belt, rollers, and supporting frame are contained within a sheet metal box to keep the device dry except for one 6-meter-long straight test section between rollers. The belt is launched from rest with a 3-g acceleration in order to quickly reach steady state velocity. This creates a temporally evolving boundary layer analogous to the spatially evolving boundary layer created along a flat-sided ship moving at the same velocity, with a length equivalent to the length of belt that has passed the measurement region since the belt motion began. Cinematic Stereo PIV measurements are performed in planes parallel to the free surface by imaging the flow from underneath the tank in order to study the modification of the boundary layer flow field due to the effects of the water free surface.

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