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Vertical gas injection into liquid cross-stream beneath horizontal surfaces IN-HO LEE, SIMO MAKIHARJU, University of Michigan, INWON LEE, Pusan National University, MARC PERLIN, STEVE CECCIO, University of Michigan — Skin friction drag reduction on flat bottomed ships and barges can be achieved by creating an air layer immediately beneath the horizontal surface. The simplest way of introducing the gas is through circular orifices; however the dynamics of gas injection into liquid cross-streams under horizontal surfaces is not well understood. Experiments were conducted to investigate the development of the gas topology following its vertical injection through a horizontal surface. The liquid cross-flow, orifice diameter and gas flow rate were varied to investigate the effect of different ratios of momentum fluxes. The testing was performed on a 4.3 m long and 0.73m wide barge model with air injection through a hole in the transparent bottom hull. The incoming boundary layer was measured via a pitot tube. Downstream distance based Reynolds number at the injection location was 5 x 10ˆ5 through 4 x 10ˆ6. To observe the flow topology, still images and video were recorded from above the model (i.e. through the transparent hull), from beneath the bottom facing upward, and from the side at an oblique angle. The transition point of the flow topology was determined and analyzed.

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