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Turbulent Boundary Layer Facility to Investigate Superhydrophobic Drag Reduction[1] JAMES W. GOSE, MARC PERLIN, STEVEN L. CECCIO, University of Michigan — Recent developments in superhydrophobic surfaces have led to potential economic and environmental benefits, perhaps most notably in skin-friction drag reduction. A team from the University of Michigan has developed a recirculating turbulent boundary layer facility to investigate the reduction of drag along engineered superhydrophobic surfaces (SHS). The facility can accommodate both small and large SHS samples in a test section 7 mm (depth) x 100 mm (span) x 1000 mm (length). Coupled with an 11.2 kilowatt pump and a 30:1 contraction the facility is capable of producing an average flow velocity of 25 m/s, yielding a Reynolds number of 84,000. Flexure-mounted test samples subjected to shear deflect to a max of 50 microns; movements are measured using a digital microscope composed of a high-resolution camera and a water immersion objective. The setup yields an optical resolution of about one micron whereas sub-micron resolution is achieved by implementing an FFT of two Ronchi rulings. Additional drag measurement methods include pressure drop across the test specimen and PIV measured boundary layers. Additional SHS investigations include the implementation of active gas replenishment, providing an opportunity to replace gas-pockets that would otherwise be disrupted in traditional passive SHS surfaces due to high shear stress and turbulent pressure fluctuations.

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James W. Gose
University of Michigan

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