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Characterization of the Far-Wake of an Inclined 6:1 Prolate Spheroid ETHAN LUST, JONATHAN PECK, US Naval Academy — Despite dramatic advances in computational power seen in the last decades, computational models are unable to predict transition, separation, and wake development for flow over three-dimensional bodies to the desired level of accuracy at acceptable computational cost. Without the ability to predict the forces and moments on the body, critical design parameters such as drag and loads on control surfaces for air- and water-borne vehicles cannot be predicted. The prolate spheroid is a popular body upon which to verify CFD models because of its simple geometry and complex, three-dimensional flow field. Advances in computational speed and experimental capabilities have prompted a renewed interest in related research. An experiment was conducted in the large towing tank facility of the U.S. Naval Academy, using a 6:1 prolate spheroid, measuring 54 in. (1.4 m) in length and 9 in. (0.23 m) in diameter. The spheroid model was inclined by 15relative to the undisturbed free surface, and towed at speeds yielding length-based Reynolds numbers from 0.5-4.2x10^6. Particle image velocimetry was used to provide two-dimensional velocity maps in two spatial-dimensions (2C2D) at downstream distances of up to 5L. These time histories show the trajectory of the wake as it leaves the tail of the model, the expansion of the wake width, the size, strength, and position of the primary vortical structures shed into the wake. These results will inform follow-on studies focused on measuring turbulent quantities in the far wake.

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