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Near-Body Velocity and Turbulence Measurements of an Inclined 6:1 Prolate Spheroid at Low and Moderate Reynolds Numbers ZACHARY NYGAARD, ETHAN LUST, 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 recirculating water tunnel at the U.S. Naval Academy, using a 6:1 prolate spheroid measuring 0.43 m (18 in.) in length. The spheroid model was inclined at 2.5, 5, 10, and 20 degrees relative to the mean flow at flow speeds yielding length-based Reynolds numbers from 0.1-3x10^6. Stereo particle image velocimetry (SPIV) was used to provide two-dimensional velocity maps in three spatial-dimensions (3C2D) and turbulence statistics. Additionally, several methods of boundary layer trip were employed and discussion of the resulting flow field presented.

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