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Theoretical and Experimental Comparison of Aerodynamic Characteristics for Flexible Membrane Wings with Cambered Frames ANDREW WRIST[1], JAMES HUBNER[2], The University of Alabama — Flexible membrane wings of the MAV (micro air vehicle) scale can experience improved lift/drag ratios, delays in stall, and decreased time-averaged flow separation when compared to rigid wings. Previous research examined the effect of frame camber on the time-averaged shapes of membrane wings and observed that increasing frame camber results in increased aero-induced membrane camber. This study involves a more in-depth DIC (Digital Image Correlation) analysis of the previous research to increase the understanding of the time-averaged shapes for membrane wings with cambered frames and offers a theoretical comparison to the experimental results. The author performed a theoretical lifting-line analysis based on the time-averaged shape for the membrane wings to calculate lift, induced drag, and circulation. The calculations include the effects of geometric twist, aspect ratio, and effective angle-of-attack. The wings, with an aspect ratio of 2, were fabricated with silicone rubber membranes and 3D printed cambered frames differing in percent camber, maximum camber location, and thickness. The DIC images were acquired in The University of Alabama's MAV wind tunnel as tests were performed at 10 m/s (Re = 50,000). The analysis will be discussed in the presentation.

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