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Investigating the Improved Aerodynamic Efficiency of Cambered Frames on Membrane MAV Wings[1] ANDREW WRIST, ZHENG ZHANG, PAUL HUBNER, Univ of Alabama - Tuscaloosa — Previous research has demonstrated that membrane wings with cambered frames are more aerodynamically efficient than those with flat frames, despite passive dynamic membrane cambering for both. To help understand this aerodynamic benefit, this study compares the time-averaged membrane shape as well as membrane vibration frequency and amplitude for a group of wings with cambered frames. The frames were 3D printed with a hardened polymer material, and a silicon rubber membrane was attached to the top surface. The frame aspect ratio is two, comprised of two cells each with a cell aspect ratio of one. The rigid leading edge extended 20% of the chord, and the trailing edge was scalloped at 25%. Camber ranged from 2-6%, camber location from 40-60%, and airfoil thickness from 4-6%. Tests were performed in the University of Alabama's MAV wind tunnel at 10 m/s (Re = 50,000). High speed imaging results of the deformation and vibration will be discussed in context to airfoil and wing theory.

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Andrew Wrist
Univ of Alabama - Tuscaloosa

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