

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Comparison of Aerodynamic Coefficients from Low Aspect Ratio Membrane Wings and their Time-Averaged Shape¹ NATHAN MARTIN, Rice University, ANDREW WRIST, ZHENG ZHANG, JAMES HUBNER, University of Alabama — Air flow over flexible membrane wings can induce vibration. The vibrating nature and the time-averaged curvature of a membrane wing may separately contribute to its improved aerodynamic characteristics compared to a flat plate of similar planform. To assess the effect of the time-averaged shape, a comparison of vibrating membrane wings and corresponding time-averaged shape of an aspect ratio two planform was conducted for membranes pre-tensions of 1%, 2%, and 4% and various cell aspect ratios. The membrane displacements were recorded using digital image correlation for each model at 6° and 18° angles of attack. The displacements were averaged, imported into CAD software, and printed using rapid prototyping equipment. The lift, drag, and pitching moment coefficients were acquired through wind tunnel testing at Reynolds number 50,000. The results indicate that membrane wings generate more drag but are more efficient than their time-averaged shapes due to greater lift.

¹Funding received by NSF REU Grant 1062611 and AFOSR Grant FA9950-10-1-0152.

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Date submitted: 25 Jul 2012

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