

Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

An Experimental Study of Flexible Membrane Airfoils at Low Reynolds Numbers¹ MASATOSHI TAMAI, J.T. MURPHY, HUI HU, Aerospace Engineering Dept., Iowa State University — Thin and flexible membrane wings are unique to flying and gliding mammals, such as bats, flying squirrels and sugar gliders. These animals exhibit extraordinary flight capabilities with respect to maneuvering and agility that are not observed in other species of comparable size. We conducted the present study to try to leverage the flexible membrane wing feature of bats and other flying and gliding mammals to Micro-Air-Vehicle (MAV) designs for improved aerodynamic performance. A comprehensive wind-tunnel experimental investigation was conducted to study the flow behavior around flexible membrane airfoils compared with their rigid counterparts. In addition to aerodynamic force measurements using force transducers, a high-resolution Particle Image Velocimetry (PIV) system was used to conduct quantitative flow field measurements around the flexible membrane airfoils. The objective of the present study is to elucidate fundamental physics and to explore the potential applications of such non-traditional, bio-inspired flexible membrane airfoils to MAV designs for improved aerodynamic performance.

¹Supported by NSF-CAREER program, Grants No. CTS0545918

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Date submitted: 12 Sep 2007

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