Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Dynamics of Compliant Membranes Forced by Vortex Shedding[1]
ARNOLD SONG, Brown University, RICARDO GALVAO, MIT, KENNETH BREUER, Brown University — Low-aspect-ratio wings composed of thin, compliant membranes are unique to flying and gliding mammals such as bats and flying squirrels. The distinct structure of the membrane wing is thought to be a major contributor to the extraordinary flight capabilities with respect to agility and maneuverability of these animals. We present wind tunnel measurements of the static deformation and unsteady vibrations of a thin, low aspect ratio membrane wing subject to forcing by vortex shedding from leading edge separation. The three-dimensional membrane dynamics are measured via high-speed stereo photogrammetric tracking of an array of discrete locations on the membrane. The dependence of the static deflection and aerodynamic forces on dynamic pressure, angle of attack and membrane elasticity are reported. In addition, at high angles of attack, unsteady vibrational modes in the membrane are measured, and connections with the leading edge vortex shedding are explored. The implications for animal flight behavior will also be discussed.

[1]Supported by AFOSR

Kenneth Breuer
Brown University

Date submitted: 03 Aug 2006 Electronic form version 1.4