Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Lift on Flexible and Rigid Cambered Wings at High Incidence[1]
ANYA JONES, PETER MANCINI, University of Maryland, KENNETH GRANLUND, MICHAEL OL, U.S. Air Force Research Laboratory — The effects of camber and camber change due to elastic deflection of a membrane wing were investigated for wings in rectilinear translation with parameter variations in wing incidence and acceleration. Direct force and moment measurements were performed on a rigid flat plate wing, rigid cambered wings, and a membrane wing. Features in the force histories were further examined via flow visualization by planar laser illumination of fluorescent dye. Below 10 degrees of incidence, Wagner's approximation accurately predicts the time-evolution of lift for the rigid wings. At higher incidence, flow separation results in force transients, and the effect of wing camber is no longer additive. Both the rigid flat plate and rigid cambered wings reach peak lift at a 35 degree angle of attack, whereas the flexible wing experiences stall delay and reaches peak lift at 50 degrees. Due to the aeroelasticity of the flexible membrane, flow over the suction surface remains attached for much higher incidence angles than for the rigid wings. For incidence angles less than 30 degrees, the peak lift of the flexible wing is lower than that of its rigid counterparts. Beyond 30 degrees, the flexible wing experiences an aeroelastically induced stall delay that allows lift to exceed the rigid analogs

[1]This work was supported by the Air Force Office of Scientific Research (AFOSR) Summer Faculty Fellowship Program and the U.S. Army Research Laboratory under the Micro Autonomous Systems and Technology (MAST) program.

Anya Jones
University of Maryland

Date submitted: 30 Jul 2014 Electronic form version 1.4