Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Fluid-structure Interaction of Rigid and Flexible Wings in Ground Effect ROBERT BLEISCHWITZ[1], ROELAND DE KAT[2], BHARATHRAM GANAPATHISUBRAMANI[3], University of Southampton — Inspired by trawling bats, combining flexible membrane wings and the vicinity of the ground, an experimental wind tunnel study is conducted at Re = 56,000 to determine the fluid-structure-ground interaction of rectangular, perimeter reinforced low aspect ratio (AR = 2) membrane wings in free flight and ground effect conditions. The pitch angle is varied between $10° \leq \alpha \leq 25°$. Flexible membrane wings are compared with rigid flat plates. Instantaneous lift and drag forces are simultaneously recorded with membrane and flow dynamics (Digital-Image-Correlation + Particle-Image-Velocimetry). The focus of this study involves coupling effects of membrane mode shapes (chordwise + spanwise) and flow structures changing with angle of attack and height over ground. A POD analysis of the flow, membrane vibrations and forces should help to identify aerodynamic beneficial vibration shapes and their impact on flow features such as leading edge and tip vortices. The knowledge is seen to be essential for efficient usage of MAVs with membrane wings in and out of ground effect.

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Date submitted: 08 Jun 2015 Electronic form version 1.4