Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Whole-field, time resolved velocity measurements of flow structures on insect wings during free flight KENNETH LANGLEY, SCOTT THOMSON, TADD TRUSCOTT, Brigham Young University — The development of micro air vehicles (MAVs) that are propelled using flapping flight necessitates an understanding of the unsteady aerodynamics that enable this mode of flight. Flapping flight has been studied using a variety of methods including computational models, experimentation and observation. Until recently, the observation of natural flyers has been limited to qualitative methods such as smoke-line visualization. Advances in imaging technology have enabled the use of particle image velocimetry (PIV) to gain a quantitative understanding of the unsteady nature of the flight. Previously published PIV studies performed on insects have been limited to velocities in a single plane on tethered insects in a wind tunnel. We present the three-dimensional, time-resolved velocity fields of flight around a butterfly, using an array of high-speed cameras at 1 kHz through a technique known as 3D Synthetic Aperture PIV (SAPIV). These results are useful in understanding the relationship between wing kinematics and the unsteady aerodynamics generated.

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Date submitted: 03 Aug 2012 Electronic form version 1.4