Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Effect of gust on flow patterns around a robotic hummingbird wing ELOY N. MARQUEZ, New Mexico State University, HUMBERTO EVANS, Technische Universiteit Eindhoven, RAMIRO ALARCON, New Mexico State University, GLEN WHITEHOUSE, Continuum Dynamics Inc., B.J. BALAKUMAR, Los Alamos National Laboratory — Numerous studies have demonstrated the importance of the leading edge vortex (LEV) in enhancing lift production during hovering flight for a hummingbird. Almost all of these experiments have been performed under laminar inflow conditions without the presence of transient flow phenomena (e.g. gust). And yet, real-life ornithopters in the field have to routinely tackle gust and directional changes in the wind. In this talk, preliminary results from an investigation of the flow field modulation around a hummingbird wing under well-controlled gusty conditions are presented. Using a 2-degree of freedom robotic hummingbird model wing mounted on a translation stage, conditions replicating a gust impacting a wing are created at the NMSU water channel facility. Phase-locked PIV velocity measurements were obtained around the wing in the presence of gusts varying from 5-30% of the mean tangential wing velocity. These measurements, in combination with force and moment measurements from a six-axis load cell, are used to understand transient flow phenomena induced by the gust, and their effect on the net thrust and lift forces on the robot's wings over a range of Reynolds number ($1400<Re<20000$).

B.J. Balakumar
Los Alamos National Laboratory

Date submitted: 15 Sep 2010 Electronic form version 1.4