Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Simplified Wake Model of a Flapping Wing THOMAS APKER, THOMAS CORKE, University of Notre Dame — A vortex wake model consisting of two parts, a strong leading-edge vortex that is shed during the flapping cycle and a continuously attached vortex line determined by quasi-steady lifting line theory was developed. The leading edge vortex is essentially an expression of the Magnus effect, while the strength of the wing-tip vortex is determined by unsteady lifting line theory. Combined, these produce the "ladder vortex" pattern seen downstream of root-flapping wings with fixed span, such as insects and most man-made flapping wing vehicles. A small flapping wing experimental setup in still air was used to provide experimental comparison to the model. Measurements include flow visualization and velocity obtained using a stereo PIV system. The flapping mechanism was mounted on a two-component force balance to obtain time-resolved lift and thrust. Data were ensemble averaged with the flapping phase cycle and used to calculate vorticity. These were then reconstructed to show the space-time development of vorticity shed from the wing during the flapping motion to compare to the model predictions.

Thomas Corke
University of Notre Dame

Date submitted: 04 Aug 2006 Electronic form version 1.4