Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Formation Flight: Modes of Interaction of a Streamwise Vortex with a Wing CHRIS MCKENNA, MATTHEW BROSS, DONALD ROCKWELL, Lehigh University — Aircraft flying together in an echelon or V formation experience aerodynamic advantages. Impingement of the tip vortex of the leader (upstream) wing on the follower wing can yield an increase of lift to drag ratio. This enhancement is known to be sensitive to the location of vortex impingement on the follower wing. Particle image velocimetry is employed to determine patterns of velocity and vorticity in successive crossflow planes, which characterize the streamwise evolution of the vortex structure along the chord of the follower wing and into its wake. Different modes of vortex-follower wing interaction are created by varying the spanwise location of the leader wing. These modes are defined by differences in the development of, and interaction between, the incident tip vortex from the leader wing and the tip vortex along the follower wing. Modes of development/interaction of the tip vortices include bifurcation, attenuation, and mutual induction. The bifurcation and attenuation modes decrease the strength of the follower tip vortex. In contrast, the mutual induction mode increases the strength of the follower tip vortex.

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Date submitted: 28 Jul 2014 Electronic form version 1.4