Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

On the Lateral Static Stability of Low-Aspect-Ratio Rectangular Wings THOMAS LINEHAN, KAMRAN MOHSENI, Univ of Florida - Gainesville — Low-aspect-ratio rectangular wings experience a reduction in lateral static stability at angles of attack distinct from that of lift stall. Stereoscopic digital particle image velocimetry is used to elucidate the flow physics behind this trend. Rectangular wings of AR = 0.75, 1, 1.5, 3 were tested at side-slip angles $\beta = -10^\circ$ and 0° with angle of attack varied in the range $\alpha = 10^\circ - 40^\circ$. In side-slip, the leading-edge separation region emerges on the leeward wing where leading-edge flow reattachment is highly intermittent due to vortex shedding. The tip vortex downwash of the AR < 1.5 wings is sufficient to restrict the shedding of leading-edge vorticity, enabling sustained lift from the leading-edge separation region to high angles of attack. The windward tip vortex grows in size with increasing angle of attack, occupying an increasingly larger percentage of the windward wing. At high angles of attack pre-lift stall, the windward tip vortex lifts off the wing, resulting in separated flow underneath it. The downwash of the AR = 3 wing is insufficient to reattach the leading-edge flow at high incidence. The flow stalls on the leeward wing with stalled flow expanding upstream toward the windward wing with increasing angle of attack.

Thomas Linehan
Univ of Florida - Gainesville

Date submitted: 24 Jul 2017 Electronic form version 1.4