Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

On leading-edge vortex attachment in rotary systems: Incident flow effects ALBERT MEDINA, U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, ANYA R. JONES, University of Maryland, College Park — The mechanism governing the stable attachment of the leading-edge vortex (LEV) in rotating systems has been believed to be rooting in a balance between the rate vorticity production from the leading-edge shear layer and the convection of vorticity-bearing mass from within the LEV to the surrounding flow field. In such a relation, the accumulation of vorticity within a vortical structure is regulated by convective influences effectively draining the structure of circulatory strength. This work numerically investigates the shear rate-convection balance assertion in low-aspect ratio rectangular flat plates undergoing unidirectional rotation in a steady freestream. The freestream is oriented parallel to the rotational axis and the effect of advance ratio on the resulting flow structures is compared with a rotary plate operating in a quiescent fluid. Depending on advance ratio, the incidence angle of the plate is adjusted to maintain a constant effective attack angle of $\alpha = 45°$ based on plate tip speeds. Of interest is the response of the system over a Reynolds number range $Re = [10^2 : 10^3]$ where axial flow prominence shifts from aft of the leading-edge vortex to within the structure.

Albert Medina
U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base

Date submitted: 02 Aug 2015 Electronic form version 1.4