Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Unsteady Aerodynamics of Static Airfoils in Reverse Flow ANDREW LIND, ANYA JONES, University of Maryland — Wind tunnel experiments have been conducted on two-dimensional blunt and sharp trailing edge airfoils held at static angles of attack in reverse flow for three Reynolds numbers. The current work is aimed at advancing the understanding of fully developed reverse flow for high-speed helicopter applications, and evaluates the potential for blunt trailing edge airfoils to mitigate unsteady rotor blade airloads in this flow regime. Time-resolved particle image velocimetry measurements at post-stall angles of attack have revealed the evolution of a trailing edge vortex formed by the roll-up of vorticity generated in a separated shear layer. Proper orthogonal decomposition (POD) was applied to the flow field measurements to improve the identification and tracking of dominant flow structures. Unsteady force balance measurements have captured non-structural vibrations with frequency content which correlates well with that of the temporal coefficients for the first two POD spatial modes. These vibrations vary in frequency with angle of attack and are shown to be linked with trailing edge vortex shedding. The findings presented here give fundamental insight towards the development of efficient rotor blades for high-speed helicopters.

Andrew Lind
University of Maryland

Date submitted: 02 Aug 2013 Electronic form version 1.4