Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A short wave instability caused by the approach of a vortex pair to a ground plane DANIEL M. HARRIS, Massachusetts Institute of Technology, CHARLES H.K. WILLIAMSON, Cornell University — In the present work, we experimentally study the approach of a counter-rotating vortex pair to a ground plane. The trajectories of the primary vortices in experiment differ quite significantly from the inviscid case, primarily due to the fact that between the vortices and the ground, a boundary layer forms, which can separate to generate secondary vortices of opposite sign; a phenomenon originally discovered by Harvey and Perry (1971). We have developed a novel technique to study this flow that allows us to *principally highlight and visualize the secondary vorticity*, in preference to the primary vorticity. As the secondary vortices rotate around the primary vortices, they begin to develop a three-dimensional instability in the presence of the strain rate field of the primaries, which is characteristically similar to the instability first observed in direct numerical simulation by Luton and Ragab (1997). We outline the origin of the instability by comparing our detailed experimental measurements and observations with prior theoretical considerations (for example, Widnall (1974) and others). We also account for the late stage dynamics through inviscid flow considerations. The study has applications to wake vortex interaction at runways and to turbulent flow transition.

Daniel M. Harris
Massachusetts Institute of Technology

Date submitted: 10 Aug 2010 Electronic form version 1.4