Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Effect of ambient turbulence on the evolution of a counter-rotating vortex pair.[1] MADIHA AHMED, FAZLE HUSSAIN, Univ. Houston — In an attempt to explain and develop strategy for control of aircraft wake vortex in a turbulent atmosphere, the evolution of a vortex column dipole (a pair of counter-rotating vortices) in the presence of fine-scale (homogeneous and isotropic) freestream turbulence is studied via DNS of the Navier-Stokes equations. The freestream turbulence is found to significantly accelerate the vortex decay via a complex vortex-turbulence coupling scenario, which we study. External fine-scale turbulence is first stretched into azimuthal filaments (see also Melander & Hussain, PRE, vol 48 (1993)) which merge into threads through successive pairings and advect along the column dipole by self-induction. Oppositely-directed advection of opposite-signed threads forms thread dipoles which then move outward by mutual-induction and also eject column fluid (see also J. S. Marshall, JFM, vol 345 (1997)). This has the effect of enhancing both mixing with the ambient fluid and the nominally planar reconnection (cross-diffusion) between the column vortex pair. We then further explore the column vortex dipole-turbulence interaction scenario and vortex decay dependence on parameters like the column vortex Reynolds number, separation of the vortices, and the intensity and scale of freestream turbulence.

[1]Funded by NSF Grant No. G092136.

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Date submitted: 06 Aug 2007 Electronic form version 1.4