Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Direct Numerical Simulations of unstratified and stratified wakes at Re=50,000 KYLE BRUCKER, SUTANU SARKAR, UCSD — Direct numerical simulations (DNS) of axisymmetric wakes with and without initial net momentum are performed at Re=50,000 on a grid with approximately 2 billion grid points. The present study focuses on this difference in the presence of stratification and attempts to elucidate the effects of buoyancy. Similarities and differences are characterized by the evolution of maxima, area integrals and spatial distributions of mean and turbulence statistics. Buoyancy allows a wake to survive longer in a stratified fluid by reducing the correlation responsible for the mean-to-turbulence energy transfer in the vertical direction. This effect is especially important in the case with zero initial net-momentum because it allows regions of positive and negative momentum to become decoupled in the vertical direction and decay with different rates. The role of internal waves in the energetics is determined and it is found that they are responsible for sustaining turbulence at the wake periphery long after the shear production has subsided. The non-equilibrium region of the Re =50,000 wake is found to exhibit a time span when, although the turbulence is strongly stratified as indicated by small Froude number, the turbulent dissipation rate exhibits inertial scaling.

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Date submitted: 10 Aug 2009 Electronic form version 1.4