Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The budget of turbulent kinetic energy in bubble plumes by acoustic Doppler velocimetry[1] CHRIS LAI, SCOTT SOCOLOFSKY , Texas A&M Univ — We present an experimental investigation on the TKE budget of a two-phase air-water bubble plume in an otherwise quiescent ambient. The required three-dimensional turbulent velocity field was measured by a profiling acoustic Doppler velocimeter. Experiments were carried out in a square water tank of $1m^3$ and covered both adjustment phase ($z/D < 5$) and asymptotic regime ($z/D \geq 5$) of the plume in which the latter is characterized by a constant local Fr_p. The dynamic length scale D has previously been derived from a two-fluid approach and delineates the two regimes. Data on the mean flow establish the existence of an asymptotic regime when $z/D > 8$ with an entrainment coefficient of 0.095 and a Fr_p of 1.63. The data also corroborate well with previous measurements of large-scale bubble plumes. A budget of TKE was performed using curve-fits derived from the radial profiles of second- and third-order moments of turbulent velocities. From the budget, TKE production by bubbles was found to be larger than that by fluid shear. Approximately 55-60% of the total work done by bubbles is used to create fluid turbulence.

[1]This research was made possible by a grant from The Gulf of Mexico Research Initiative to the Gulf Integrated Spill Research (GISR) Consortium.

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Date submitted: 01 Aug 2016 Electronic form version 1.4