Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Direct Numerical Simulations of Low Mach Number Turbulence and Sprays WEI LIU, YUNLIANG WANG, CHRISTOPHER RUTLAND — Direct numerical simulations are being performed to investigate spray-turbulence interactions. Spray models, such as the injection, drag force, and evaporation models, are implemented into a three-dimensional direct numerical simulation (DNS) code with low Mach number approximations. Complete two-way couplings of mass, momentum, and energy between the spray and the gas phase flow are included in the formulations. The gas phase flow is discretized in a Eulerian frame, and the droplets are tracked in a Lagrangian frame. Results for the cases of the single droplet evaporation and the cases for the penetration length of the injected sprays have been compared to experimental measurements, and reasonable matches have been achieved. An analysis of the effects of the droplet evaporation on the gas phase turbulence has been conducted for both single droplet and spray simulations. It is found that the evaporation of droplets has a great impact on the generation of turbulence. Current work for this research includes three-dimensional simulations of sprays interacting with different initial gas field. A-priori studies for large eddy simulation (LES) models are also conducted using spray-turbulence DNS results.

Wei Liu

Date submitted: 28 Jul 2005 Electronic form version 1.4