Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Void fraction and bubble size in a simulated hydraulic jump[1]
ADAM WITT, JOHN GULLIVER, LIAN SHEN, St. Anthony Falls Laboratory —
Two- and three-dimensional numerical simulations of a hydraulic jump are carried out with the open source software package OpenFOAM using a Volume of Fluid numerical method and a realizable k-ε turbulence model. Time-averaged air-water properties are obtained over a 15 second sampling time. Void fraction profiles show good agreement with experimental values in the turbulent shear layer. Sauter mean diameter approaches experimental results in the turbulent shear layer, while showing grid dependence down to a uniform computational cell size of 0.625 mm. Three-dimensional results show a minor improvement in the prediction of entrained air compared to two-dimensional results at a multiple of 341 in increased computational time for the chosen grid. Relative error in bubble diameter is similar between two- and three-dimensional simulations. The results indicate a Volume of Fluid, realizable k-ε numerical model accurately predicts the void fraction profile when the Sauter mean diameter to grid size ratio surpasses 8.

[1]This research was supported by funding from the U.S. Department of Energy, the Hydro Research Foundation, the University of Minnesota and the University of Minnesota Supercomputing Institute.

Adam Witt
St. Anthony Falls Laboratory

Date submitted: 19 Jul 2013 Electronic form version 1.4