Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

An experimental investigation into the effect of Marine Hydrokinetic (MHK) turbine array spacing on turbine efficiency and turbine wake characteristics NICK STELZENMULLER, ALBERTO ALISEDA, University of Washington — Three 1/45 MHK turbine scale models were tested in a flume at various array spacings. The model turbines were instrumented to measure torque and angular velocity. Incident flow on the turbines and in the wakes was characterized via PIV and ADV measurements. Flow characteristics: mean velocity, turbulence intensity, and vorticity are correlated with turbine performance. Tip speed ratio (TSR) similarity (although not Reynolds number) of the turbines is achieved by controlling the applied load with magnetic brakes inside the model turbine nacelles. Wake characteristics and turbine efficiencies were investigated at a range of TSRs, with the goal of "tuning" an array to maximize overall array efficiency. Grids were placed in the flume upstream of the turbine array in order to change the turbulence intensity of the flow incident to the array. High levels of turbulence intensity in the incident flow is consistent with natural conditions in tidal currents, and has a strong effect on turbine wake dissipation. These experiments used a "reference model" turbine geometry developed for DOE at the National Renewable Energy Laboratory for the purpose of facilitating the comparison of experimental and numerical results in marine hydrokinetic turbine research.

Nick Stelzenmuller
University of Washington

Date submitted: 03 Aug 2012 Electronic form version 1.4