Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Interaction between an axial-flow model hydrokinetic turbine and an erodible channel CRAIG HILL, University of Minnesota - St. Anthony Falls Laboratory, MIRKO MUSA, University of Trento, LEONARDO P. CHAMORRO, University of Illinois - Department of Mechanical Science and Engineering, MICHELE GUALA, University of Minnesota - St. Anthony Falls Laboratory — Laboratory experiments were carried out to examine the effect of relatively large-scale bedforms on the performance of a model axial-flow hydrokinetic turbine. The turbine rotor, $d_T = 0.15$m, was attached to a miniature DC motor, and allowed for voltage data acquisition at 200 Hz along with 3D hub-height inflow velocity, U_{hub}, approximately $7d_T$ upstream of the turbine. Spatio-temporal bed elevations were acquired along three longitudinal sections and at least one transverse transect within the flume providing the temporally-averaged scour and deposition patterns characterizing the turbine near-field region. Turbine-turbine interaction was investigated under aligned configurations in the streamwise direction with variable spacing both in clear water scour and live bed transport conditions. Effects from both migrating bedforms and the upstream turbine were observed in the long-term and short-term voltage fluctuations of the downstream turbine. Combined measurements of inflow velocity, bed topography and turbine voltage were used to obtain joint statistics and correlations, which provided an indication of the variability in environmental exposure and performance that hydrokinetic turbines will encounter in natural erodible rivers.

Craig Hill
University of Minnesota - St. Anthony Falls Laboratory

Date submitted: 01 Aug 2013 Electronic form version 1.4