Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Mean and turbulent flow development through an array of rotating elements[1] ANNA CRAIG, Stanford University, JOHN DABIRI, California Institute of Technology, JEFFREY KOSEFF, Stanford University — The adjustment of an incoming boundary layer profile as it impacts and interacts with an array of elements has received significant attention in the context of terrestrial and aquatic canopies and more recently in the context of horizontal axis wind farms. The distance required for the mean flow profile to stabilize, the energy transport through the array, and the structure of the turbulence within the array are directly dependent upon such factors as the element height, density, rigidity/flexibility, frontal area distribution, element homogeneity, and underlying topography. In the present study, the mean and turbulent development of the flow through an array of rotating elements was examined experimentally. Element rotation has been shown to drastically alter wake dynamics of single and paired elements, but the possible extension of such rotation-driven dynamics had not previously been examined on larger groups of elements. Practically, such an array of rotating elements may provide insight into the flow dynamics of an array of vertical axis wind turbines. 2D particle image velocimetry was used along the length of the array in order to examine the effects of an increasing ratio of cylinder rotation speed to streamwise freestream velocity on flow development and structure.

[1]Work supported by a NSF Graduate Research Fellowship & Stanford Graduate Fellowship to A.E.C, by funding to J.O.D. from ONR N000141211047 and the Gordon and Betty Moore Foundation through Grant GBMF2645, and by funding from the EFML.

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Date submitted: 24 Jul 2014 Electronic form version 1.4