Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Vortex dynamics in the near-wake of tabs with various geometries using 2D and 3D PIV. AXY PAGAN-VAZQUEZ, US Army Construction Engineering Research Laboratory, DOLAANA KHOVALYG, University of Illinois at Urbana-Champaign, CHARLES MARSH, US Army Construction Engineering Research Laboratory, ALI M. HAMED, LEONARDO P. CHAMORRO, University of Illinois at Urbana-Champaign — The vortex dynamics and turbulence statistics in the near-wake of rectangular, trapezoidal, triangular, and ellipsoidal tabs were studied in a refractive-index-matching channel at Re = 2000 and 13000, based on the tab height. The tabs share the same bulk dimensions including a 17 mm height, a 28 mm base width, and a 24.5o angle. 3D PIV was used to study the mean flow and dominant large-scale vortices, while high-spatial resolution planar PIV was used to quantify high-order statistics. The results show the coexistence of counter-rotating vortex pair (CVP) and hairpin structures. These vortices exhibit distinctive topology and strength across Re and tab geometry. The CVP is a steady structure that grows in strength over a significantly longer distance at the low Re due to the lower turbulence levels and the delayed shedding of the hairpin vortices. These features at the low Re are associated with the presence of K-H instability that develops over three tab heights. The interaction between the hairpins and CVP is measured in 3D for the first time and shows complex coexistence. Although the CVP suffers deformation and splitting at times, it maintains its presence and leads to significant spanwise and wall-normal flows.

Leonardo P. Chamorro
University of Illinois at Urbana-Champaign

Date submitted: 28 Jul 2016 Electronic form version 1.4