Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Effect of Wind Tunnel Wall Adaptation on Flow over a Circular Cylinder SERHIY YARUSEVYCH, MICHAEL BISHOP, University of Waterloo — The presence of test section walls in many experimental facilities give rise to blockage effects, which detrimentally influence experimental data. A unique method to eliminate such blockage effects is to adapt the walls of a test section so as to mimic the conditions of an unbounded flow. The effect of such wall adaptation on flow development over a circular cylinder was the focus of this investigation. Velocity and surface pressure measurements were made in three test section wall configurations: geometrically straight walls (GSW), aerodynamically straight walls (ASW), and streamlined walls (SLW). In all the wall configurations investigated, tests were conducted for Re_d = 58,000 and model blockage ratios of up to 17%. The results show that, in GSW and ASW, blockage effects significantly alter flow development, affecting separated shear layer instability frequency, vortex shedding frequency, and limiting wake growth. Streamlining the walls successfully mitigates these adverse effects, with the relevant flow parameters shown to match those obtained in previous investigations conducted at low blockage ratios. Although the blockage effects produce an increase of both the separated shear layer instability and the wake vortex shedding frequency in GSW and ASW, the results suggest the ratio of these frequencies is invariant with the wall configuration. A comparative analysis of experimental data is performed to explain the observed trends.

Serhiy Yarusevych
University of Waterloo

Date submitted: 03 Aug 2009 Electronic form version 1.4