Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

The effect of aspect ratio on vortex pinch-off over laminar and turbulent regimes JOHN FERNANDO, DAVID RIVAL, Queen's University — In the current study, vortex rings formed behind accelerating flat plates are investigated to determine the role of aspect ratio on pinch-off over a range of $10^3 \leq \mathrm{Re} \leq 10^5$. We begin by demonstrating that aspect ratio plays a primary role in pinch-off, while the role of plate-edge curvature is of secondary importance. For vortex rings produced in the wake of elliptical plates (AR>1), the point of vortex pinch-off has been shown to be coterminous with the formation of a pressure maximum between the vortex ring and shear layer, as the elliptical ring deforms away from the feeding source. For the circular plate (AR=1), pinch-off is not clearly identified, and the vortex ring eventually breaks down in the wake. It is hypothesized that with increasing Reynolds number the vortex rings develop more quickly due to increased levels of mixing (entrainment) across the shear-layer interface. As such, vortex pinch-off is hastened for the circular plate with increasing Reynolds number, yet remains unchanged for the elliptical plate, for which the timescales of vortex-ring deformation (i.e. detachment) are faster than the rate of fluid entrainment. Force and velocimetry measurements are used to support this hypothesis.

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Date submitted: 30 Jul 2015 Electronic form version 1.4