Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Vorticity amplification near the stagnation point of landing gear wheels: effect of the orientation of the impinging vorticity MINGYAO GU, GRAHAM FELTHAM, ALIS EKMEKCI, University of Toronto Institute for Aerospace Studies — When oncoming streams of weak vorticity aligned with the axle axis of a two-wheel landing gear impinge near the forward stagnation point of the wheels, a mechanism for vorticity collection, growth, amplification into discrete large-scale vortices, and shedding was formerly shown to exist. In the current study, the impinging vorticity streams are perpendicular to the axle axis, i.e. in a vertical orientation as opposed to the horizontal orientation before. Experiments are conducted in a recirculating water channel using hydrogen bubble visualization and particle image velocimetry at a Reynolds number of 32,500 (based on the wheel diameter). As with the horizontal orientation, vorticity collection and amplification are observed, but the large-scale vortices thus formed are stretched around the wheel circumference in contrast to being stretched around the wheel sides, as observed for the horizontal orientation. This flow behavior varies with the impingement location of the vorticity streams across the wheel width. Maximum vorticity amplification occurs at a critical impingement location and drastically alters the flow separation along the wheel circumference. In addition, the instantaneous vortical structures are identified and tracked using a Galilean-invariant criterion.

Mingyao Gu
University of Toronto Institute for Aerospace Studies

Date submitted: 01 Aug 2014 Electronic form version 1.4