Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Topological study of steady state, three dimensional flow over a backward facing step[1] ANASTASIOS LIAKOS, United States Naval Academy, NIKOLAOS MALAMATARIS, George Mason University — The topology and evolution of flow over a backward facing step in three dimen- sional channel flow is examined for low to moderate Reynolds numbers. Direct nu- merical simulations were performed via a home made parallel finite element code. The computational domain has been designed according to actual laboratory experiment conditions. Analysis of the results is performed using the three dimensional theory of separation. Results indicate that a (primary) vortex is present for all Reynolds numbers immediately downstream from the step. Frictional stresses along the lateral wall create a novel vortical structure similar to a horseshoe vortex. A vortex along the top wall appears at Re = 400. As the Reynolds number increases, the top vortex increases both in spanwise and streamwise length and stunting the growth of the primary vortex. The downstream motion of the top vortex releases frictional stress thus destroying some critical points upstream while creating new ones downstream. Finally, at Re = 900 and 950, the primary and top vortices are twisting severely, which may indicate the onset of instability.

[1]Financial support from ONRG-VSP, Grant Number N62909-14-1-V068 is acknowledged

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Date submitted: 31 Jul 2015 Electronic form version 1.4