Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Flow Control via a Single Spanwise Wire on the Surface of a Stationary Cylinder ALIS EKMEKCI, Purdue University, DONALD ROCKWELL, Lehigh University — The flow structure arising from a single spanwise wire attached along the surface of a circular stationary cylinder is investigated experimentally via a cinema technique of digital particle image velocimetry (DPIV). Consideration is given to wires that have smaller and larger scales than the thickness of the unperturbed boundary layer that develops around the cylinder prior to flow separation. The wires have diameters that are 1% and 3% of the cylinder diameter. Over a certain range of angular positions with respect to the approach flow, both small- and large-scale wires show important global effects on the entire near-wake. Two critical angles are identified on the basis of the near-wake structure. These critical angles are associated with extension and contraction of the near-wake, relative to the wake in absence of the effect of a surface disturbance. The critical angle of the wire that yields near-wake extension is associated with bistable oscillations of the separating shear layer, at irregular time intervals, much longer that the time scale associated with classical Karman vortex shedding. Moreover, for the large scale wire, in specific cases, either attenuation or enhancement of the Karman mode of vortex formation is observed.

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Date submitted: 26 Jul 2007 Electronic form version 1.4