Abstract Submitted
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On The Persistence Of Turbulent Boundary Layer Drag Reduction Under Pulsed DC Plasma Actuation[1] SAMARESH MIDYA, FLINT THOMAS, THOMAS CORKE, Institute for Flow Physics and Control, University of Notre Dame — Experiments are reported which use a novel method of active flow control explicitly designed to intervene in Streak Transient Growth which was first postulated by Schoppa and Hussain (POF 1998, JFM 2002) as the dominant mechanism for the production of streamwise vortices in wall-bounded turbulent flows. The flow control method utilizes pulsed-DC plasma actuator arrays that are mounted flush with the wall in a ZPG turbulent boundary layer. A key finding of Schoppa and Hussain (1998) was the persistence of drag reduction for a finite time interval $T_M^+ = T_M u_\tau^2/\nu = O(10^3)$ after termination of near-wall actuation. This time scale ultimately governs the required streamwise stagger between successive actuators for a given drag reduction application. In the reported experiment the time scale T_M^+ is established in a ZPG TBL. Oil film interferometry is used to directly measure the local wall shear stress at several consecutive locations downstream of a pulsed-DC actuator array. In this manner, the spatial evolution of the local wall shear stress is obtained and contrasted for the controlled flow and non-actuated flows. Subsequently, the characteristic streamwise distance $\Delta x \propto U_e T_M$, over which local skin friction relaxes back to natural values is determined.

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