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Experimental Study of Laminar Separation Bubbles with Active Flow Control[1] DAVID BORGMANN, JESSE LITTLE, University of Arizona — Laminar separation bubbles (LSB) that form under the influence of an adverse pressure gradient are examined in a low turbulence wind tunnel. The LSBs are formed along the surface of a flat plate using a displacement body that is mounted from above. Rapid formation of spanwise vortical structures due to the primary shear layer instability promotes transition to turbulence and determines the extent of the separated region. Direct numerical simulations have shown the effectiveness of techniques that exploit the shear layer instability for active flow control (AFC). AFC in the form of 2D disturbance waves leads to the formation of coherent spanwise vortical structures that can reduce or completely eliminate the LSB. With a properly chosen forcing frequency and amplitude, the secondary absolute instability can be suppressed thus delaying transition and even relaminarizing the flow downstream of reattachment. The success of this AFC strategy is strongly affected by freestream turbulence where even modest levels can reduce the control authority due to excitation of Klebanoff modes. Therefore, the question arises whether the observed transition delay and relaminarization is possible in a real environment. This motivates a study of LSB AFC on a flat plate using DBD plasma actuators.

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