Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Active flow control of the laminar separation bubble on a plunging airfoil near stall[1] JESSE LITTLE, MARK AGATE, ARTH PANDE, University of Arizona — The effects of small amplitude, high frequency plunging motion on the X-56A airfoil are examined experimentally at Re=200,000 for 12 degrees angle of attack. The purpose of this research is to study the aerodynamic influence of structural motion when the wing is vibrating close to its eigenfrequency near static stall. Specific focus is placed on the laminar separation bubble (LSB) near the leading edge and its control via plasma actuation. In the baseline case, the leading edge bubble bursts during the oscillation cycle causing moment stall. A collaborative computational effort has shown that small amplitude forcing at a frequency that is most amplified by the primary instability of the LSB generates coherent spanwise vortices that entrain freestream momentum, thus reducing separation all while maintaining a laminar flow state. Results (PIV and surface pressure) indicate that a similar control mechanism is effective in the experiments. This is significant given the existence of freestream turbulence in the wind tunnel which has been shown to limit the efficacy of this active flow control technique in a model problem using direct numerical simulation. The implications of these results are discussed.

[1]Sponsored by AFOSR

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Date submitted: 31 Jul 2019 Electronic form version 1.4