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Control of Tollmien-Schlichting Waves on a Flat Plate Using a Piezoelectric-Driven Oscillating Surface HALEY DELL'ORSO, BURAK TUNA, EDWARD MEMAURO, MICHAEL AMITAY, Rensselaer Polytechnic Institute — Micro-air vehicles operate in the regime of low Reynolds numbers where the drag associated with skin friction is significant. One proposed method for drag reduction is to control the transition from laminar to turbulent flow by using active surface modification to either excite or suppress instabilities within the flow. To do so, the Piezoelectric-Driven Oscillating Surface (PDOS) actuator was developed and quantified. Two PDOS actuators were placed on a flat plate at two stream wise locations in a low Reynolds number flow. The upstream PDOS was actuated at a characteristic frequency appropriate to phase-lock Tollmien-Schlichting waves within the flow while the downstream PDOS was actuated at the anti-phase to reduce the magnitude of the T-S waves. Particle image velocimetry data were obtained along the centerline of the flat plate at different streamwise locations. Data showed that the upstream PDOS successfully locked-in to the instabilities in the flow and the growth of T-S waves was recorded over the increasing streamwise locations from the leading edge of the flat plate. Finally, the anti-phase (at the proper amplitude) was applied using the downstream PDOS and yielded substantial attenuation of the magnitude of the T-S waves.

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