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Vortex Development in a Laminar Separation Bubble measured via Tomographic Particle Image Velocimetry[1] JOHN KURELEK, SERHIY YARUSEVYCH, University of Waterloo, MARIOS KOTSONIS, Delft University of Technology — The development of shear layer vortices in a laminar separation bubble is investigated experimentally using Planar and Tomographic Particle Image Velocimetry. The experiments are carried out in a series of wind tunnel tests, with the bubble formed on a flat plate subjected to an adverse pressure gradient. Sensitivity to spanwise uniform (2D) and small-amplitude spanwise modulated disturbances (3D) is explored, with disturbances produced using surface mounted dielectric barrier discharge plasma actuators. Compared to the natural case, both types of forcing lead to earlier vortex formation that is rendered essentially two-dimensional at roll-up. While the vortex filaments remain largely two-dimensional until breakdown when subjected to the 2D forcing, deformations rapidly develop within the separation bubble at the spanwise wavelength that matches the input wavelength when 3D forcing is applied. The results elucidate the mechanism responsible for the observed rapid vortex deformations from the initially weak spanwise component of the input disturbances and the associated impact on the mean bubble characteristics.

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