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On vortex shedding in low Reynolds number flows over an airfoil SERHIY YARUSEVYCH, University of Waterloo, GREG KAWALL, Ryerson University, PIERRE SULLIVAN, University of Toronto — Development of coherent structures in a separated shear layer and wake of a NACA 0025 airfoil was studied experimentally. Wind tunnel experiments were carried out for a range of Reynolds numbers and three angles of attack. Flow characteristics were assessed via surface pressure measurements, hot-wire velocity measurements, and flow visualization. A laminar boundary layer separation occurred on the upper surface of the airfoil for all cases examined, resulting in the formation of a separated shear layer. Two types of coherent structures were identified and investigated in detail. Laminar-to-turbulent transition, which occurred in the separated shear layer, was associated with the formation of roll-up vortices. Shear layer roll-up occurred when naturally amplified disturbances reached sufficient amplitude. The resulting roll-up vortices were found to play an important role in the transition process. Wake vortices formed in the near-wake region and were shed alternatively on the upper and lower sides of the turbulent wake. It has been established that the fundamental frequency of the shear-layer disturbances exhibits a power law dependency on the Reynolds number, whereas the wake vortex shedding frequency displays a linear dependency on the Reynolds number. Based on the obtained results, a universal scaling for the wake vortex shedding frequency has been determined.

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