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The pre-cursor of Kelvin-Helmholtz instabilities in wake-perturbed separated boundary layers[1] AYSE G. GUNGOR, MARK P. SIMENS, JAVIER JIMÉNEZ, U. Politécnica Madrid — The interaction of large-scale wake disturbances with a pressure-induced separation bubble on a flat plate is studied by direct numerical simulation. The space-time development of the separated region shows roll-up vortices in the separated shear layer. Their appearance is closely associated with the receptivity of the upstream attached boundary layer. The wake-passing excites a linear normal mode of the boundary layer. This mode, which is initially very small, appears in the form of two-dimensional wave-trains upstream of the separation point, but becomes unstable and transforms into the Kelvin-Helmholtz mode as the profile separates. Studies based on varying the frequency or modifying the shape of the forcing further support this scenario of the initial development of the rolls in the separated shear layer, and show that the influence of the wakes is not to directly force the Kelvin-Helmholtz instability of the separation bubble, but to induce perturbations upstream in the attached boundary that eventually seed the instability of the separated shear layer.

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