

Abstract Submitted
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Flat-plate boundary-layer receptivity to free-stream vortical disturbances with roughness RICHARD BOSWORTH, JONATHAN MORRISON, Imperial College — This study focuses on the experimental investigation of the roughness-induced generation of Tollmien-Schlichting (TS) waves in a flat-plate boundary layer, exposed to free-stream vortical disturbances. Experiments are taken in the department's low-speed, low-turbulence wind tunnel where streamwise and lateral free-stream turbulence intensities are below 0.07%. Repeatable, harmonic, 2D free-stream disturbances are created using a metal ribbon placed upstream of a metal plate, with a leading edge designed specifically for receptivity experiments. The ribbon is forced to vibrate at a frequency conducive to the generation of TS waves within the boundary layer. It is shown that, without roughness present on the plate, the vortical disturbances decay into the boundary layer and that TS waves are not generated. The addition of roughness strips, with heights on the order of the inner deck scaling from Triple Deck Theory, clearly initiate a boundary layer response with the characteristic TS wave profile. This further confirms the theoretical predictions that a scale conversion process is required to generate TS waves from free-stream disturbances in a flat-plate boundary layer.

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