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Favorable Pressure Gradient Turbulent Boundary Layers: Part 2. Effects of the Upstream Conditions on the Inner Flow LUCIANO CASTILLO, RAUL BAYOAN CAL, KATHERINE NEWHALL, Rensselaer Polytechnic Institute, GUNNAR JOHANSSON, Chalmers University of Technology — A low-Reynolds number experiment was conducted to study the upstream condition effects on the inner flow of a favorable pressure gradient (FPG) turbulent boundary layer. This was viable due to the use of 2-D laser-doppler anemometry (LDA) and analyzing the data using the equilibrium similarity analysis for pressure gradient turbulent boundary layers. Several upstream conditions were studied through the isolation of each particular condition in which a series of downstream traverses were taken. Conditions such as upstream wind-tunnel speed, trip-wire position and strength of pressure gradient were investigated. The velocity as well as turbulence quantities in the streamwise and wall-normal directions have been measured. Using the friction velocity obtained through the momentum integral equation, it was possible to normalize the mean velocity deficit and Reynolds stress profiles; thus obtaining information about how the inner flow was affected by the upstream conditions and the strength of pressure gradient. The argument is strengthened by comparing the data to an already performed experiment on the effects of upstream condition on smooth zero pressure gradient turbulent boundary layers in the same facilities carried out by Castillo and Johansson.

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