Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

The stabilizing role of anisotropy in the free stream on boundary layer development BETTINA FROHNAPFEL, JOVAN JOVANOVIC, EDIN SKALIC, MILENKO JOVANOVIC, Friedrich-Alexander-University Erlangen-Nuremberg — An experimental study on the transition of a flat plate boundary layer was conducted in the large wind tunnel of the chair of fluid dynamics (LSTM) in Erlangen, Germany. Although this is not an especially designed transition tunnel it was possible to maintain a stable laminar regime up to Re_x=4x10^6, one of the highest transition Reynolds numbers achieved in a flat plate boundary layer. It is argued that this was possible due to a stabilizing effect originating from the high anisotropy level in the free stream disturbances that exists in the tunnel. Based on a statistical analysis of the dynamical equations for small axisymmetric disturbances, the influence of anisotropy on the dynamics of those disturbances in a laminar boundary layer was studied. The derived transition criterion is formulated in terms of a transition Reynolds number - based on intensity and Taylor length scale of the disturbances - that shows a dependency on the anisotropy level of the free stream disturbances. In this respect all available existing measurements on natural boundary layer transition at high Reynolds numbers were analyzed.

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Date submitted: 29 Jul 2005 Electronic form version 1.4