Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Flat-plate boundary-layer receptivity to high amplitude, spanwise-oriented, vortical disturbances in the free-stream[1] RICHARD BOSWORTH, JONATHAN MORRISON, Imperial College London — Extending previous experimental work on boundary-layer receptivity to harmonic free-stream forcing with roughness, the current study focuses on the high amplitude (Tu>1%), 2D case. It is shown that at these high amplitudes the boundary layer response is markedly different to the low amplitude case and that roughness is not required for this behaviour to appear. The behaviour within the boundary layer takes the form of low-frequency, streaky structures characteristic of 'Klebanoff-modes' and the beginnings of bypass transition rather than 2D Tollmien-Schlichting waves. Traditionally, high turbulence levels are created with turbulence grids, however, the current set up creates qualitatively similar behaviour in a different manner allowing easy variation of the incoming disturbance amplitudes. This may provide a novel way to study two different routes to transition - simply via the addition or subtraction of a roughness strip - in a single controllable experiment. The free-stream disturbances are created via a vibrating ribbon placed above and upstream of the plate leading edge and the disturbance signature is measured using a single cross-wire. Correlation measurements taken within the boundary layer provide details of the streaky structures present.

[1]This work is carried out under the LFC-UK grant

Richard Bosworth
Imperial College London

Date submitted: 30 Jul 2015 Electronic form version 1.4