

Abstract Submitted  
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**An Experimental Study of the Receptivity of a Supersonic Laminar Boundary Layer** ZHILEI WU, GARRY BROWN, Princeton University, MAE TEAM — The prediction of transition and its sensitivity to various disturbances has a major impact on system performance. It is also probably true that the least well understood aspect of the onset of transition in a supersonic boundary layer is the receptivity of the boundary layer to free stream acoustic disturbances and free stream turbulence (vorticity and entropy fluctuations). Techniques have been developed (for this short run time) which have enabled the rejection of the ‘naturally occurring’ boundary layer response to other free stream disturbances. An x-t diagram has been created from the experimental results. The diagram and the corresponding detailed collapse of the wave packet measurements clearly show an oblique acoustic wave in the free stream traveling at 1003m/s (reference temperature 297.65K) and amplifying boundary layer wave-packets which travel at 392m/sec and 424m/sec. The x-t diagram also shows a surprising sensitivity in the receptivity to the actual free stream disturbance. On the x-t diagram, the amplifying boundary layer wave-packets are traced back to the leading edge of the boundary layer. It is found that the instability waves are driven by the followed packets in the free stream, whose wave vector is different from that of the leading packet. Further studies show that the followed packets have wave lengths in the spanwise direction that match those of the instability waves at down stream locations.

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