PRESSURE CHANGES AT TRANSITION BETWEEN REGULAR AND MACH REFLECTION

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A series of experiments involving the monitoring of reflected pressure during the reflection of plane shocks from plane and curved wedges has been performed. A duplicate set of calculations was also performed using an in-house numerical code based on the weighted average flux scheme. Small piezoelectric gauges 3.2 mm in diameter, were mounted along the centerline of each wedge. The incidence angle and Mach number of the shock waves were chosen such that transition from regular reflection to Mach reflection occurred. lt was found in the plane wedge experiments, that the reflection pressure increased as the incident angle increased, and peaked at an incident angle a few degrees beyond the detachment angle, and then decreased in the Mach reflection region. The curved wedge experiments also showed a significant increase in pressure at the transition point between regular and Mach reflection. The position on the curved wedge where transition occurred was determined by a set of soot experiments. The pressure experiments used small and fast rise time (= us) piezoelectric gauges which aided in identifying any short duration pressure increases. The radius of the curved wedge was 1.42 meters, which permitted a gradual transition between regular and Mach reflection, possible widening the increased pressure region. It is suggested that the large radius of curvature of the wedge, coupled with the small size and short rise-time of the gauges has permitted observation of the rise in the pressure at transition, which we believe not to have been reported previously.

The numerical code showed similar results to the gauges but the peak pressures were higher. lt was also found that, especially near transition. grid resolution is very important in establishing self similar flow. The code also showed the existence of a narrow pressure spike of width 4us at the position where transition occurs on the curved wedge. The pressure increase at transition from regular to Mach reflection is of significance in resolving the long standing question about the shape of the height-of-burst curves from air burst explosions.