A SIMPLE CORRELATION BETWEEN DYNAMIC PRESSURE IMPULSE AND VEHICLE VELOCITY

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This paper presents a detailed analysis of the five sets of data collected from in-tunnel tests of a US Army personnel carrier, the M 113, in the Large Blast and Thermal Simulator (LB/TS). In these tests, the M 113 is subjected to dynamic pressure impulses ranging from 6.0 to 20 kPa-s. The time histories of static and dynamic pressures at or near the vehicle are designed to simulate a nonideal nuclear airblast. The environment is measured by the gages in the nearby instrumentation rakes. The corresponding response of the vehicle, in particular, its horizontal acceleration along the tunnel axis, is measured by an accelerometer hard-mounted in the vehicle. The data from this and other gages on the vehicle is collected by an onboard data recorder. Detailed comparisons of the dynamic pressure and the accelerometer records reveal a simple relationship between the two physical quantities. The horizontal velocity of the vehicle is proportional to the dynamic pressure impulse as long as the vehicle is airborne, a statement of Newton's second law (force α acceleration). Because of the highly oscillatory nature of the accelerometer records, the results are presented in integrated quantities, namely velocities and displacements. The constant of proportionality is expected to be a function of the vehicle's weight and geometry, and the Reynolds number of the flow. This result suggests that if the proportionality constant is known, the accelerometer record of a vehicle can be used to deduce the applied dynamic pressure and the dynamic pressure impulse. Ibis can be very useful for the exit jet tests where the vehicle is placed outside the tube and where accurate pressure measurements are difficult.