DESIGN STUDIES OF DRIVERS FOR THE US LARGE BLAST/THERMAL SIMULATOR

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All the current US Large Blast/Thermal Simulator (LBTS) designs produce blast waves using a number of relatively small steel driver tubes emptying through a converging/diverging nozzle into a larger concrete expansion tunnel. Simulator geometry, driver gas pressure and driver gas temperature determine the overpressure of the primary shock and the yield simulated.

These factors also control the development of a recompression shock an d a contact surface which ca limit the useful duration of a simulation. Computational studies of these and other LBTS driver characteristics are carried out in order to determine an optimum driver configuration.

In the computational studies, the Ballistic Research Laboratory quasi-one dimensional (BRL-Q1D) code is used to solve the Euler equations by an implicit, finite difference technique. In one on the studies, the code is used to determine the amount of driver heating needed to produce density matching across the contact surface. The effect of driver gas heating on the recompression shock and on simulated yield is also determined. The driver heating study is carried out for different driver geometries and limited comparisons to experimental date are performed.

The BRL-Q1D code is also used to computationally study the feasibility of using baffles for waveshaping in the driver. Each driver baffle is modeled as an area constriction with an associated head lost. Optimum baffle configurations and driver lengths were determined for a number of overpressures and yields.
Finally the quasi-one dimensional code is used to study the feasibility of using a fast acting valve to replace the diaphragm in each driver. The effects of the different valve opening time histories are computationally studied.