DEVELOPMENT OF THE BRL PROBATIVE TUBE

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The US Army Ballistic Research Laboratory (BRL) is currently developing an advanced blast simulation test bed called the BRL Probative Tube. This new shock tube is being constructed by modifying the existing BRL 2.44m diameter shock tube. A new high pressure driver tube, a double diaphragm system, a cryogenic gas supply system and an active rarefaction wave eliminator (RWE) are being added to the existing shock tube. The resulting facility will be able to act as a test bed for advanced blast simulator hardware, simulator control software, and instrumentation. In addition, the facility will provide a means of verifying new computation models of blast flow and means of testing small military systems or scale models.
The new gas supply system is made up of a liquid Nitrogen storage tank, a cryogenic pump and a pebble bed heater. The new high pressure driver is an un-insulated, cylindrical pressure vessel mounted inside the existing 2.44m shock tube driver section. A converging nozzle connects the cylindrical portion of the driver tube to the throat section. A double diaphragm system is mounted in the throat section. The downstream end of the throat section passes through a new bulkhead which closes off the end of the 2.44m expansion tunnel. The existing expansion tunnel is used without major modification. The existing reaction pier has been refurbished but not fundamentally altered. Finally, a hydraulically driven, active RWE has been added to the downstream end of the expansion tunnel. The new RWE has both active side and end vents for controlling the flow exiting the expansion tunnel.

During operation, the cryogenic pump pushes the liquid Nitrogen through the pebble bed heater where it is vaporized and heated. Not Nitrogen gas flows out of the pebble bed heater and into the high pressure driver where it is stored briefly. Once the driver reaches operating conditions, the diaphragm is opened releasing the gas into expansion tunnel, forming a blast wave. The blast wave moves down the expansion tunnel to RWE. The RWE adjusts the flow so as to eliminate any waves generated by the blast moving out of the expansion tunnel into the atmosphere.

This paper details the design and installation of the new components of the BRL Probative Tube. The paper also discuss the early characterization of the facility.