HIGH-PRESSURE SHOCK TUBE EXPERIMENTS TO STUDY THE RESPONSE OF BUILDING FACADE MATERIALS TO SIMULATED IDEAL AND NONIDEAL AIR BLAST

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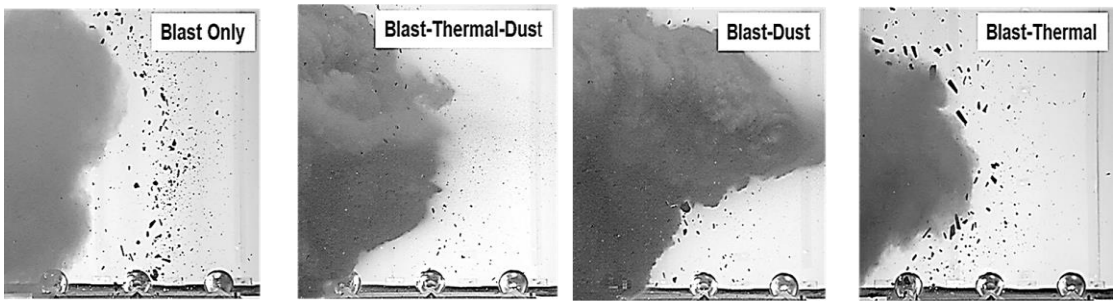
Abstract: In support of DTRA's Test and Analysis for Low-Altitude Nuclear Effects (TALANE) program, ARA is utilizing a novel explosively driven shock tube to investigate how plates made from common building facade materials such as concrete and glass fragment when exposed to high-pressure ideal and nonideal nuclear air blast. The shock tube, which is located at ARA Moriarty Range (AMR) near Albuquerque, New Mexico, USA, is 62 ft long and can apply a peak overpressure of up to 5,000 psi to specimen plates held at the muzzle end. To produce a nonideal dust-laden air blast environment, a thin disc made from fine clay powder is placed approximately 10 ft upstream of the specimen. To investigate the thermal effects, the specimen is heated radiantly before the shot is fired. To characterize the blast environment, static and stagnation pressures are measured with fast response transducers and compared with SHAMRC numerical simulations. In addition, advanced high-speed video cameras are deployed to capture stereoscopic images of the fragments after they exit the opaque cloud formed by the detonation products. Using the ProAnalyst® image analysis software, we combined high-resolution images obtained from two synchronized high speed video cameras to obtain 3D distributions of size and velocity of fragments. The image below shows the significant variation of the fragment cloud produced by a 3/8-inch-thick glass specimen loaded by ideal and nonideal air blast.



To study the fragmentation response of large structures, a Medium Scale Shock Tube (MSST) is being constructed at ARA that can produce incident peak pressure of up to 40 psi and pulse duration of 200 ms. A compressed air driver is used to eliminate the opaque detonation cloud that prevents early observation of the fragments. Full-scale walls and structures can be tested outside the muzzle area with the standoff of target location adjusted to expose the test structure to the required peak pressure.