NUMERICAL SIMULATION OF STANDARDIZED THERMOBARICS TESTS IN A TWO-ROOM STRUCTURE

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The Defense Threat Reduction Agency (DTRA) operates a four-room reconfigurable thermobarics (or explosives) test structure at Chestnut Test Range on Kirtland AFB, New Mexico. The structure is divided into two, two-room test beds one side accommodating nominal 2-lb cased charges with the nominal 8-lb cased charges being tested on the other side. To date, six series of tests, comprising over 200 separate charges and more than 20 different explosives along with various case configurations have been conducted. Dynamic and static pressure gages are located throughout the structure with emphasis on the blast effects in the room adjacent to the explosive source room. One thermobarics formulation that contains a significant amount of aluminum particles has been selected for a careful study in this paper. Its measured blast performance has been compared against results of numerical simulations with a multi-phase reacting turbulent flow code, SHAMRC. It has been shown that the thermobarics does not perform as well as the potential energy stored in the formulation. Especially, aluminum particles do not participate much in an anaerobic reaction with detonation product gases in the early phase of fireball expansion, or in an aerobic reaction with the ambient air at later times. Only a very small portion of aluminum particles (of smaller sizes) reacts at early times of fireball expansion and then additional reaction takes place when shock waves are reflected from the structure walls and when instability-driven turbulence takes place in earnest. Most of the afterburning energy is coming from carbon burning with air.