NUMERICAL MODELING OF C-4 LONG-TERM BLAST WAVE EVOLUTION IN CONFINED ROOMS

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ABSTRACT

The objective of research effort is to investigate the long-time quasi-steady flow field initiated by explosives in confined rooms. Here we modeled a test in which a cylindrical charge, 20 lbs of C-4, was hung in the center of a room and detonated. This facility and explosive were modeled previously. However, at that time, we were only concerned with the initial shock peak overpressure, and not in the long-term reverberation through the facility. Indeed, the predicted initial peak pressures in the blast room were in excellent agreement with the data. Nevertheless, at later times, the reverberating waves were arriving later, with a lower peak pressure and an accumulated lower impulse. Analysis showed that for the long duration, the prediction is short in energy by about 12% to 15%. As past experience suggested that C-4 would add about that much in afterburn energy, we incorporated an after-burn model.

C4 is composed of 91% RDX ($C_3H_6N_6O_6$) and 9% of binders such as DOP ($H_{38}C_{24}O_4$), PIB (H_8C_4), and fuel-oil. Comparing with TNT, the oxygen balance of RDX is relatively higher. Nevertheless, it is still under-oxidized.

”Cheetah”, a thermo-chemical code developed by LLNL, that solves the thermo-dynamic equation between product species to find chemical equilibrium, was used to estimate the remaining CO and CH_4 after detonation. From these remaining species, the afterburning energy was computed and added to the flow field. The computation of the detonation and afterburn of C4 in the confined multi-room was performed. Pressure and impulse histories at several stations inside rooms were compared with experimental data.