EFFECT OF AEROBIC AFTERBURN ON FREE FIELD BLAST

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Aerobic afterburn can occur after detonation of military explosives due to their fuel richness and oxygen deficit, respectively. The energy released during the afterburn of detonation products with air can greatly exceed the energy of detonation. However, with the required mixing of fuel and air and the time needed for the reaction, complete afterburn is frequently tied to confined and internal detonations. In the free field, only a small fraction of detonation products is assumed to burn fast enough to affect the blast pressure history.
At the MABS24 conference, precision measurements of blast from a spherical Composition B charge were presented in detail [1]. Whilst simulations of these tests with LS-DYNA and ProSAir reported in [2] could fairly well reproduce the primary shock, the peak pressure of the secondary shock was underestimated and the calculated arrival times were by far too late.
To investigate a possible influence of afterburn on the measured free field blast characteristics, the hydrocode SPEED [3] with its implemented mixing controlled afterburn model was applied. Due to the high precision of the measurements in the tests, a direct correlation of measured and simulated pressure histories was possible.
Including the aerobic afterburn into the simulation, a remarkable agreement with the experiments could be found for a multitude of features: from the primary shock to even the ground reflection of the tertiary wave. In addition, the SPEED model could be checked with respect to fireball expansion, shock heating, and enhanced combustion.
While so far, the free field effects of aerobic afterburn were regarded as negligible for practical applications like weapon effects or protection of structures [4], the test setup analyzed here revealed that the maximum impulse may well be underestimated by 20% when afterburn is neglected.

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