BLAST SIMULATIONS OF DISPERSED POWDERED EXPLOSIVES FOR MINEFIELD BREACHING

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Conventional explosive line charge systems do not neutralize all landmines. Fortunately, the high blast yields from Improved Dispersed Explosives (IDX) can initiate mines. Bimodal, a type of IDX being evaluated for mine neutralization, uses dissemination of two sizes of explosive particles (to achieve a high concentration ground layer, coupled to a low concentration cloud). Bimodal mine neutralization involves dispersion, followed by detonation, of explosive material. It is very difficult to analyze experimentally the optically thick continum created by dispersion of the bimodal material. Therefore, detailed numerical simulations of the bimodal phenomena play an important role in the development of this concept. The MPHASE code has been developed to perform bimodal simulations. MPHASE simulates initiation and propagation of detonation waves in multi-phase mixtures. A key advantage of MPHASE is its description of detonation phenomena over a wide range of explosive particle concentrations. MPHASE has been validated for one dimensional problems over a wide range of particle densities. Two dimensional MPHASE simulations have been performed, for explosive neutralization of mines, in which the initial particle concentration is non-uniform and varies by several orders of magnitude (high concentration of explosive powder in a ground layer and low concentration in a low density cloud). The weight of condensed phase per unit area is kept the same in a series of simulations so that the effects of initial particle density distribution on detonation wave parameters is apparent. The MPHASE simulations have provided useful insights and understanding of bimodal detonations, including the dynamics and structure of detonation waves. MPHASE simulations have been used for predictions of experimental tests. These simulations have been a useful complement to limited field tests.