THE EFFECT OF SHOCK ON THE RETARDATION OF HIGH VELOCITY FRAGMENTS IN WATER

Craig Hoing and Dr Ian Barnes

DOSG/DPA/MoD
Ash 2b, #3212, MoD Abbey Wood, Bristol, BS34 8JH, UK

The Defence Ordnance Safety Group (DOSG) has recently evaluated a commercial water barrier system and is concerned with influences which may negatively affect water as a mitigant. Parkes et al previously declared the stand-off from the barrier as an important parameter. For maximum effectiveness it is essential that fragments pass through water prior to shock as the relative effectiveness of water (to retard fragments) is decreased when the water is in a "shocked" state.

DOSG have investigated the performance of water to retard fragments under different shock conditions. Firstly, using numerical simulation (AUTODYN 2D), the residual speed of high velocity steel projectiles on exit of a water tank was determined. The model was then run repeatedly varying the arrival time of the projectile wrt a shock wave entering the water. Cases were run from "no-shock" through to "full-shock" (shock had passed through the water, reflected from the back surface and reached the front face of the tank).

A complex experiment was then set-up to replicate the simulations. Firing steel projectiles from a modified 30mm cannon into a tank the effect of High Explosive (HE) shock was determined experimentally. A 1kg HE charge, in the form of a doughnut, was suspended 0.3m from the face of the tank. The projectile was fired through copper timing foils, a copper trigger foil and through the centre of the HE before hitting the tank. The HE was fired by using the trigger signal, through a delay box and an Exploding Bridge Wire (EBW) detonator. With no timer delay set, an initiation time of 7μs for the EBW was achieved. Cases for "no-shock" through to "full-shock" and beyond were investigated with timer delays.

The paper will describe the results of the study and also examine the effect of the tank wall materials.