DEVELOPMENT OF REACTIVE FRAGMENT DAMAGE AND LETHALITY ASSESSMENT ALGORITHMS

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Key words : Reactive Fragments, Damage and lethality models, Experiments, Numerical modelling

Reactive Materials are an emerging class of materials which can replace some inert components in a warhead such as the casings, shaped charge liners and/or fragments in order to add additional energy into the system. These materials can be engineered to release their energy within the detonation fireball or within the target structure after an initial impact. Their mode of delivering damage is fundamentally different to conventional high-explosive/fragmentation warheads and so new research is needed to characterise aspects of both lethality and safety.

The current paper outlines a programme of work to generate initial damage and lethality assessment algorithms for reactive fragments. These could be applied to help in both damage assessment of targets or in understanding safety in storage and transport.

In this initial work two sets of gas gun trials where undertaken, firing reactive and non-reactive fragments into a chamber which contained either electrical or fuel tank structures. These experiments, together with modelling, were used to assess the effect of the reactive fragment hitting or passing close to the target structures at various impact velocities.

Analysis of the electronic component trials found that the fragment could miss the electronics by a relatively large distance whist still causing significant damage. The trials results were used to generate a simple algorithm that was implemented into a fast running lethality code in order to assess system Pk (probability of kill) for a reactive and non-reactive warhead concept.

Further trials using a fuel bottle to represent a tank, and a fuel tray to represent a partially empty tank, showed a significant increase in the probability of igniting the fuel when a reactive fragment was used vs an inert fragment. The analysis of these trials shows that a larger vulnerable area of the aircraft target could be determined if the fuel tanks could be ignited through fragment strike. The fast running algorithm was further updated with these results and a full system Pk analysis undertaken for a representative aircraft target.