NUMERICAL OPTIMIZATION OF SPECIFIC EFFECTS EXPLOSIVES

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ABSTRACT

ln recent years, in order to meet requirements stemming from new war theatres, great efforts have focused on the development of new kinds of weapons able to generate specific effects such as, on one hand, high blast and temperature effects, or, in the other hand, low collateral damages.

The blast effect is mainly due to the ability of the detonation products to react with the oxygen of air. This phenomenon called afterburning strongly contributes to generate high pressure impulse, especially in confined spaces. This is why metallic particles, mainly aluminium particles, are commonly used in Enhanced Blast eXplosives (EBX).

On the contrary, requirements for low collateral damages munitions are a strong energy delivery in the immediate environment of the target and a quick attenuation beyond a lethal distance to be defined in accordance with the target environment. To do so, the key idea is to convert a part of the detonation energy into kinetic energy to project fine dense particles such as tungsten particles. These particles generate strong impulse effects in close environment but due to their high density, they quickly fall down on the ground after their projection. This is why the best explosive loadings for low collateral damages munitions are commonly called Dense Inert Metal Explosives, or DIME.

In the frame of recent studies Le Bouchet Research Centre (AIRBUS SAFRAN LAUNCHERS) has studied new types of explosive compositions which are able to generate tuned effects as a function of the distance from the charge, in order to customize on demand the range of specific effects for a dedicated application.

In a first part, the paper presents the numerical model DECO which has been specifically developed to help formulation works to adapt the ingredients (nature, content, particle size) to the targeted effects. Then, the numerical optimization process is detailed, as well as the formulation works leading to optimized compositions. At last, the comparison is made between experiments and calculations.