COUPLED CFD/CSD/DPM MODELING OF A CASED CHARGE DETONATION AND FRAGMENTATION

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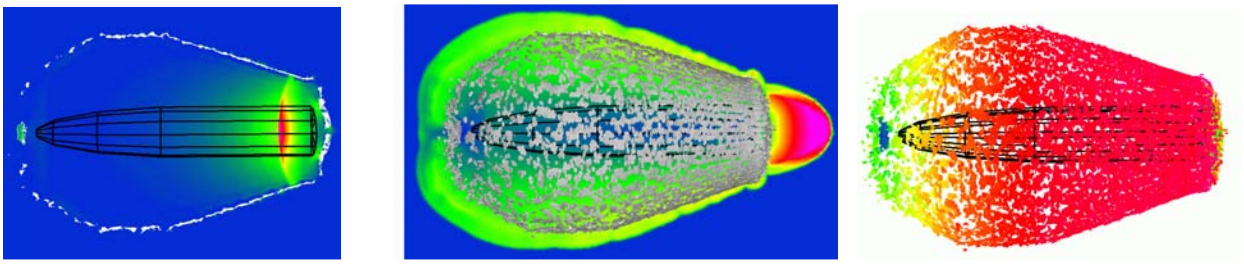
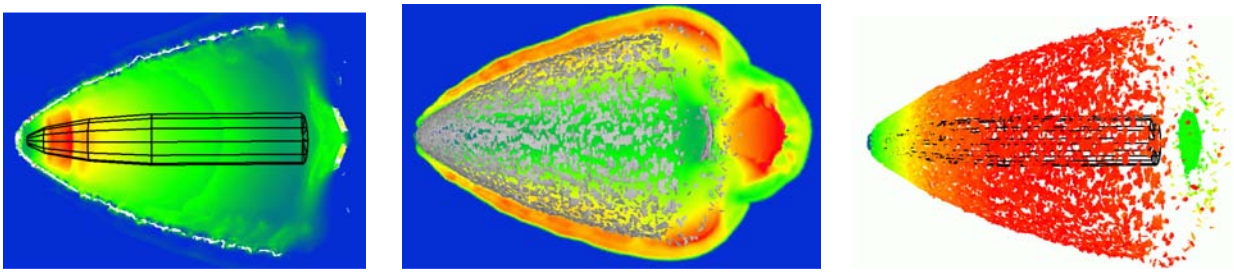
This abstract describes a study of a generic cased charge detonation and fragmentation using a coupled Computational Fluid Dynamics (CFD) and Computational Structural Dynamics (CSD) methodology. The coupled algorithm combines FEFLO98 (CFD) and MARS (CSD) via an embedded approach. This combination enables a more accurate depiction of the physical processes modeled here, namely: detonation initiation and propagation within a cased HE, case cracking and fragmentation, airblast and fragment propagation and impact on the enclosing walls, and the walls response to the loading.
Several numerical simulations were conducted. These studies examined the load exerted on the surrounding walls as a function of the detonation initiation point (nose or tail) and case orientation (horizontal or vertical). A limited set of results, for nose and tail-detonation of cased charges, is shown below. These results demonstrate some significant differences in the way both airblast and fragments were generated and launched. The tail-detonated simulation show shearing of the base plate almost immediately, which, in turn, resulted in:

1. Significant blast energy escape through the opening. The maximum pressure at 32.8μs for the nose-initiated wave reflected is almost three times that of the tail-initiated wave reflected;
2. As the containment held longer for the nose detonation, the higher pressure contained produced a significantly higher fragment velocity, resulting in about 50% higher fragment kinetic energy.
3. The longer containment produced a faster detonation product expansion in the circumferential direction, with a maximum velocity of about 4900 m/sec.



Pressure, velocity and fragment velocity contours. Above: Nose Detonation, Below: Tail



Pressure Super-imposed velocity and Fragments Fragment velocity

Fig 1.Comparison of Pressure, Velocity and Fragment Velocity: nose vs. tail ignition at 32.8μs.