Multiple Explosively Formed Penetrator (MEFP) Warhead Technology Development

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Background

MEFP Warhead technology was initiated in the 1980's to provide a warhead that could produce many highly effective penetrators for the attack of light materiel targets. Previously, EFP warheads were designed to produce a single rod shaped or ball shaped penetrator for deep armor penetration. With the MEFP warhead concepts, the liner was designed and formed to produce many individual penetrators to attack light materiel area targets. Initial MEFP warhead concepts utilized a steel case, LX-14 explosive billet and a tantalum, iron or copper liner embossed or formed to produce the individual penetrators.

A MEFP liner is basically a conventional EFP liner that produces a shotgun like spray of compact fragments. The MEFPs are formed and projected from the liner after the explosive billet is detonated. Figure 1 shows the basic components of a typical MEFP warhead; liner, housing, retaining ring, detonator and booster.

With the advent of the MEFP warhead concept, designs were investigated for a variety of weapon systems. Warheads were analyzed and tested for use in mine clearing, various demolition devices for defeat of diesel fuel drums and light armor.

Penetrator shapes including strips, spheroids, ellipsoids, and rods have been designed and tested for various applications. Penetrator weights from 5 to 50 grams have been provided in various warhead designs with velocities of .5 to 2.5 km/sec. Penetrator spray patterns of various sizes and shapes have also been demonstrated by liner design changes to provide focused or directional patterns.

An extensive test database has been produced to verify performance at standoffs from .25 to 100 meters against armor and light materiel targets.

Modeling

A modeling capability has been demonstrated to predict penetrator formation, MEFP pattern coverage and MEFP interaction with the target. Both Lagrangian and Eulerian hydrocodes have been used to predict the MEFP warhead penetrator characteristics. Typical warhead models can be cylindrical, triangular and rectangular shaped designs as shown in Figure 2. These models have shown excellent agreement with test results for the designs tested.

Design

MEFP liners have been fabricated using tantalum, iron or copper. A hexagon pattern is imparted on the liner to produce the individual penetrators. Design tools were developed to control the size of the MEFP, control the shape of the MEFPs and also to control the MEFP pattern. The MEFP quantity, size, mass and pattern can be adjusted to optimize the warhead's lethality for application in a particular munition.

Applications

MEFP warhead technology has been applied to many different systems to attack a variety of targets. Primary targets including various thicknesses of armor and steel up to 1 inch thick have been penetrated at standoffs up to 100 meters. Other targets have included diesel fuel drums and mine fields.

Conclusions

MEFP warhead technology has advanced to produce many new and novel applications for attack of critical targets. Computer models have been established to design and evaluate MEFP warhead lethality, achieving good predictions of MEFP formation and pattern coverage. Promising MEFP warhead concepts are being evaluated and fielded for Active Protection Systems, Mine-neutralization, M303 SOF Demo Kit and other systems.

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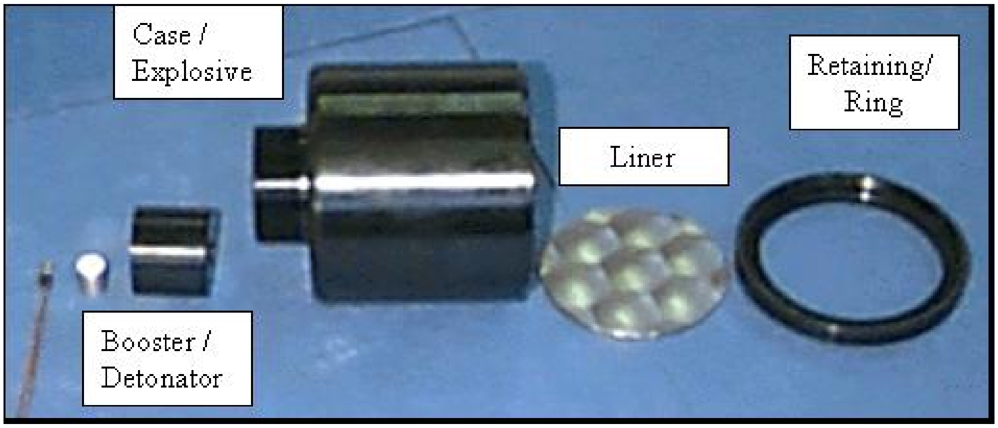

Figure 1. Multiple Explosively Formed Penetrator (MEFP) Warhead Hardware

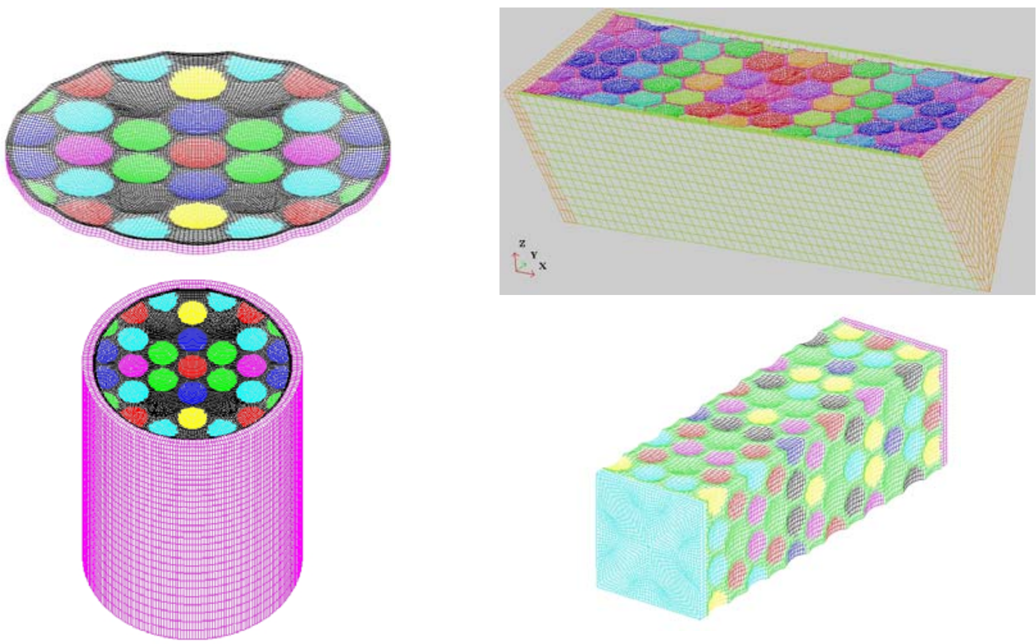

Figure 2: MEFP Warhead Configurations