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STEERABLE HITILES AGAINST TBM WARHEADS

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The proposed steerable hitile concept has high explosive wedges on the circumference which can be ejected in selectable segments. For these ejections, small high explosive traces are used. After the ejection of the selected 180° sector in the aiming direction, which is possible with 12° resolution, the remaining segments over the range of the other 180° will be initiated in a time delay of a few hundred microseconds. This results in a transverse velocity range of 100 m/s for a mono-hitile or multi-hitiles of about 20 kg total mass on a lethality enhancer of the 25 kg class.

INTRODUCTION

Chemical or biological submunition TBM (tactical ballistic missile) warheads need the impacts of a large mass in form of a mono hitile or better, that of dispersed multi hitiles on the projected area, to damage a high number of submunitions. At a moderate or a near miss distance trajectory, the hitile or hitiles have to be fired into the target. The function of the "predictor" called fuze sensor for the lethality enhancer is visualized in Fig. 1 [1]. It has to start the operational sequence at a relatively large distance before passing the target in the miss distance (MD), because the transverse velocity v_{tra} and the radial velocity v_{rad} are small compared to the very high relative velocity v_{rel}.

The predictor starts the following sequence:

1. Ejection of the explosive segments which are oriented to the target direction.
2. Initiation of the residual segments after a delay time Δt. The detonating charges are pushing the hitile or the multi-hitiles into the target.
3. Definition of the second delay time for the initiation of the radial dispersing charge to spread the hitiles.

The principle function of the aimable lethality enhancer is presented in Fig. 2. The internal core consists of one or multiple hitiles. A large number of high explosive segments is arranged around this core. They can be individually ejected with small detonating charges arranged in lines. The predictor selects the target direction and triggers the detonators for the detonation of the explosive traces.

The detonations of these lined charges eject all the explosive segments which should not detonate later. With a time delay of a few hundred microseconds the remaining high explosive segments are initiated which are driving the hitile or hitiles in the target direction. The internal core can consist of a single mass or multiple masses represented by simple heavy metal parts of steel or tungsten alloy or pyrophoric materials or from a very special design (Fig. 3).

MONO HITILE

A sketch of an aimable mono hitile lethality enhancer with 12° azimuth resolution is presented in Fig. 4. The mono block has 30 explosive traces which can be individually triggered, for example, by EFI detonators. They eject the explosive segments with 200 m/s velocities within 20 µs and in a time jitter of less than ± 1 µs. To avoid that the base plate being pushed away by these detonations, holes are provided in the bottom plate for the escape of the explosive products. For shock reduction, a plastic sheet is inserted in the so-called spider plate with 5 legs to initiate the remaining explosive segments with one detonator, independent of the remaining angle section. In the sketch of Fig. 4, the top fuze system with the 30 EFI detonators and the bottom fuze system with the time-delayed axial detonator are not drawn in detail.

A flash X-ray picture in Fig. 5 shows the simultaneous detonations of 13 EFI detonators and the ejection of the 13 HE segments by the detonating explosive traces and of the 2 adjacent segments, pushed only by friction with reduced velocities.

A complete system ready for tests to demonstrate the aimed ejection of the explosive segments in a demo test is given in Fig. 6. The ejection of the HE segments by the explosive traces was perfect and the intended or wanted segments are still remaining on the mono hitile. The upper fuze system is understandably deformed after the intended detonation of the 13 EFI detonators (Fig. 7). But the bottom initiation system is still in full contact to the warhead. By the detonation of the 13 lined charges, the steel cylinder of the lethality enhancer is pushed away from its frame by the momentum conservation. After the resettlement and the initiation of the 15 remaining explosive segments by the bottom fuze, the 20 kg heavy mono-hitile was flying with 80 m/s in the target direction (Fig. 8).

MULTI HITILES

As mentioned in the introduction, also multi-hitiles are investigated in comparison to a mono hitile. Instead of using a 20 kg heavy mass 18 “rods” with an individual mass of about 1 kg are arranged in the core (Fig. 9). By the detonation of the external charge segments, a natural spread of the hitiles is achieved. If more radial dispersion is wanted, an internal charge can be fired, arranged in the axis of this multi hitile lethality enhancer (Fig. 10). If this should not be wanted, this dispersing charge can be ejected, pushed out by a small high explosive charge. The double flash X-ray picture shows the ejection of the plastic bonded charge with 112 m/s velocity together with the aluminum pushing plate

(Fig. 11). By using high explosive charges for the ejection, the time delays are in the microsecond range and the used high explosive charges have no aging problems.

By the detonation of this radial dispersing charge in the axis, the 12 externally arranged hitiles are achieving velocities of 90 m/s and the 6 internal hitiles 60 m/s which is ideal to fill up the area of the target with these hitiles more or less equally (Fig. 12). The design was made for a lethality mass category of 25 kgs. But surely, this weight can be either easily increased or also reduced.

DIRECT HIT

If the anti TBM missile should symmetrically hit the TBM-warhead, the predictor will initiate the high explosive charges during the crash impact to get blast and fragmentation damage corresponding to Fig. 2 c.

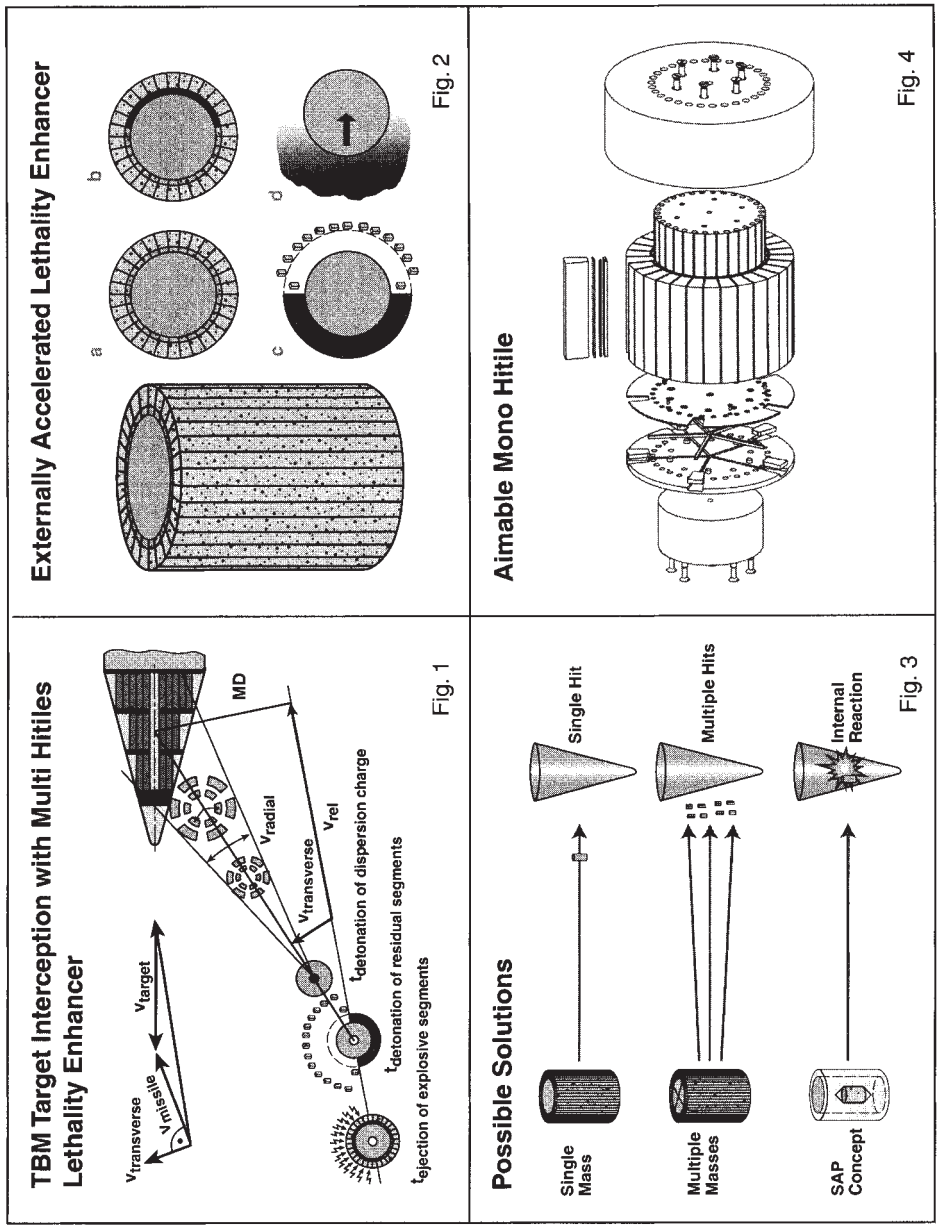
If an asymmetric hit will occur, the hitiles can be fired shortly before the impact crash into the area which is not or much less covered by the missile structure itself.

CONCLUSION

Steerable hitile or hitiles will improve the damage against chemical or biological TBM submunition warheads in any case, with symmetric direct hits, and especially with asymmetric direct hits or at moderate miss-distances. The feasibility of the shown design or solution is already demonstrated in fundamental tests.

REFERENCE:

1. H. Muthig, “Suchkopfgestützte Zündung von Gefechtsköpfen für Flugabwehrsysteme”, *Internal Report, Phase III, ED-No.: VM 0015,* 1999


TBM Target Interception with Multi Hitiles
Lethality Enhancer
MD
v_{target}
$v_{missile}$
$v_{transverse}$
v_{radial}
$v_{transverse}$
v_{rel}
$t_{detonation\ of\ dispersion\ charge}$
$t_{detonation\ of\ residual\ segments}$
$t_{ejection\ of\ explosive\ segments}$
Fig. 1
Externally Accelerated Lethality Enhancer
a
b
c
d
Fig. 2
Possible Solutions
Single Mass
Multiple Masses
SAP Concept
Single Hit
Multiple Hits
Internal Reaction
Fig. 3
Aimable Mono Hitile
Fig. 4

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FXR of the Ejection of the HE-Segments

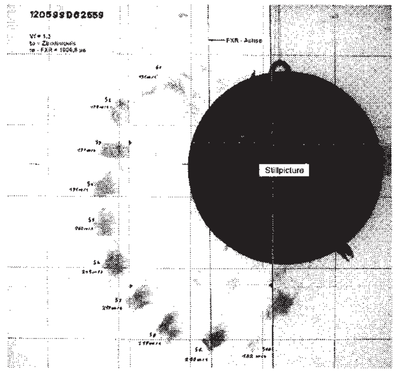


Fig. 5

Demo of Aimable Mono-Hitiles at Meppen
1. Test 1999

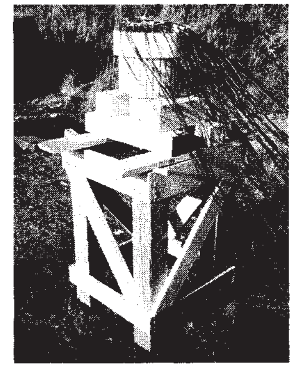


Fig. 6

13 x Ejections of HE-Segments EFI

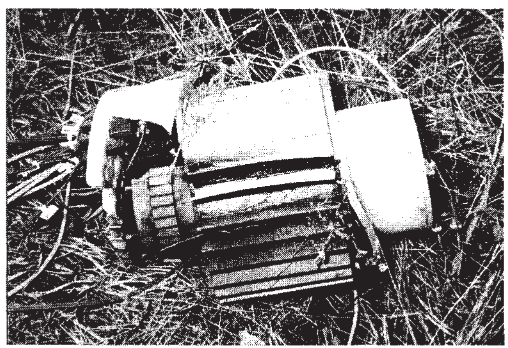


Fig. 7

Fired Mono-Hitile with 80 m/s

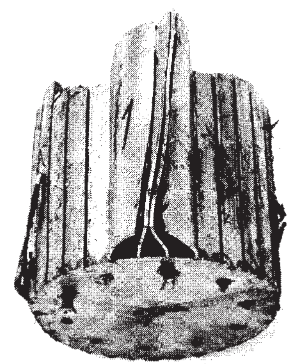
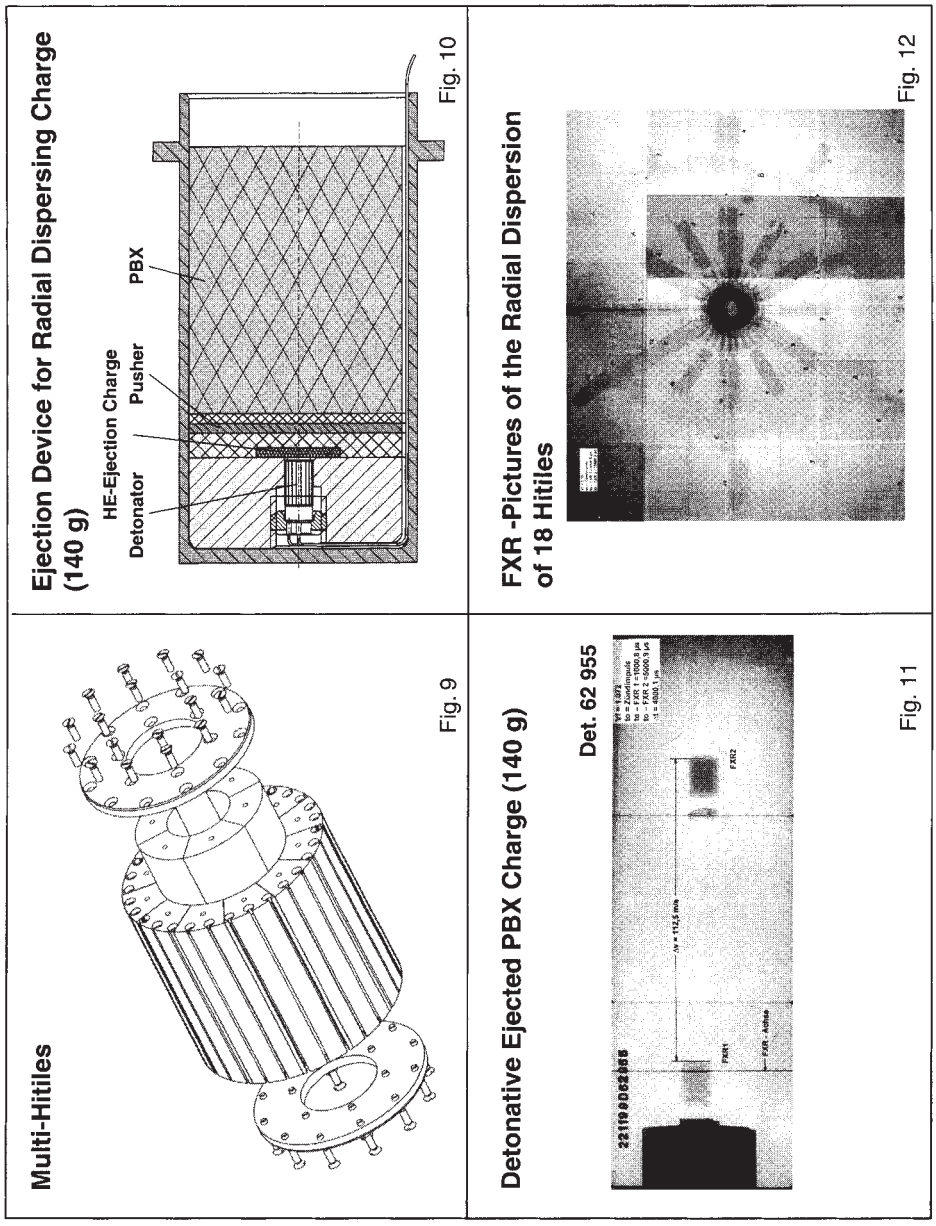


Fig. 8


Multi-Hitiles
Fig. 9
Ejection Device for Radial Dispersing Charge (140 g)
HE-Ejection Charge
Pusher
PBX
Detonator
Fig. 10
Detonative Ejected PBX Charge (140 g)
Det. 62 955
FXR1
FXR2
FXR - Achse
Fig. 11
FXR -Pictures of the Radial Dispersion of 18 Hitiles
Fig. 12