Abstract: 12612

Title: 40mm High Explosive Multi-Mode (HEMM) Grenade Concepts

The munition concepts described in this paper greatly expand the capability of infantry to engage and defeat targets during MOUT; especially against targets in defilade. They allow the user to direct virtually all of the fragments produced by the munition at the target area while retaining the current burst-on-contact, omnidirectional fragmentation and anti-armor modes.

POINT/OBJECTIVE OF PRESENTATION: The paper will present a description of the evolution and verification of munition design concepts that will greatly enhance the ability of infantry to defeat targets in defilade. It will also explore how design features in these concepts may be further exploited to improve currently fielded 40mm grenades.

CONTENT: The Government tasked Battelle with developing several concepts that increase the lethality of 40mm HEDP grenades by at least 25% when functioning in the anti-personnel role. This work was done under USG contract W15QKN-09-C-0105 between AMSRD-AAR-AEM-I and Battelle. Battelle has developed (to Technology Readiness Level 2 to 3) at least two feasible concepts, one spin- and one fin-stabilized, for an advanced capability, low-velocity 40mm munition that can directly attack targets in defilade. Each of these concepts employs separate fragment packages that deploy in a preferred direction, and therefore, concentrate nearly all of the fragments produced by the munition at the specified target plane. The most significant finding is that there are several unique and innovative concepts for fuzing and initiation that are feasible and can provide significant performance extensions to 40mm low-velocity grenades. It was also found that several of these concepts appear to be feasible for 40mm high-velocity grenades as well. In addition, design concepts and insights for the safe and arm subsystem (S&A) could be retrofitted to existing 40mm grenades to reduce their cost and significantly reduce their failure to function rate.

The concept munitions developed in this work: 1) are substantially more reliable than current mechanically-fuzed munitions through the use of an entirely solid-state, programmable S&A subsystem that uses COTS or COTS-adaptable electronics to avoid substantial development time and cost; 2) have greater lethality by allowing the user to direct all of the fragments produced by the munition in a selected direction (left, right, or down) to attack targets in defilade; 3) provide the user with additional flexibility in one munition by being able to select one of several modes: point-contact detonation, omnidirectional airburst, and directed-pattern airburst while retaining legacy capabilities of burst-on-contact omnidirectional anti-personnel fragmentation mode and anti-armor mode.

Feasibility of the concepts was examined using several modeling and simulation tools to assess the stability of each concept during an in-flight reconfiguration that allows the fragment pattern to be directed along a pre-determined vector. Analyses indicate that the concepts are aeroballistically stable; although marginally so. There are opportunities to improve stability with continued development, i.e., reconfiguring component locations. Development risk is lowered through the use of COTS-adaptable components that are lightweight, sturdy, reliable, and inexpensive. Unit cost, in full-rate production, is expected to be comparable to currently fielded munitions due to the use of COTS-adaptable electronic components in the S&A subassembly, a much simpler liner design, and use of existing mass-production techniques to produce inexpensive pre-formed fragments.