Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

NEW EXPLOSIVE CONCEPT REDUCES COLLATERAL DAMAGE

Increased attention to the employment of precision weapons has decreased the occurrence of unintentional collateral damage; however, the development of new munitions to do the same has fallen behind, until now. AFRL's dense inert metal explosive (DIME) successfully demonstrated an effective mechanism to reduce collateral damage, helping the warfighter to prevent the loss of public support and, more importantly, the loss of innocent life.

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Accomplishment

Survivability problems of conventional air blast transducers were encountered while measuring the close-in blast environment from DIME charges. In 2002, a specially designed Hopkinson bar gauge was utilized to obtain near-field blast measurements from a DIME charge. However, the 2002 tests produced data at only one distance at normal incidence.

AFRL's current 20-charge test series corrected that problem and produced reflected pressure and impulse data from a variety of distances and angles of incidence, facilitating a lethality analysis of the DIME concept. This data was used to create pressure and impulse maps that detail the near- and far-field magnitudes versus distance and angle of incidence, effectively validating the DIME charge as a low-collateral-damage munition.

Background

DIME concepts intentionally add heavy, nonreactive metal (tungsten, in this case) to an explosive composition. Upon detonation, the heavy tungsten particles are propelled outward in a cloud-like fashion with the advancing air blast pressure wave. Initially, the tungsten powder cloud travels in front of, and then with, the advancing shock. Then after a short distance, on the order of approximately 40 charge diameters, the forces of drag and gravity cause the tungsten particles to decouple from the blast field and fall to the ground or dissipate into the air.

The high-velocity tungsten powder cloud interaction with targets in the near field increases impulse and enhances lethality, while two mechanisms reduce damaging effects to collateral assets present in the far field. The first mechanism, the lack of fragmentation from a normal casing, eliminates fragment-induced lethality altogether. Secondly, the tungsten particles fall out of the air blast field with increasing distance. Since the tungsten particles fall out and the volume of high-explosive constituents are smaller in a DIME concept, far-field air blast is reduced significantly.

Munitions
Support to the Warfighter

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-MN-16)