Lethality Division

Summary

- Full-scale and sub-scale ground test programs to evaluate interceptor lethality
- Computational continuum mechanics
- Lethality instrumentation for flight tests
- Post-engagement high altitude release testing
- Chemical and biological agent response to kinetic energy weapons

The Lethality Division conducts testing and analysis to support the acquisition of kinetic energy weapons and the development and improvement of system-level lethality codes.

Extensive lethality testing and analysis is conducted by the Lethality Division of the Kinetic Energy Interceptor Directorate of the Space and Missile Defense Technical Center in support of the acquisition of kinetic energy weapons. The Lethality Division develops lethality data applicable to threat targets containing high explosive, chemical, biological, and nuclear payloads. The test data collected by the Lethality Division continually supports the development and improvement of system-level lethality codes.

Overview

The Lethality Division of the Kinetic Energy Interceptor Directorate conducts extensive lethality testing and analysis to support the acquisition of kinetic energy weapons. Since 1986, they have developed lethality data applicable to threat targets containing high explosive, chemical, biological, and nuclear payloads. The Lethality Division test data continues to support the development and improvements of system-level lethality codes. The Lethality Division is also a key player in Live Fire Test and Evaluation (LFT&E) of missile defense systems.

Benefits for Tomorrow's Defense

The Lethality Division conducts testing and analysis to support the acquisition of kinetic energy weapons and the development and improvement of system-level lethality codes that in turn provides advanced protection and sustainment of our Future Force.

Technical Concept

The Lethality Division conducts full-scale and sub-scale ground test programs to evaluate interceptor lethality. Rocket sled tests at Holloman Air Force Base, N.M., provide full-scale lethality data for hit-to-kill interceptors impacting chemical, biological, high explosive, and simulated nuclear targets. Full-scale testing allows the most accurate characterization of high explosive initiation and *in situ* destruction of (simulated) chemical and biological agents. Unlike guns, modest sled-track launch loads allow high fidelity interceptor replicas to be used for closing (relative) velocities of 2 kilometers per second (km/s) or less. The Lethality Division has conducted numerous rocket sled tests since 1991 and has developed a unique capability to replicate endoatmospheric interceptor guidance angle in a controlled manner.

For testing at higher closing velocities, scaled, gun-launched projectiles must be used to replicate interceptors. The Lethality Division has conducted more than 100 gun tests to evaluate interceptor (endo- and exo-atmospheric) lethality performance against all target types at velocities ranging from 1.7 km/s to 7.0 km/s. The light-gas gun test facilities at the Arnold Engineering and Development Center in Tullahoma, Tenn., were used for testing.

The Lethality Division performs "numerical experiments" to complement and supplement lethality test data. First-principle physics computer codes (HULL, CTH, and ALE-3D) solve the partial differential equations governing continuum mechanics at microsecond time steps and provide a real time evolution of target damage caused by hypervelocity impact and high explosive initiation. These powerful tools often provide critical lethality data when ground or flight testing is not possible.

The Lethality Division participates in flight tests at White Sands Missile Range, N.M., and the Ronald Reagan Ballistic Missile Defense Test Site, Marshall Islands, allowing for evaluation of the lethality for actual hit-to-kill intercepts. The main lethality diagnostic for flight tests is the Photonic Hit Indicator (PHI), which was developed and refined under Lethality Division management. The PHI uses an optical fiber mesh that is part of the target outer surface. When the fibers are broken, PHI determines where an interceptor strikes a target and downlinks that data to ground telemetry stations before the target and PHI transmitter are destroyed by the impact. PHI telemetry ground stations are operated at White Sands, Reagan Test Site, and Wake Island.

In addition to PHI, the Lethality Division designs and builds instrumented chemical submunitions for some targets used at White Sands. This instrumentation, which is a custom telemetry transmitter, helps the debris search team find any post-intercept survivors.

Crystal Mist and the Transport Response Experiment (TREx) were conceived and conducted to obtain field data for use in evaluating ground sensors and benchmarking atmospheric transport and diffusion models. These models are used to predict collateral damage from chemical or biological target intercepts. Both of these programs used calibrated glass micro-beads – dispersed by aircraft, balloon, and sounding rocket – to simulate post-engagement agent clouds. These clouds were tracked and analyzed by an array of airborne and ground-based sensors.

The Lethality Division developed a variety of test protocols for investigating the response of both chemical and biological agent stimulants to impact aerodynamic and environmental conditions. Bulk agent *in situ* negation has been investigated with lab-scale and full-scale impact tests and post-test chemical analysis.

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