COUNTERING FUTURE ANTI-ARMOR THREATS

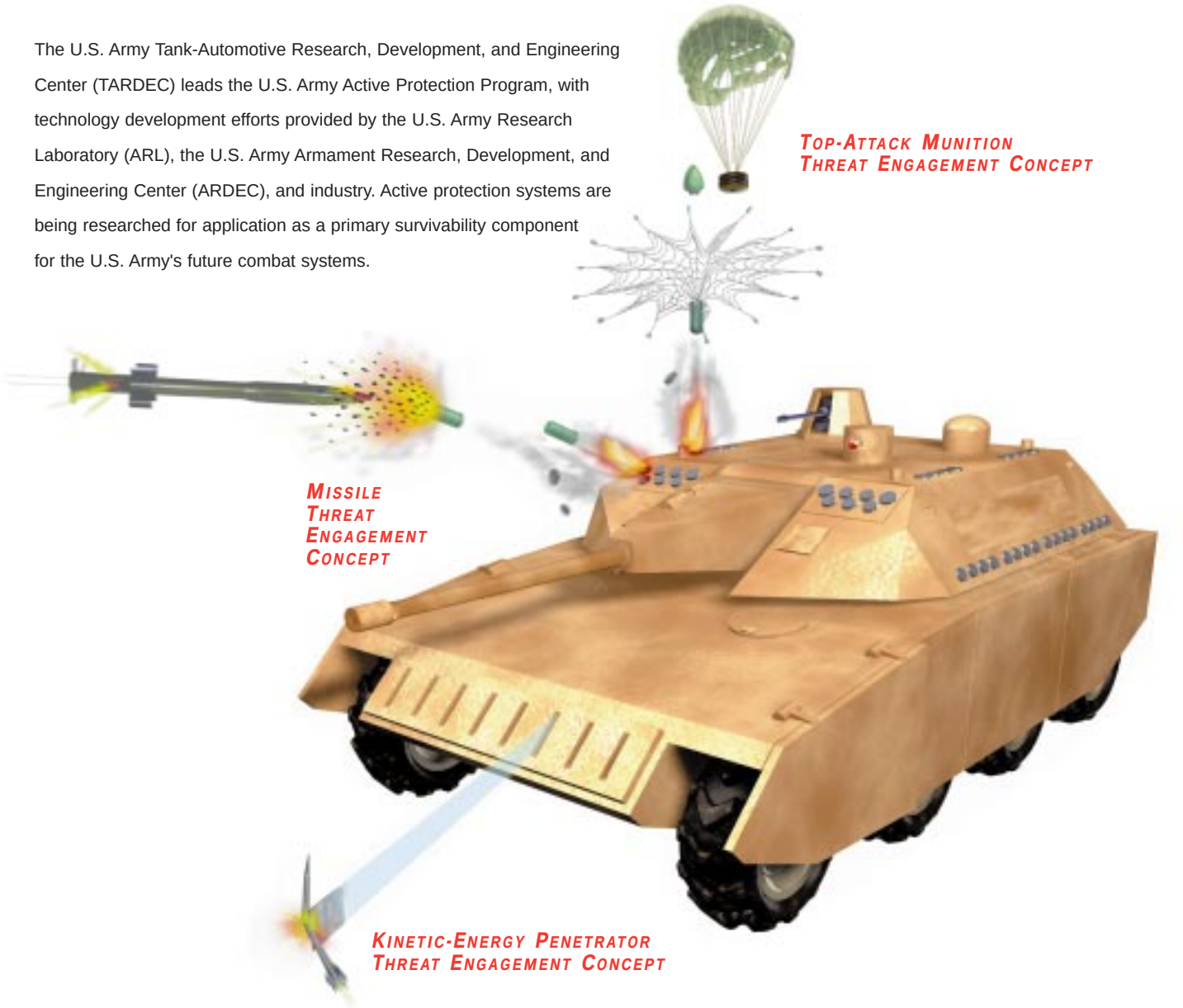
U.S. Army Tank-Automotive RDE Center

U.S. Army Armament RDE Center

U.S. Army Research Laboratory

Active Protection

The U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC) leads the U.S. Army Active Protection Program, with technology development efforts provided by the U.S. Army Research Laboratory (ARL), the U.S. Army Armament Research, Development, and Engineering Center (ARDEC), and industry. Active protection systems are being researched for application as a primary survivability component for the U.S. Army's future combat systems.



TOP-ATTACK MUNITION THREAT ENGAGEMENT CONCEPT

MISSILE THREAT ENGAGEMENT CONCEPT

KINETIC-ENERGY PENETRATOR THREAT ENGAGEMENT CONCEPT

Active protection systems are novel survivability concepts intended to provide protection to armored vehicles that equals or exceeds that of massive, passive armors at only a fraction of the vehicle weight. The Army's Full-Spectrum Active Protection Program is designed to develop and demonstrate technologies that can be applied to both current and future ground vehicle developments. Full-Spectrum Active Protection is intended to be a "leap-ahead" capability in combat vehicle survivability to effectively defeat all known anti-armor threats within the "hemisphere surrounding the vehicle".

ACTIVE PROTECTION SYSTEM COMPONENTS

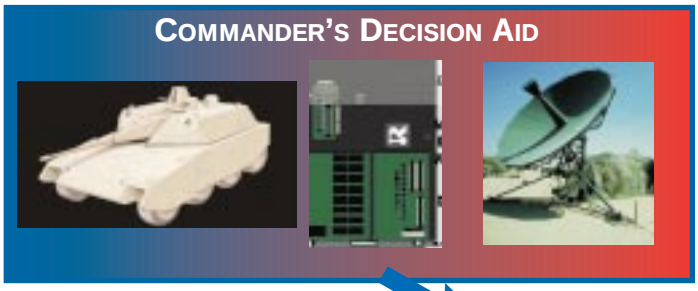
- THREAT DETECTION
- THREAT TRACKING
- SIGNAL PROCESSING
- THREAT-COUNTERMEASURE ENGAGEMENT
- BASE ARMOR RESIDUAL-THREAT DEFEAT

Sensor and Information Technologies

The operational concept of active protection is the accurate detection and tracking of a threat and the timely deployment of a countermeasure to defeat the threat. This requires the application of advanced sensor, idata processiing, armor, and weapon technologies as an integrated system on the vehicle. A variety of sensors will be employed on board the vehicle to provide the capability of detecting and tracking multiple munition and directed-energy weapon threats. Signal and information processing technologies will provide the "brains" to enable the vehicle commander to select the most appropriate countermeasures. Countermeasures will include not only active protection but electronic devices, obscurants, decoys, and other technologies for hit and detection avoidance.

FMCW Millimeter-Wave
Active Protection Radar

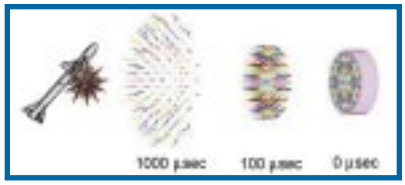
Passive Infrared (IR)
Tracking Sensor



Hit Avoidance
Advanced Technology
Demonstration

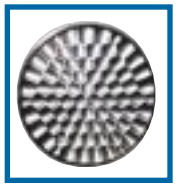
The Hit Avoidance Advanced Technology Demonstration (ATD) Program addressed the challenges of integrating advanced sensing and information technologies into an effective vehicle-mounted survivability system. A key element of this program was the development of a Commander's Decision Aid (CDA). The CDA provides information processing and resource management capabilities that integrate user, vehicle, and off-board data to classify threats and recommend appropriate countermeasures. The CDA, Near-Term Active Protection System (N-TAPS), and other elements of the Hit Avoidance ATD will provide an underpinning to the successful application of active protection systems in ground vehicles.

Active Protection Countermeasures



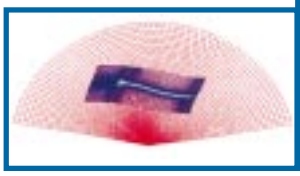
Multiple EFP Threat Engagement Concept

The critical component of an active protection system will be its countermeasure. Countermeasures will provide an effective means of deflection, disruption, or "hard kill" of anti-armor weapon threats such as tank rounds, missiles, and artillery fire. Warheads, armor plates, and other devices launched from vehicle platforms are being developed (or adapted) as potential active protection countermunitions. Some examples include Momentum Transfer Armor, Multiple Explosively Formed Projectile (EFP) Warhead, Blast Deflection Warhead, and "Birdcatcher" Net. The complete defeat of threats, which are not induced to miss the vehicle, may require some passive base armor on the vehicle to defeat the residual threat following the countermeasure intercept. Advanced concepts featuring lightweight high-strength materials are being investigated to achieve passive "debris-defeat" mechanisms at acceptable weight densities.

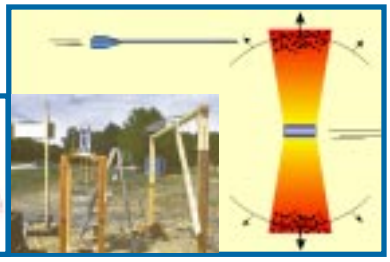


Multiple EFP Liner

Performance requirements of AP countermeasures and other active protection system components will vary with the types of anti-armor threat, which are primarily categorized into two classes—chemical-energy (CE) and kinetic-energy (KE) munitions. Successful development of active protection systems to defeat CE threats, such as the relatively slow-moving and large-signature missile, poses several technical challenges. Even more challenging, however, are counter-KE systems, which must be considerably more accurate, agile, and robust. The extremely fast-moving and low-signature KE threats must be detected at further distances, tracked at higher data rates, intercepted closer to the vehicle, and ultimately consumed by robust passive base armor on the vehicle. Despite these technical risks, considerable progress has been made. An extremely sensitive Passive IR Tracking Sensor has demonstrated the ability to accurately track KE projectiles at range rates and data rates at or near the program requirements. Subscale experimentation of the Momentum Transfer Armor, Radial Shaped-Charge Warhead, and Multiple EFP Warhead countermeasures has demonstrated the ability to successfully intercept KE threats.



Coupled Computational Fluid Dynamics and Structural Model of Blast Deflection Mechanism



Blast Deflection Threat Engagement Concept and Experimental Testing Configuration

FOR FURTHER INFORMATION

U.S. Army Tank-Automotive Research, Development, and Engineering Center
Warren, MI
Mr. James Soltesz
(810) 574-5653 or DSN 786-5653
solteszj@tacom.army.mil

U.S. Army Research Laboratory
Survivability Concepts Branch
Aberdeen Proving Ground, MD
Dr. Andrus Niiler
(410) 278-4884 or DSN 298-4884
niiler@arl.army.mil

website: www.arl.army.mil / wmrd

U.S. Army Armament Research, Development, and Engineering Center,
Picatinny Arsenal, NJ
Mr. Richard Fong
(973) 724-2516 or DSN 880-2516
rfong@pica.army.mil

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