Research Project for the Future of Main Battle Tank Protection Systems Update

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Running Head: Research Project for the Future of Main Battle Tank Protection Systems Update

Introduction

Tank protection is divided up into areas, starting from farthest to closest are: reconnaissance and strategic deception; mobility, stealth, and situational awareness; signal reduction and jamming, deception; soft-kill and hard-kill active protection systems; armor; and finally spall liner (which stops armor on the inside from flying off and injuring crew), crew body armor, insensitive munitions (no ammunition rack detonations), and energy absorbing seats (Rahman, Malik, Kumar, Balaguru & Sivakumar 2017). The weapons of today, such as shaped charge warheads and other guided munitions, have reduced the effectiveness of conventional passive armor on armored vehicles. Vehicles of today must now rely less on passive armor systems and rely more on sensors, computers, and other technologies (Rapanotti, DeMontigny, Cantin & Palmarini 2002). What this means is that the tanks of today need to rely on detection and hit avoidance to increase survivability. By reducing both the size and the background emissions of the armored vehicle, survivability is increased. Hit avoidance is based on missile laser detection, missile detection and tracking, and countermeasures, such as diverting the missile and destroying the missile (Rapanotti, DeMontigny, Cantin & Palmarini 2002).

On the subject of hit avoidance, Active Protection Systems (APS's) are defined as a defensive system designed to intercept, destroy, or confuse attacking enemy munitions. There are two forms of APS's, active ("hard kill"), a system used to damage and destroy incoming projectiles, and countermeasures ("soft kill"), which confuse and divert a projectile, such as a guided missile. The first APS

system was Drozd, a Soviet system developed from 1977 to 1982 based on experiences in Afghanistan. Other APS systems are Shtora-1, Arena, POMALS, and MIDAS (Meyer 1998).

Current APS systems also were created to defeat antitank guided missiles (ATGMs), not high explosive (HE) or kinetic energy (KE) rounds, such as armor-piercing, fin stabilized, discarding sabot (APFSDS) rounds. ATGMs of today also attack from above, either from ATGM launchers or ground attack aircraft. Current shaped-charge warheads, such as those from man-portable antitank systems (MANPADS) (Meyer 1998).

Literature Review

Current armor schemes use sloped add-on steel armor, composite armors with ceramic plates, and explosive, reactive armor (ERA) (Rahman, et. al. 2017). A 360° design philosophy (known as the "Super Whittaker Theory") has been created: a 95° vertical arc from -5° to 90° of possible dangers in a circle surrounding the vehicle. Dangers include other main battle tanks (MBTs) and armored fighting vehicles (AFVs) in the -5° to 5° arc; rocket propelled grenades (RPGs) and helicopters, as well as fixed-wing aircraft take up the 5° to 15° arc and the 15° to 30° arc, respectively; and finally artillery and cluster munitions, taking up the final arc between 30° and 90° (Rahman, et al. 2017).

Armored vehicles have two main measures to counter enemy projectile: active protection systems and armor. Rolled homogeneous steel has remained the standard all over the world for use in tank

production. This steel armor continues to be used because of its ability to increase its own penetration resistance. This can be achieved through cycles of tempering. Increasing hardness while maintaining toughness has been the key to success for this armor type (Singh, et. al. 2017). Active Protection Systems (APS's), on the other hand, are defined as a defensive system designed to intercept, destroy, or confuse attacking enemy munitions. There are two forms of APS's, active ("hard kill"), a system used to damage and destroy incoming projectiles, and countermeasures ("soft kill"), which confuse and divert a projectile, such as a guided missile (Meyer 1998).

The United States Military's current fleet of motorized combat vehicles were designed to counter the Soviet Union's numerically superior ground forces and current maneuver warfare. They were not designed with the threat of insurgents in mind. Today, fighters using man-portable anti-tank weapons (MANPATs), such as RPG-7s, are able to surprise combat vehicles with high penetration shaped charge rounds that can knock out even the most heavily armoured main battle tanks. Situational awareness of the battlefield is the key to combat survival and superiority (Ramesh 2017).

Armor in Main Battle Tanks (MBTs) make up 46% of weight and 50% of overall volume. Due to the current battlefield of irregular warfare, the current Whittaker theory of directional probability of variation (DPV) on a 60° arc to the front of the tank is outdated. Thus, a 360° design philosophy (known as a "Super Whittaker") has been created (Rahman, et al. 2017). Rolled homogeneous steel has remained the standard all over the world for use in tank production (Singh, et.

al. 2017). However, new protection technologies like ultra-hard steel with a hardness of 600 BHN(over 300 more than regular steel), should be used to develop completely new and revolutionary armored fighting vehicles (Rahman, et. al. 2017).

Update

The history of the armored vehicle goes back into ancient times with the War Elephant, which evolved into the armored carriage, to the armored train, to armored cars, and finally to tracked vehicles during the First World War. What I've learned during my research was that the first active protection systems came from the Soviets due to their experiences in Afghanistan (which, for some reason, weren't used during the Chechen Wars). I have also learned that these devices come in two different types, "hard kill" (which destroys the projectile) and "soft kill" (which diverts the projectile). Besides the research, the production has been behind schedule for some time, due to the fact that we didn't know where to send the order form and haven't received our parts due to this setback. Thus, the design and production of the simulated active protection system has been pushed back into the fourth quarter. Both the time in and out of class will be needed to complete the active protection system, as well as completing research using steel plates.

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