

Land Convoy Protection



AM General Humvee and a Bell Kiowa Warrior protecting a convoy in Iraq

While the protection of convoys has become acute in recent operations, particularly with the proliferation of remote-controlled explosives, the risks involved are older than one might think: «To conduct a convoy in safety through an enemy's territory, where it is exposed to attacks either of regular, or of partisan troops, is one of the most hazardous operations of war,» wrote West Point professor Dennis Hart Mahan in an 1847 military text book.

Roy Braybrook and Ian Kemp

American, British, French and other armies in the 19th Century understood the vulnerability of their supply columns to native attack. For most of the 20th Century military planners of almost every nationality believed that supply columns would be operating in a rear area where the only threat would come from air attack and Allied air superiority during the final stages of the Second World War made even that a remote threat. French forces fighting communist guerrillas in Vietnam in the 1950s and US forces facing the same opponent a decade later learned there was no safe rear area and supply columns travelling on main supply routes became an easy target for guerrilla attacks. The tactics, techniques, procedures and technical solutions, such as armed and armoured gun trucks, developed by US forces during the Vietnam War were quickly forgotten after the US Army returned its full attention to the conventional confrontation with the Soviet Union.

America's conventional forces quickly crushed the Iraqi Army during Operation Iraqi Freedom in March-April 2003, but in the months that followed, culminating in the concerted attacks between 9 and 11 April 2004, it became clear that supply columns, particularly those that appeared

weakly armed and poorly defended, were the preferred target for the Iraqi insurgents. Improvised explosive devices (IED) are used both as stand-alone weapons and to initiate ambushes.

The American armed forces FY07 supplemental request presented in February asked for funding to pave 21 IED hotspots in Afghanistan to an average length of ten km. The request noted «that paving IED hotspots reduces the ability of insurgents to plant IEDS in the roadway (the normal method of placement in Afghanistan)» and enhances the ability of coalition forces to detect them.

Virtual Convoy Trainers

As enemy attacks on convoys increased in 2003 the US Army identified the need to improve the training of soldiers in convoy operations, particularly those in combat support and combat service support units. These are no longer simply administrative moves, but combat operations which require proper planning, preparation and execution. Prior to the conflicts in Afghanistan and Iraq convoy defence training typically followed a path which included marksmanship training, live firing from single vehicles; first stationary then on the move, tactical training using the Multiple Integrated Laser Engagement System (Miles), multiple vehicle training using blank ammunition and

finally a convoy live-fire exercise. The heavy demands on equipment, ammunition, ranges, supervisory personnel and time, as well as competing training and 'real world' demands, meant that few units completed the full cycle.

In February 2004 the Product Manager for Ground Combat Tactical Trainers within the US Army's Program Executive Office for Simulations, Training and Instrumentation (PEO STRI) launched an 'Unusual and Compelling Urgency Procurement' for a Virtual Combat Convoy Trainer (VCCT) that would provide cost effective, realistic training that could be configured to simulate the contemporary operational environment. The VCCT is a virtual training system to train drivers, commanders, gunners and passengers of military vehicles, such as the Humvee, which is typically used as a convoy escort vehicle, how to identify and avoid a potential ambush, identify IEDs, return fire, manoeuvre and react appropriately.

PEO STRI awarded contracts to Raydon and Lockheed Martin Simulation and Training Systems to each provide training services based on two VCCT suites with an option to buy the systems at the end of the service contract. Raydon delivered its trainers 45 days after contract award and Lockheed Martin within 66 days. PEO STRI ordered a further VCCT from Raydon and two from Lockheed Martin and in November 2005 exercised its option to purchase the seven systems. The US Army Pacific funded a VCCT contract, also managed by PEO STRI, to support training by its units in Hawaii and Alaska.

Mounted in standard 53-foot trailers enabling the trainer to be moved to support training at different locations, both VCCT designs replicate four Humvees. In



Mounted in two standard 53-foot trailers the Virtual Combat Convoy Trainer, such as the Lockheed Martin Simulation and Training Systems design shown here, can be moved to different locations to support training. (Lockheed Martin)

the Raydon design each soldier – vehicle commander, gunner – is equipped with head-mounted displays providing a 360 degree view while the drivers are equipped with flat panel displays. The original Lockheed Martin design incorporated a wrap-around screen providing a 220° field-of-view for all crew members. The VCCT utilises both generic and specific terrain databases, such as one for Baghdad. Crews are able to conduct mission preview/rehearsals and their performance during the mission is monitored and recorded for an after-action review (AAR). In the two years since the delivery of the first VCCTs in August 2004 more than 88,000 army personnel have been trained on the system. Since the VCCTs were delivered the prime contractors have introduced improvements such as Humvee turret rings in the Lockheed Martin trainer and improved AAR capability and climate control in the Raydon VCCT. Further improvements that PEO STRI is planning include the integration of the Counter Radio-Controlled IED Electronic Warfare (Crew-2) systems in both versions, the provision of a 360° field-of-view for the vehicle crews in the Lockheed Martin system and the introduction of more peripheral vision in Raydon's HMDs.

The VCCT is also in service with the US Marine Corps and US Air Force. In July 2006 Lockheed Martin delivered its first fixed-site VCCT to the air force for installation at Camp Bullis, Texas. Last year Lockheed Martin also upgraded the six US Marine Corps systems to provide a 360° field-of-view by leveraging technology from its Close Combat Tactical Trainer Reconfigurable Vehicle Simulator. In the marine configuration the Humvee can be configured as a standard vehicle with ring mount or an up-armoured vehicle with gun shields on the crew-served weapon and modified vehicle dynamics. Between 300 and 350 marines are trained each week on the four VCCTs located at the Marine Corps Air Ground Combat Center at Twentynine Palms, California. The minimum training session is four hours although some units use the facilities for several days.

In a separate army-funded project Lockheed Martin is developing the Close Combat Tactical Trainer Reconfigurable



Waiting for explosive ordnance disposal to confirm the scene is safe, Staff Sgt. Christopher Hawks (left) and Master Sgt. Albert Schneider (right) prepare to collect evidence and take pictures. (US Air Force)

Vehicle Simulator (RVS). The developmental model fielded at Fort Hood, Texas last year can be configured to represent three Humvees and two Heavy Expanded Mobility Tactical Truck (Hemtt) variants. It takes at most two hours to reconfigure the RVS; simply put, the simulator is spun about so that the rear end of the Humvee becomes the front of the Hemtt. Each 53-foot trailer contains two vehicle simulators and the sides of the trailer are extended outwards to accommodate a full 360° field-of-view.

To meet the needs of the US Army National Guard for low-cost alternative to the VCCT Raydon developed the Vir-

tual Convoy Operations Trainer (Vcot), which is mounted in a single 53-foot trailer. It uses three types of virtual crew stations: an actual Humvee, supplied by the user, is appended with training equipment outside of the trailer; one reconfigurable crew station similar to those used in the VCCT and three Multipurpose Wheeled Crew Stations with positions for the vehicle commander, driver and gunner. The Vcot can be set up or torn down within two hours.

Convoy Escort Vehicles

The US Army had deployed more than 450 Textron Marine & Land Systems M1117 Guardian Armored Security Vehicles (ASV) to Iraq where the type serves as the army's primary convoy protection platform. It was selected in 1995 to provide US Army military police units with a better-protected vehicle than the M1114 up-armoured Humvee. Modular ceramic composite appliqué armour provides all-round protection against 7.62 mm ball ammunition, while the crew compartment, weapon station and ammunition storage areas are protected against 12.7 mm armour piercing attack. The ASV can withstand a blast of up to five kg of TNT in the wheel wells and an overhead 155-mm blast at 15 metres. With a crew of four the ASV is fitted with a Textron one-person turret armed with an Mk 19 40 mm automatic grenade launcher and an M2 12.7 mm heavy machine gun. Textron has received contracts from the army to supply more than 1360 vehicles.

Textron was one of nine companies to have received contracts from the Marine Corps Systems Command on 26 January to each produce two Category I and two Category II Mine Resistant Ambush Protected (Mrap) vehicles for evaluations which are now underway. The other companies invited to submit contenders were BAE Systems, Ground Systems Division, Oshkosh Truck, Protected Vehicles, General Dynamics Land Systems – Canada, Force Protection, Armor Holdings, General Purpose Vehicles and International Military and Government. In March General Purpose Vehicles informed the US Marine Corps that it would not be able to deliver prototypes for evaluation and in May the ASV was eliminated from the programme. The initial announce-



A Force Protection 6 x 6 Cougar Joint EOD Rapid Response Vehicle undergoes the first of a four-shot series of explosions at the US Army's Aberdeen Test Center. The US plans to use more Mrap vehicles such as this in the patrol and convoy escort roles. (US Department of Defense)



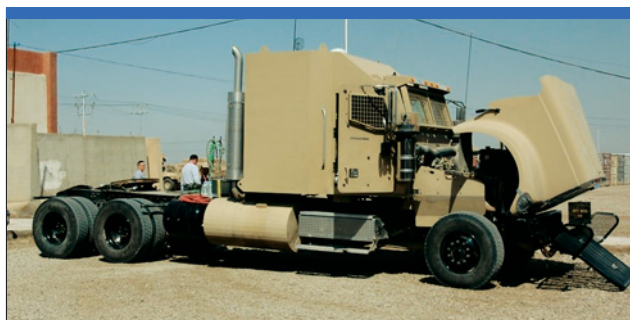
A US Army Boeing AH-64 Apache attack helicopter casts a shadow as it passes over a Textron M1117 Armored Security Vehicle. Both platforms are protecting a convoy in Iraq. (US Army)

ment indicated the Department of Defense was seeking up to 4100 vehicles worth about \$ two billion, with the army wanting 463 Category I and 2037 Category II vehicles, the marines 538 and 420 with the US Navy and US Air Force receiving smaller quantities. The project has skyrocketed since then. In mid-February Lieutenant General Emerson Gardner Jr, Deputy Commandant of the US Marine Corps for Programs and Resources, announced the service plans to increase its buy to 3700 vehicles, enabling the replacement of all Humvees in Iraq on a one-for-one basis. In May the army also announced its intention to replace all Humvees in theatre. The combined total could exceed 21,000 vehicles. Chairman of the Senate Foreign Relations Committee Joseph Biden, Jr wrote Secretary of Defence Robert Gates in late May, «I strongly support your decision to make Mine Resistant Ambush Protected (Mrap) vehicles the military's top acquisition priority.»

US forces have been using Force Protection Buffalo and Cougar vehicles in Afghanistan since 2003 and in Iraq since 2004 primarily for IED clearance. In common with most Mrap designs the vehicles feature V-shaped, blast-deflecting hulls and a raised chassis. «These vehicles are big, heavy and expensive but we know the payoff was great,» Gardner told the House Armed Services Committee. «Our experience is that marines in these vehicles are four to five times safer than a marine in an armoured Humvee.»

To expedite deployment production contracts have been awarded in parallel with the MRAP evaluation. In February

Marcorsyscom awarded a \$ 55.3 million delivery order to BAE Systems for 15 Category I and 75 Category II Mrap vehicles, a \$ 67.4 million order to Force Protection for 65 Category I and 60 Category II vehicles, an \$ 11 million delivery order to General Dynamics Land Systems for ten Category I and ten Category II vehicles, a \$ 30.6 million order to Oshkosh for 100 Category I vehicles and a \$ 37.4 million order to Protected Vehicles for 60 Category II vehicles. All vehicles were scheduled to be delivered by



This International 5000-MV Heavy Equipment Transport Truck, driven by civilian contractors of the US Army's 15th Sustainment Brigade in Iraq, has been fitted with extensive armour protection. (US Army)

June 2007. The largest contract to date was a \$ 481 million order for 300 Category I 4 x 4 Cougar and 700 Category II 6 x 6 Cougar vehicles awarded to Force Protection on 23 April. Under the terms of a joint venture agreement General Dynamics Land Systems will produce a portion of the vehicles at its Lima, Ohio plant and assist Force Protection with programme management. The need to field as many Mrap as rapidly as possible could result in each of the seven remaining contenders receiving a slice of a pie that could total \$ 25 billion.

protect our Soldiers against enemy rifle fire and IED blasts.» More than 2500 kits had been deployed by the end of March and Rock Island Arsenal is scheduled to produce 7500 kits by July 2007 and 20,000 by the end of next year.

IED Jammers

EDO Communications and Countermeasures Systems received an \$ 88 million contract in early April from the US Naval Sea Systems Command for the production and support of vehicle-mounted Counter Radio-Controlled Improvised Explosive Device Electronic Warfare (Crew) systems, 'to meet urgent Department of Defense requirements in support of Operation Iraqi Freedom and Operation Enduring Freedom'. Work on the 1100 Crew 2.1 installations covered by this initial contract is expected to be complete by May 2008. Up to 10,000 systems, with a potential value estimated at up to \$ 500 million, could eventually be ordered. Later that month EDO's Impact Science & Technology business unit was awarded a contract to provide 1100 Crew 2.1 systems which were developed independently of the EDO contender for the contract. Neither the manufacturers nor



International received a \$ 623 million contract from the US Marine Corps in early June to produce 1200 Category I Mine Resistant Ambush Protected vehicles. The MaxxPro design uses a modular concept developed in conjunction with Plasan Sasa of Israel. (Plasan Sasa)



One GD Canada-built derivative of the Mowag Piranha is the Canadian Forces' Bison, with IBD Mexas and Amap-1 for protection against small arms fire, mines and IEDs. (Canadian Forces)

the Naval Sea Systems Command, which is the lead agency for the Department of Defense in this effort, would reveal details of the systems.

EDO received production contracts worth almost \$ 105 million in the two years following its November 2003 selection by the US Army Communications-Electronics Command to provide its Warlock jammer. The Warlock is produced in two versions to interrupt different frequency bands; the Warlock Green is powered by the 24V DC power supply of any military vehicle while the Warlock Red is designed to connect to a vehicle 12V DC power supply or the cigarette lighter. Many of the Warlock jammers were produced in a combined, single system configuration with associated Dual Band Antennas. The Warlock was derived from EDO's earlier Shortstop Electronic Protection System, which began development in 1990 and entered production in 1998. The Shortstop was designed to protect troops against proximity-fused weapons such as mortar rounds and artillery shells by detonating them prematurely. Unlike Shortstop the Warlock jams the signal to prevent explosive devices from detonating.

Not Only IEDs

United Nations/Coalition land convoys are at risk, not only from small arms fire and road mines, but also from rocket-propelled grenades (RPG), anti-tank guided weapons and mortar bombs.

The defensive emphasis is currently on improved armour, but additional protection can be provided by advanced sensors possessing the ability to detect and track incoming guided and unguided missiles. Defensive systems can then initiate countermeasures (obscurants, infrared jammers and decoys) for a 'soft-kill', or activate a 'hard-kill' active protection system (APS).

Defensive aids for convoy protection are lightweight descendants of heavier systems, developed to reduce missile-related tank attrition.

The first hard-kill system was the early 1980s' Soviet KBP Drozd (Thrush), which weighed almost a tonne and combined millimetric-wave sensors with fragmentation warhead rockets. Notwithstanding successful use against RPGs in Afghanistan, the Drozd was abandoned

due to limited (60°) coverage and collateral casualties.

The 1990s' KBM Arena-E hard-kill system was even heavier, but it extended cover to 220°, and reduced the infantry danger zone to between 20 and 30 metres radius. However, for infantry fighting vehicles it is too heavy and expensive. It also depends on being combined with explosive reactive armour.

The 1990s also brought various 'soft-kill' dispenser systems, including Russia's KBM Shtora-1 (Curtain-1) and France's Galix, a joint effort by Giat (now Nexter) and Lacroix. Activated by a laser detection device, such systems provided a valuable advance.

The Galix launcher (introduced on the Giat Leclerc in 1992) has been widely exported, and Rosobronexport is still offering the Shtora-1 as a BMP-3 upgrade. Nexter has developed the Kit Basique de Contre-Mesures, which will go on the Leclerc.

The post-9/11 period brought demands for APS for lighter vehicles that are being attacked from a short range, while in proximity to friendly troops.

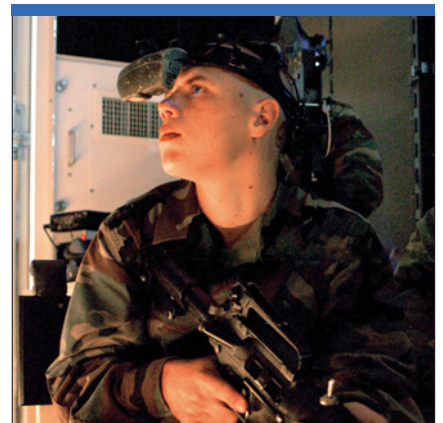
The most advanced Western lightweight hard-kill system currently available appears to be the 450-kg Trophy, developed by Rafael with IAI/Elta Systems. Later development will extend effectiveness to cover kinetic energy rounds. Despite reportedly successful trials, the Trophy is not yet on Israeli or US Army vehicles.



Developed to meet the needs of the Israel Defence Force Elisa's Electronic Jammer Against Bombs (Ejab) has been in Polish Army vehicles operating in Iraq. The modular system can be either hand-held or vehicle mounted. (Elisa)

Both services may be waiting to test the rival Israel Military Industries Iron Fist, which uses an IAI/Elta radar and an optional Elbit-Elisra infrared detector. The Iron Fist is being developed for lighter vehicles and employs a blast warhead. It is claimed to be effective against the full threat range, including kinetic energy rods.

In March 2006, following a successful firing, the Raytheon Quick Kill system was chosen for use in the US Army Future Combat System (FCS). Weighing only 136 kg, the Quick Kill features a Raytheon Cobra Aesa radar and a 'soft' vertical launch for the interceptor. This minimises crew discomfort and provides 360° cover for minimum weight. The



A US Navy sailor wears a head-mounted display while in a mock-up of a Humvee inside the Raydon Virtual Combat Convoy Trainer. The VCCT is now used by all four American services to train units before deployment to Iraq. (US Navy)

interceptor employs a downward-focused blast to minimise collateral effects. The Quick Kill is scheduled for operation on FCS vehicles from 2011 but may be fitted earlier to the GDLS Stryker and BAE Systems Bradley.

The leaders in this field include Eads Defence Electronics, whose Muss (Multi-function Self-protection System) has been selected for the German Army Puma AFV. Krauss-Maffei Wegmann is responsible for systems integration, and Rheinmetall/Buck Neue Technologien for the countermeasures.

IBD Holding, which owns IBD Deisenroth, Chempro and Akers Krutbruk, is responsible for the Mexas (Modular Expandable Armor System) and Amap (Advanced Modular Armor Protection) systems. A 400-kg APS by IBD, using blast warheads, forms the basis for Nexter's Shark (planned for the VAB and Brams vehicles), and is being studied by Sweden and Britain (and reportedly the US Marine Corps). IBD is now co-operating with Rheinmetall on APS developments.

Diehl BGT Defence is developing its Awiss to protect the Leopard 2 with fragmentation grenades. Other European companies active in this field include Ruag and Thales. □