Virtual Combat Convoy Training

One of the most sobering and unpalatable lessons stemming from the ongoing operations in Iraq is the vulnerability of resupply convoys to ambushes by insurgents and terrorist groups.

Convoy attacks using rocket-propelled grenades, improvised explosive devices, roadside bombs, suicide cars and other weapons are responsible for one-third of the more than 730 US combat deaths suffered by US forces in Iraq by mid-September 2004, and the negative impact of these attacks extend well beyond the number of casualties and destroyed vehicles. A very embarrassing pointer at the seriousness of the situation came in mid-October, when 18 members of a South Carolina based Army Reserve unit refused to carry out a resupply mission because they considered their trucks unsafe and the route too dangerous.

Addressing this problem requires a combination of appropriate technologies and weapons to increase the survivability and self-defence capabilities of the convoys, carefully formulated doctrines for the organisation of the convoys and the conduct of the resupply missions, and above all appropriate training for the personnel assigned to such missions.

Due to the very nature of the threat and the operational environment, realistic training for convoy duties can only be implemented through a very extensive recourse to simulation and virtual reality systems, as an indispensable preliminary phase to live-fire training and exercises. In addition to providing training, these systems are also very useful in assisting in the formulation and evaluation of refined doctrines and procedures, as indicated above.

An Emergency Requirement

During the earlier phases of Operation "Iraqi Freedom", the US Army did not have a train-
VRGS rendering of a convoy simulation, using the MetaVR database of an area at the outskirts of Baghdad. (Photo: MetaVR)

The EST system integrated with the WST convoy trainer using VRSG simulation. (Photo: Cubic Corporation)

threat areas as choke points. While providing basic to advanced convoy skills, the system was also to expand in weapons engagement training and allow networking of up to four vehicles in a simulated environment to sharpen crew discipline. By rehearsing missions on simulated streets, convoy soldiers will be able to anticipate potential choke points that are ideal spots for planting roadside bombs, which could lead to the mapping of new routes before they ever drive down the actual streets. In practice, the trainer would allow soldiers and mission planners to define when, where and how (if at all) to travel down certain roads.

Furthermore, the Army hopes to use the system to develop new combat convoy Tactics, Techniques and Procedures (TTP), such as defining what each vehicle should do when the group is attacked. Marksmanship training will be a key part of the training in the simulator, as users can shoot anything in the virtual environment. The simulations include lone gunmen, guerrilla groups, roadside bombs, suicide bombers and rocket-propelled grenades attacks in a variety of urban scenarios in which the soldiers go on missions with actual street scenes of Baghdad, Fallujah and Tikrit.

Given that National Guard soldiers are arguably more likely than active-duty personnel to be involved in convoy duties, while they are in an even more urgent need of appropriate training, the virtual convoy trainer programme in run jointly by the US Army Forces Command (FORSCOM) and the US Army National Guard Bureau.

Many companies responded to the Army’s request and the Service selected two, each with a different notion for a virtual trainer, to build a set of two prototype systems each for
The view from the driver’s position using the WST system. (Photo: III Corps)

The Lockheed Martin VCCT trailer houses a full-scale replica of an HUMVEE vehicle, while the trailer’s sides act as screens for the virtual imagery. (Photo: Lockheed Martin)

Evaluation. Each system is configured for convoys of up to four HUMVEE (HMMWV) 4x4 vehicles, and both are truck-mounted so they can be moved quickly from base to base.

Warrior Skills Trainer

Pending availability of the new mobile virtual convoy trainer system at Army-wide level, from November 2003 through July 2004, 5,500 III Corps soldiers were trained for convoy duty at Fort Hood, Ft. Carson and Ft. Stewart prior to departure for Iraq using MetaVR real-time 3D visualisation to simulate a virtual Baghdad. The Warrior Skills Trainer (WST) convoy simulator was developed by on-site III Corps and Alien Science and Technology staffs, with collaborative development of the Commander’s Work Station (CWS) accomplished by IDSI.

WST provides a field-initiated prototype training environment for units to practice convoy TTPs before live training or as refresher training. It consists of three simulators of HUMVEE 4x4 vehicles, in which trainees drive through a virtual representation of Baghdad and surrounding areas, in a manner similar to driving in a video game. Trainees can communicate with each other and with their instructor in the simulation control area through headset communication networks.

HMMWV driving, communications and other capabilities are supported by the JCATS simulation. All friendly, enemy and non-combatant events that occur while driving are produced by JCATS and its interaction with the virtual driving system, consisting of the National Simulation Center’s Commander’s Workstation and MetaVR VRSG. Each HMMWV has joysticks for rotating the driver’s view, a laptop with software to track the driver’s movement in the simulation, and a corresponding map to help navigation. Each HMMWV is also equipped with a mixture of two simulated individual weapons and a simulated crew-served weapon provided by the Engagement Skills Trainer (EST), which trainees use to engage the enemy in a gunnery scenario linked to the driving scenario. The EST system is integrated with the WST convoy trainer, running VRSG visuals. As a result of the integration, training with networked convoy and gunnery simulations occurs in a seamless, realistic manner; for example, a driver and other vehicle occupants can react defensively and return fire if the vehicle is under attack.

A total of 24 MetaVR visual systems are in use for convoy training at Ft. Hood, TX (six), Ft. Carson, CO (twelve), and Ft. Stewart, GA (six). Each MetaVR delivery includes collection of 22 HUMVEE models in the 3D content entity library, with each model having four paint schemes.

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Schematic organisation of the second generation implementation of the WST device at Ft. Carson with twelve MetaVR visual systems. (Diagram: III Corps)
Raydon's VCOT

Raydon Corp. of Daytona Beach, Fla., was awarded a $5.6 million contract in spring 2004 to produce its version of a virtual convoy trainer. The Raydon system, designated Virtual Convoy Operations Trainer (VCOT) has two truck-mounted containers with interiors modified for simulation training. The VCOT is based on a software program used to teach high school students to drive, and which is combined with mapping data and ballistic simulation. Soldiers wear helmet-mounted displays of a 360° simulated environment and sit at different stations throughout the trailer, but in the “virtual world” within their helmets, they are all in a single HUMVEE 4x4 vehicle in one of five positions: vehicle commander, driver, machine gunner and two back-seat observer riflemen.

The company stresses that this configuration ensures that soldiers are trained to anticipate ambushes and other insurgent actions from all possible directions by allowing the crew to observe, maneuver, and fire their weapons through a full 360° circumference. Crew members are not limited by fixed screen projections, and rather have a complete and continuous view of the entire virtual world around them. Further, the system's flexibility allow users to choose the vehicle mix for their convoy, the weapon systems employed on each vehicle, the routes along which the convoy will travel, and the type and strength of enemy activity along the convoy route. Raydon has delivered two systems, each consisting of four devices, each of which can train a full HUMVEE crew. The two prototype systems are currently being used at Fort Bliss, Texas, where at the time of this writing the 116th Brigade Combat Team made up of Idaho National Guard units is undergoing training, and at Camp Shelby, Miss., which is currently forming units from the Tennessee and Mississippi National Guard ahead of their deployment in early 2005. These are nominally armour units mounted on M-1A1 Abrams tanks, but they will spend more time in armoured HUMVEEs than tanks once they get to Iraq. The National Guard Bureau has already placed an order for an additional six VCOT systems.

Lockheed Martin's VCCT

Lockheed Martin Simulation, Training & Support based in Orlando won a $9.6 million contract to build two Virtual Combat Convoy Trainer (VCCT) suites, consisting of four trainers each in 60 days. The first system was delivered in early August to Camp Shelby, while the second arrived on 27 August at Fort Bragg, NC for the XVIII Airborne Corps, which is getting ready to deploy to Iraq.

Lockheed Martin has followed a different approach than Raydon's. The company teamed with Firearms Training Systems (FATS) to develop a system in which soldiers are placed inside a full-scale HUMVEE replica accommodated inside a truck trailer. The HUMVEE replica includes high-fidelity driver controls and accurately reproduces replicates all the physical and visual constraints associated with the vehicle. The trailer’s side panels expand out and screens drop around the front and sides of the vehicle, showing a simulated environment projected onto a 180° field of view.

Lockheed Martin's VCCT system integrates the FATS' virtual small arms trainer (SAT), Indirect Fire Trainer (IFT) and Close Air Support (CAS) simulation in addition to Lockheed Martin's own fielded Close Combat Tactical Trainer (CCTT) for the new convoy training device. Vehicle simulation for the VCCT is derived from software developed for both CCTT and the UK's Combined Arms Tactical Trainer (CATT). Along with maps of Baghdad, the trainer also includes detailed topography of Tikrit and Fallujah, other Iraqi cities where US convoys have been repeatedly attacked.

In addition to the visuals, the trainer has an audio track to lend realism to the training.

Innovative Procedures

To rapidly make these new training tools available to soldiers, the Army sidestepped traditional procurement practices. Instead of buying the systems, the service is leasing them for one year with terms that call for periodic improvements and modifications based on user feedback. Industry officials say that based on the Army's deployment schedule, the service requires as many as 35 of these trainers.

Between August, when the systems were brought on-line and mid-October about 1,000 soldiers have been trained on them. A maximum of 20 soldiers can train on each system at a time. In addition to Camp Shelby, Fort Bragg and Fort Bliss an additional system will soon be deployed to Fort Hood. First reports indicate that soldiers said they found the virtual trainers helpful, but they had difficulty adjusting to some of the specific idiosyncrasies of the different systems.

The Lockheed Martin VCCT trailers arriving at Camp Shelby in August 2004. (Photo: Lockheed Martin)