

# Virtual SAT – Actual Benefits

## Reviewing the Virtual SAT Market's Developing Trends



**Peter Matthews takes a look at Virtual Small Arms Trainers and sees that the market is incredibly well-served with a range of products from manufacturers around the world. One trend is the increased use of technologies being targeted to meet specific training requirements coming from Iraq and Afghanistan.**

**T**he use of simulated live fire trainers is not new. From the early film-based versions using sub-calibre ammunition to today's laser-based devices featuring high-end graphics systems, such training devices have been around for over 40 years.

Some 25 years ago, the UK Ministry of Defence undertook a number of studies and concluded that the SAT greatly improved the soldier's marksmanship skills when he fired the real weapon on the range. Over the years, new technologies have increased the capabilities of this form of training to add collective tactics and decision making skills (shoot-don't shoot) to the basic marksmanship skills training process.

The difference today is that the modern virtual Small Arms Trainer (SAT) is no longer used as part of a linear training system to prepare

the soldier for live firing but has become a central device for maintaining skills during regimental service and whilst the soldier is deployed on active service. The SAT is today, an essential tool in maintaining operational readiness and capability.

Indeed, such systems can feature visual databases of operational areas where the soldier is deploying to provide an element of pre-deployment reconnaissance and familiarisation.

As we shall see, the quality of modern graphics systems not only improves the fidelity of the SAT by immersing the trainee within the scenario but increasingly, computer generated graphics are being used to teach soldiers the operation of various weapon systems and how to strip and assemble them. In addition, the move away from tethered weapons means that the virtual SAT has become much more realistic.



## Not Just Dismounted

Another trend to appear in recent years has been the adoption of ground vehicle and helicopter door gunner trainers. These developments have been as a direct result of the coalition force's experiences in Iraq and Afghanistan.

Before looking at some examples of such trainers, it is worth highlighting that the customer has an amazing choice to make as the market is bursting with different virtual SAT devices. As well as the major players such as Meggitt Training Systems (formerly FATS), Cubic Defense Simulation Systems Division, Thales and Laser Shot, companies such as Raydon, Fidelity Technologies, E-COM, ELI, Noptel, ZEN Technologies and AIS all provide a range of equipment to both the military and law enforcement markets.

Some of the latest contracts to be let include those won by Cubic in Lebanon and Kyrgyzstan. These contracts, valued at more than \$5 million, have been awarded under the Foreign Military Sales (FMS) system and feature Cubic's Engagement Skills Trainer (EST) 2000 which was developed for the US military market.

Over 1,000 EST systems have been deployed to US military and overseas customers so far and the system now comes with an enhancement known as EST Plus which provides the opportunity to network the device to other simulators and to allow shoot-on-the-move and convoy operational training to be undertaken.

The programme in Lebanon is currently in the installation phase. Five locations will each receive a 10-lane EST 2000. This turnkey programme calls for Cubic to undertake building and delivering the systems along with pre-fabricated buildings, spares and logistic support for two-years.

In the second contract, the Kyrgyz Republic will receive four EST 2000 that will be installed in existing military facilities. A two-year support contract is expected to be signed next year.

Cubic is currently developing a complete range of SAT devices covering individual to collective training requirements. As well as EST 2000, the company has its most recent product, the EST Dismounted Solution (EST DS) device which has been designed to train the individual soldier. Featuring a booth with a projected visual system, EST DS can be used for individual training or simulators can be networked together. Soldiers move through the scene using a weapon or floor mounted joystick.

*Crytek is supplying its visual system for a number of virtual SAT and vehicle trainers including those of Meggitt and Cubic.*

(Source: Crytek)

The joystick approach is used by a number of SAT companies and surprisingly, for this author at least, many military forces accept this method of training. Some argue that with the booth-type SAT, the field-of-view is too small for realistic training and by adding a non-normal procedure, such as moving the scene via a joystick instead of the normal method of moving the head and eyes in a scanning pattern, such trainers provide negative training. Despite this criticism, such devices are selling to customers throughout the world.

With the company's Warrior Skills Trainer (WST), Cubic has addressed the needs of the vehicle mounted weapon and individual passenger weapons fired from within or without the vehicle. With a potential for 360 degree visual display system, the WST can be networked to numerous other trainers including EST, CCTT, JCATS and call for fire trainers to provide a fully integrated collective training solution.

The device uses tetherless weapons and recoil is provided by means of a CO2 cartridge. Each cartridge provides around 400 shots.

"The WST is designed to immerse the trainee into the scenario and as well as high-fidelity graphics, we also have the ability to inject smells and smoke to increase realism still further," explains Mark Saturno, Cubic's Director of Business Development at its Simulation Systems Division in Orlando.

A recent demonstration of the WST at the company's Orlando site featured mounted and dismounted scenarios. The visual system in the current system has been supplied by MetaVR and features its Afghanistan database but according to Cubic's Terry Kohl, VP and General Manager of its Simulation Systems Division, "we are really visual system agnostic and will supply whatever solution the customer wants."

One of the company's latest small arms training systems is its COMBATREDI product. Featuring a man-worn computer, COMBATREDI is designed to provide a fully-immersive training environment for the individual soldier. Featuring a high-definition helmet mounted display (HMD) to provide a 60 x 45 degree field-of-view of the VBS2 graphics, the soldier is also fitted with sensors to



*The Warrior Skills Trainer (WST) from Cubic is designed to be networked and is used for collective training.*  
(Source: Cubic Defense)

determine his firing position, thereby altering the view in his HMD. According to Cubic's President, Brad Feldman, COMBATREDI highlight's Cubic's approach of "fusing soldier-tech with the latest consumer electronics and gaming technologies," to provide training solution for the customer.

## Market Trends

Based in Suwanee, Georgia, Meggitt Training Systems' virtual small arms trainer business has been one of the leaders in providing simulators to the military and law enforcement markets for a number of years. Its FATS line of products are in-service in more than 60 countries.

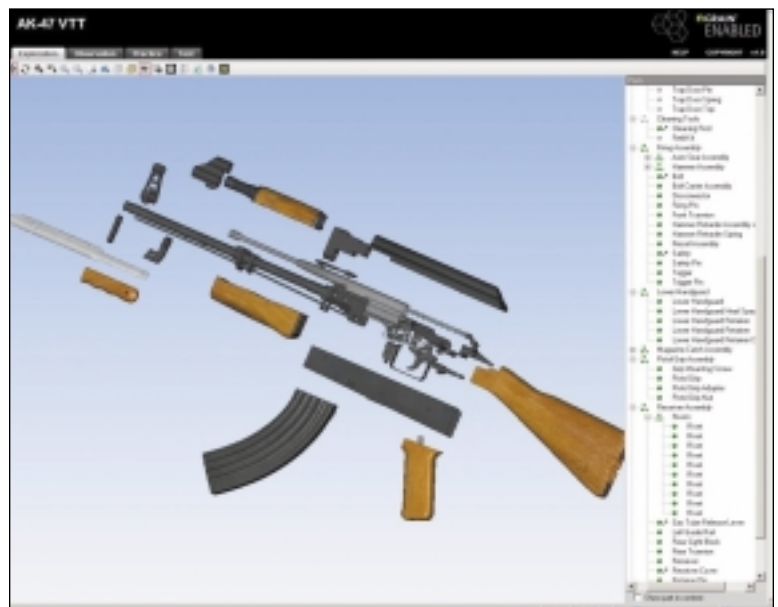
"Although figures change, over the past year our average ratio of law enforcement to military business has been around 20:80," says Tom Shirey, Director of Simulation Systems Sales at Meggitt Training Systems. "As to the future, I see that the major markets would appear to be saturated but there are opportunities in countries that are now seeing the benefits that virtual small arms training can bring. These benefits include the fidelity of the weapons, and through DIS and HLA, the ability to link with other simulators and SAF. There is also the obvious cost saving benefit and like all virtual simulation, the ability to repeat the exercise."

Another trend highlighted by Shirey includes the switch from video-based visualisation to the increased use computer generated graphics, "because of the increase in realism and reduced cost." Like Cubic, Meggitt has demonstrated its system with the Crytek CRYEngine 3 games engine with some spectacular results.

Another US-based virtual SAT player is Laser Shot. Its Military Skills Engagement Trainer (MSET) technology has been used as the basis of its Boat Gunnery Trainer which is in

*The rise in the availability of modern graphics and their drop in price have led companies such as NGRAIN to develop high-fidelity virtual small-arms trainers.*

(Source: NGRAIN)



use with the US Naval Coast Warfare Group 1 and the US Navy EOD Group 1. It comprises a simulated boat on a three DoF motion platform. Crew-served weapons such as the M2, M240 and Mk19 can be replicated.

Laser Shot's transition from conventional lane-based SAT to a training device based on a specific platform is now a common practice. Gunnery trainers are now in widespread use and based on ground vehicles, helicopters and as we have seen, boats. Another example of the latter is in Singapore where the Singaporean Coast Guard commissioned its Meggitt patrol boat trainer last July.

As far as helicopter door gunner trainers are concerned, Binghamton Simulator Company has its Advanced Generation Simulation System II (AGSS II) that was launched in 2005. This was developed into the Prototype Aerial Virtual

Environment Trainer (PAVET) under the terms of a Small Business Innovation Research (SBIR) contract for the US Navy. The device was modelled around the MH-60 helicopter and as well as providing door gunner training, the device can also be used for Search and Rescue (SAR) and Vertical Replenishment (VERTREP) training.

Like most door gunner trainers, AGSS/PAVET uses a HMD to immerse the gunner in a 360 degree virtual world and some type of motion sensor to position the gunner and weapon within the simulation. In the case of the VDGT, that sensor is Ascension Technology's Flock of Birds magnetic tracking system.

The US Army has adopted the Raydon Virtual Door Gunner Trainer (VDGT) for its UH-60 and CH-47 crews using door mounted M240H weapons. The DIS compliant VDGT has been linked to the L3 Link Aviation Combined Arms Tactical Trainer (AVCATT) to provide an integrated crew training environment.

In Germany, the Thales Deutschland Sagittarius small arms trainer forms the basis of the door gunner trainer supplied to the German Army's helicopter force. Based around the M3M 7.62 mm machine gun, instead of using a HMD, the Thales device uses a curved display screen onto which the visual scene is projected.



*Cubic Defense has developed a range of virtual SAT systems covering individual to collective training. Shown here is its COMBATREDI dismantled infantry trainer.*

(Source: Cubic Defense)

Thales Deutschland has a long pedigree with small arms trainers and especially, in its supply of trainers to the German armed forces. In 1998, it was selected as the winner of the AGSHP programme and today, has 170 trainers in-services throughout Germany. In addition, AGHSP/Sagittarius is used by 11 foreign customers including Ireland, Portugal and Botswana.

Another European company to provide virtual SAT systems is the Czech Republic's E-COM Simulation and Training Systems. The company's SATS system can be used from individual up to 24 weapons including small arms, light and heavy machine guns and anti-armour weapons. Like other players, E-COM has moved away from video to use the latest graphics technologies to increase realism and allow instructors to create flexible scenarios.

As we have already seen, modern graphics systems are providing some impressive results in raising the fidelity levels of virtual small arms trainers but these graphics are also leading to other improvements.

## Nuts and Bolts

Most military forces start their small arms training syllabus by teaching recruits how the weapon works and how it is stripped and assembled. Historically, this process was taught using 2D printed diagrams supported by lots of 'monkey-see, monkey-do' exercises.

Canadian company NGRAIN, says that its Virtual Task Trainers (VTT) utilizing Virtual Task Software (VTS) enable real-time, unscripted student interactivity with 3D equipment simulations. This, says the company, enables virtual hands-on practice of tasks and procedures including part removal and replacement. NGRAIN's interactive capabilities leverage what they call "active learning methodologies" to improve knowledge retention. The company says that when compared to conventional learning approaches, such as a student watching an animation and only retaining 30 percent of the information delivered, the VTT improves knowledge transfer to 80 percent or higher.

The US Marine Corps has recently placed an order for VTT to train marines for a number of equipment types, including small arms.

"The NGRAIN solution fills a critical need identified by the [USMC] to support their current and future classroom instruction for Infantry Weapons, Towed Artillery, and Light Armored Vehicle Systems and sub-systems," said Captain Jason Lacis, Executive Officer, Marine Detachment, Aberdeen Proving Grounds.

"We look forward to deployment of the NGRAIN Virtual Training Software at the individual schoolhouses at Aberdeen Proving Grounds and Camp Johnson, and expect to see great results including improved training and reduced overall training and maintenance costs," said John Jones, Program of Instruction Manager at the Marine Corps Combat Service Support School in Camp Johnson.

Also in-service with the US National Guard and US Air Force, the VTT has also been used in Afghanistan to train Afghan National Army (ANA) personnel and British Army instructors.

USAF VTT training applications centred around the aerial gunner whose Specialty Training Standard requires that they receive hands-on training as part of their three-level course. However, due to a lack of access to equipment for training, students were receiving only task knowledge training, and were missing the hands-on training component. NGRAIN says that the 344 Squadron at Lackland AFB exhausted all avenues in a search for demilitarized or unserviceable weapons for use in training and chose instead, the VTT.

Another company to develop a virtual small arms trainer is Digimation. Its Glock 19 small arms trainer is now available. Using photorealistic interactive 3D animation and graphics, Digimation's Glock 19 virtual trainer familiarises students with the weapon's individual parts, functionality, safety procedures, and operation.

"Digimation virtual trainers are designed to help students become familiar with complex equipment, learn operational skills, and master complex maintenance and repair procedures," explains David Avgikos, CEO of Digimation. "Numerous studies confirm the advantages of this type of 'learn by doing' approach over traditional paper and PowerPoint methods."

"Our goal is to achieve a level of realism that can stand up to the closest scrutiny by those most familiar with the real world counterpart," said Grant Niesner, Technical Director at Digimation and project lead for the weapons trainer. "Our tolerance for bad graphics is pretty low. This generation of students in particular expects an extremely realistic experience when it comes to interactive training."

It would appear that this approach to early small arms training is beginning to catch on. At the recent IITSEC, DISTi Simulation was showing an AK47 training device created using its GL Studio product.

## Wrapping it Up

The virtual SAT is a recognised and proven part of the military training process. Over recent years, the product has developed as tetherless weapons and high-performance graphics have transformed the fidelity of such devices. With the adoption of DIS/HLA networking, such trainers may be integrated with other training devices to provide higher level collective training.

The use of the virtual SAT has grown over recent years and to an extent, the mature global market has been saturated however, many other nations are viewing the SAT as a 'must have' and not a 'nice to have' piece of training equipment. One of the drivers here is the continuing operational impact of theatres like Iraq and Afghanistan.