

The Development of Wargaming and Constructive Training

Introduction

Modern constructive training systems are based upon the theory of wargaming. Although wargames can be said to have originated in China over two millennia ago, the first formal application for training military commanders and staff did not take place until the early nineteenth century with the arrival of *Kriegsspiel* and its associated Staff Ride in Prussia.

Today, wargames have been supplemented by computer-based constructive simulation for command and staff training as well as a host of other roles. It is vital to understand that wargames/Staff Rides are still conducted and provide a valuable training and educational role. Frequently, wargaming and constructive training can be combined, as is the case in the UK with Exercise *Joint Venture*.

There are scores of different constructive training systems on the market. The majority are designed to train at the theatre, corps, divisional, brigade and battalion levels and most have their roots in the 1980s. This paper will discuss the challenges presented by such systems, in particular the growing need for flexibility, intuitive interaction and entity fidelity.

This White Paper will conclude by looking at the MASA SWORD product and how it presents users with a possible solution for constructive command and staff training.

The Development of the Wargame

The theoretical concept of wargaming dates back over 2,000 years and can be witnessed in the development of board games such as chess. Chinese military tactician, Sun Tzu famously wrote that the military commander should; 'Know the enemy, know yourself; your victory will never be endangered. Know the ground, know the weather; your victory will then be total.'ⁱ

The military staff system was developed by Prussia and France in the late eighteenth century. In France, its staff system was designed by Pierre Alexander Berthier, during his time as Napoleon's Chief of Staff in Italy in 1896. His book on the subject recoded the roles and responsibilities of HQ staff and this publication was eventually translated into English, German, Russian and Spanish. So with the staff system developed, the focus then turned to training the commanders and those appointed to staff positions.

The idea behind wargaming was to prepare military staff to conduct the battle. Such processes provided an element of training as well as developing Courses of Action (COA), decision making skills, validating doctrine and preparing for unforeseen actions by the enemy – the so-called 'what ifs'.

In 1811, the development of the 'first true wargame' was undertaken by Baron Georg Leopold von Reisswitz, a Prussian Army officer. Known as *Kriegsspiel* (wargame), the table-top exercise featured a gridded board onto which 3D geographical features, military units and buildings were placed. Movements were dictated by throwing dice and the chance factor as to which number appeared replicated Clausewitz's 'friction of war'.

Von Reisswitz's *Kriegsspiel* proved popular and was a major factor in Prussia's success in the Franco-Prussian war (1870-71) and the earlier Austro-Prussian war (1866). Variants of *Kriegsspiel* were adopted by the UK (1872), Italy (1873), France (1874) and Russia (1875).ⁱⁱ

The development of command and staff training systems and the role of the staff in war was soon adopted in the US. The US Army's Captain Roger Fitch wrote *Estimating Tactical Situations and Publishing Field Orders* in 1909. Portions of Fitch's book were used to create US Army's first Field Service Regulations (FSR) manual and this led to the maturation of the US Army's staff system.

One of the supporting components to the Prussian Army's *Kriegsspiel* method of training staff officers was the Staff Ride. This has been described by Gardiner as follows:

'A staff ride differs from a guided battlefield tour in that it is an educational technique for studying leadership, decisions taken and whether alternatives could have been employed; and it requires active participation, where each group member assumes the role of a participant in the battle, and he is questioned by the others as to the view on what occurred on the battlefield.'ⁱⁱⁱ

In many ways, the Staff Ride is similar to the Tactical Exercise Without Troops (TEWT) where, normally junior officers, learn tactical deployment and the effects of terrain and going. Tactical challenges are set on real ground and officers are tasked with deploying fictional assets accordingly and then defending their deployments to the Directing Staff (DS).

The *Kriegsspiel* or wargame, along with its associated Staff Ride component, provided both training and education for staff officers and commanders. It is worth considering the difference between the two processes.

Kline describes training as emphasising, 'the psychomotor domain of learning. Training that is done in the cognitive domain is generally at the knowledge level and lower part of the comprehension level...education on the other hand, teaches a minimum of psychomotor skills. It concentrates instead on the cognitive domain, especially the higher cognitive levels...'^{iv}

In essence, training is a closed loop process where everything is undertaken in an approved manner such that the same result is achieved at the end of the process. This is often referred to as behaviourist learning.

In comparison, education is an open system of continuous learning whereby, 'right answers and ways of doing things often do not exist in education – only better or worse ones.'^v

These are important differences and it can be seen therefore that a wargame, and its

successor, the constructive training system, can provide both a training and educational function. This is an important distinction and has implications for the procurement of such systems. For example, if an army requires a new constructive training system to undertake command and staff training, doctrinal development and decision making skills at the Brigade or Battalion level, the constructive training solution that is chosen must have the flexibility to undertake the roles for which it has been procured.

In the twentieth century, command and staff training was undertaken using the Command Post Exercise (CPX). Again, such exercises are still conducted. The aim of the CPX was to train command post staff and commanders using a Master Events List (MEL) that generated certain events at set times. Commanders and staff had to react to these events and were monitored by a large number of DS who recorded and assessed their actions according to an agreed doctrine that was normally contained in FSR or an operations manual.

Clearly, the older form of CPX lacked flexibility and was proscriptive in nature. That said, before the introduction of computers, such exercises were valuable and served a purpose.

Digital Developments

The next phase in the development of staff officers came with the application of computer technology to the wargame. This initially occurred in the US with the RAND Corporation in the 1960s although these systems were mainly used for doctrinal development. As processing power, miniaturisation and the appearance of artificial intelligence (AI) wargaming has taken on a different hue that has led to a proliferation of computer-based command and staff training systems that are now in use around the world.

One of today's major challenges in speaking of the wargame process is one of definition. The following two definitions underscore this issue.

‘What is a wargame? A wargame is an attempt to get a jump on the future by obtaining a better understanding of the past. A wargame is a combination of *game*, history, and science. It is glorified chess. A wargame usually combines a map, playing pieces representing historical personages or military units, and a set of rules telling you what you can or cannot do with them. The object of any wargame is to enable the player to re-create a specific event and more important to be able to explore what might have been if the player decides to do things differently.’^{vi}

Robel has a more relevant military view.

‘The most widely used US Army *wargames* are called *Constructive Simulations*, and include JANUS (not an acronym), the Brigade/Battalion Battle Simulation (BBS), and the Corps Battle Simulation (CBS). JANUS is used most for company to Brigade Training, BBS for Battalion and Brigade Training, and CBS for Division and Corps Training. These are the most widely used simulations for training in the Army today, although others are available. Finally, there are the emerging simulations like WARSIM or OneSAF.’^{vii}

Constructive simulation may be defined as follows: ‘a constructive simulation includes simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes. A constructive simulation is a computer programme. For example, a military user may input data instructing a unit to move and to engage an enemy target. The constructive simulation determines the speed of movement, the effect of the engagement with the enemy and any battle damage that may occur.’^{viii}

It is worth noting that the different constructive training systems used by the US Department of Defense (DoD), including WARSIM, OneSAF and Joint Land Component Constructive Training Capability (JLCCTC), all have different functions in terms of what level of unit or formation they are designed to provide training for. At present, there is no ‘one size fits all’ as far as constructive training is concerned.

Before looking at constructive training in more detail, it is worth highlighting that this computer-based training system has not totally replaced all aspects of wargaming or for that matter, the CPX. In the UK for example, that nation’s *Joint Venture* series of exercises are designed to train a theatre level staff system. Most of the exercise is conducted as a conventional Command Post Exercise (CPX) using actual Battle Management Systems (BMS), paper maps and communications equipment. Minimal use is made of a constructive training system to provide ‘red force’ inputs.

Constructive Training Considerations

There are a number of considerations that have to be taken into account when selecting a constructive training system. As described above, constructive training systems are usually designed to undertake a specific training task; for example, the US Joint Theatre Level Simulation (JTLS) is designed for theatre-level operations, CBS for Corps and Divisional level simulation as well as BBS and JANUS for Brigade/Battalion training.

Such systems present a number of challenges. Most started their development in the early 1980s and nearly all systems were created for use by the US Department of Defense (DoD). In many ways, these early systems have been unable to take advantage of modern developments to processing technology and software developments such as AI and are doctrinally tied to US DoD Tactics, Techniques and Procedures (TTP).

Due to the use of older operating systems and architectures, further development is difficult. More modern designs make use of improved hardware and software architectures and ‘technical refresh’ is designed into the system from the outset to ensure that such constructive training systems remain at the forefront of technical development and truly reflect current TTP.

The other benefit of modern constructive training systems is their scalability. The ability to upgrade or add items such as a logistic,

cyber warfare or CBRN capability provide increased flexibility and maintain the relevance of the training system for its user audience.

Another consideration with older constructive training systems is the manpower required to script and conduct exercises is often considerable. With military manpower always at a premium, users must factor in this resource commitment before selecting a constructive training system for procurement. One example, from the New Zealand Defence Force, shows that in 2007 the Army ran its Exercise *Suman Warrior* using the JANUS constructive training system. The exercise required 55 operators, all of which required a two-week pre-exercise training course.

In Exercise *Suman Warrior* 2014, JANUS as well as OneSAF and Joint Semi Automated Forces (JSAF) systems, had been replaced by MASA SWORD. Pre-exercise training was cut to a matter of days through the use of a web-delivered e-learning package and SWORD's more intuitive Human Machine Interface (HMI) meant that the manning level was reduced by 66%. In addition, the hardware needed to support the exercise was significantly reduced.^{ix}

Modern constructive training systems such as SWORD, provide a degree of flexibility that is completely missing from older systems that have been designed to train specific military formations. In Peru for example, Colonel (Retd) Guillermo Ortiz Hervera, the Officer Commanding at the country's Tactical Training Centre (CETAC) has said that the Peruvian Army, 'adopted a modern constructive training system [SWORD] to train at all levels for a spectrum of different scenarios that include conventional warfare, anti-terrorist operations and disaster management.'^x

'SWORD also allows us to plan, prepare and validate courses of action that we might want to undertake in the future,' said Ortiz Hervera. 'Such plans were devised for the impact of El Nino in November 2015 when the country was hit very hard.'

One key component of the modern constructive training system is its fidelity. This fidelity applies to entities (such as vehicles, weapons and units), terrain, infrastructure (such as roads, urban construction and canals) and weather effects. With modern systems such as SWORD, the parameters of the entities can be readily changed through drop down menus or users can simply undertake exercises with SWORD's out-of-the-box content.

This content includes predefined military units (infantry, armour, artillery, engineering, aviation, logistic forces for example), public safety and security (police, firefighters and ambulances), asymmetric threats (terrorists, militias or unruly crowds) government agents and civilians (NGOs or refugees). Hundreds of missions and scenarios can be created and trained for.

Observations on MASA SWORD

As well as the technological advantages of SWORD that have been briefly described above, the development of the product has frequently been undertaken hand in glove with the system's military customers. These military customers can be found in 13 countries across the globe where SWORD is used to train command and staff personnel at the Divisional down to Company levels.

This close working relationship with the customer has led to a development roadmap that sees customer feedback implemented in regular update releases of SWORD several times a year. This ensures that all users have the latest version at all times.

A SWORD server can be installed in less than 15 minutes, allowing its users to focus on actual training rather than wasting time with unnecessary software complexity issues. A powerful web-based administration tool allows remote trainees to access exercises and scenarios. SWORD can also run on a standard laptop. With its modern and intuitive Graphical User Interface (GUI), trainees can become proficient with the system in a matter of hours.

With a previously described 'out-of-the-box' content set, SWORD also includes a simulation server, a gaming client, a timeline, tools for scenario preparation, terrain generation, physical and decisional models adaptation, After-Action Review (AAR), a self-training module and a web-based interface to manage distributed exercises. Together, these attributes make SWORD one of the most capable, flexible and efficient constructive training systems available anywhere in the world.

SWORD can represent high-fidelity ground forces immersed in highly realistic joint forces or coalition scenarios, through the use of detailed physical models and advanced interoperability features. Platoons and companies in SWORD are intelligent and autonomous. They can receive operational orders and execute them without additional input from the operators, while adapting their behaviour accordingly as the situation evolves. Such a level of fidelity on combat actions, the operations of battalions, brigades, army divisions and higher, provides commanders and their staff with remarkably reliable simulation exercises that are lacking in competitor systems.

In addition, everything in SWORD can be customized to match the user's actual equipment and doctrine: from vehicle speeds, weapon system performance and sensor accuracy, through unit composition, basic loads and logistics systems, to unit TTPs and types of mission.

SWORD is not just a stand-alone constructive training system. The product has been adopted by several companies, including Saab, Systematic and RUAG, the latter where

it has been integrated with OSPREY to provide constructive command post training from company to division level. SWORD is also used in the TACTIC research programme in France to integrate C2 system using the NATO standard Battle Management Language (BML). SWORD has also been linked to serious games engines such as VBS 3 to provide virtual representation of units and for AAR..

Conclusion

In conclusion it can be seen that ever since the staff system was developed in France and Germany in the late eighteenth century, the military was aware that it needed a system to train its commanders and staff. Initially, this system was the *Kriegsspiel* or wargame and this approach was adopted by most military forces around the world.

This wargame approach is still used, and alongside the Staff Ride and TEWT, provides an excellent training and educational tool. Such an approach has limitations and such training has been supplemented by the CPX and more latterly, computer-based constructive training systems.

Not all constructive training systems are the same and many lack flexibility, contain low-fidelity entities, need high levels of maintenance and call upon large numbers of personnel to use the systems in command and staff exercises.

The new generation of constructive training systems exemplified by SWORD, address the shortcomings of earlier systems by providing a flexible, high-fidelity and intuitive approach to the command and staff training challenges that confront armies around the world.

ⁱ Sun Tzu. *The Art of War*, translated by Griffiths, Samuel (Oxford: OUP, 1963)

ⁱⁱ Tolk, Andreas. *Engineering Principles of Combat Modeling and Distributed Simulation* (Hoboken: Wiley, 2012)

ⁱⁱⁱ Gardiner, Ivor. 'Wargaming: An Overlooked Educational Tool' in *British Army Review*, No.165, Winter 2016.

^{iv} Kline, John. 'Education and Training: Some Differences' in *Air University Review* January-February 1985.

^v Ibid.

^{vi} Stanley, Bruce. *Wargames, Training, and Decision Making. Increasing the Experience of Army Leaders* (Fort Leavenworth: USACGSC, 2000)

^{vii} Robel, Michael. *The Difference Between Military & Civilian Wargames*. Accessed at https://www.strategypage.com/wargames/articles/wargame_articles_2004919231.asp on 03 July 2016.

^{viii} US DoD *Simulation Glossary* (December 2010)

^{ix} Nash, Trevor. 'New Zealand Defence Force Mission Command Training School' in *Military Training & Simulation News*, Vol.17, Issue 1, 2015.

^x Col. Ortiz Hervera to author at MASA User Group Conference, Saumur, France, 30 March 2016.