Adapting Commercial Off-the-Shelf Games for Military Simulation

ABSTRACT
The interactive digital medium of computer games holds promise for application in the realm of military simulation. This paper presents the Defence Science & Technology Agency (DSTA) and the Singapore Armed Forces’ (SAF) initiative to leverage commercial computer games for military applications, how several SAF schools have adopted modified commercial games to enhance classroom instruction, and our future plans to extend the use of games in the SAF.

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INTRODUCTION

It is a common perception that computer games and military simulators are very different entities. Many games entertain by drawing participants into a virtual world that calls for a suspension of the user's disbelief; military simulators, on the other hand, seek to attain a high level of realism in order to derive meaningful simulation results. In reality, they both share a common set of enabling technologies, and it is beneficial to both the game industry and military simulation community to tap each other's innovative solutions (Zyda and Sheehan, 1997). This paper describes the DSTA-SAF initiative to exploit computer games for military applications, the approach adopted in successfully modifying suitable commercial off-the-shelf (COTS) games to find relevance for training, and our future plans.

CONVERGENCE OF SIMULATION AND GAMES

Military simulation systems evolved as sophisticated applications that run on high-powered computer workstations, while computer games were initially programmed by hobbyists to run on machines like the Commodore Amiga (Herz, 2002). However, the availability of faster processors, larger hard disks, and graphic accelerators to PC owners enabled game developers to leverage advances by computer scientists in areas such as real-time 3D graphics, artificial intelligence and networking. The increasing power of the PC heralded the rise of the extremely lucrative game industry that has since produced numerous titles that begin to rival military simulators in terms of the level of detail and richness of experience.

GAMING IN THE MILITARY

Indeed, the potential of computer games as a cost-effective conduit to motivate and engage a game-savvy generation of soldiers in repetitive tactical thinking “anytime, anywhere”, has not gone unnoticed among various armed forces.

In 1995, the US Marine Corps had the prescience to take advantage of the Doom shareware in the development of Marine Doom, which was designed to hone the teamwork and coordination of four-soldier fire teams (Riddell, 1997). The advent of fully 3D games presented new possibilities for military application. In the past few years, the US Army has spent millions of dollars to work with developers to create various games, including America’s Army, which started out as a recruitment tool but has since been used to train future officers at West Point (Roth, 2003). Another such game is Full Spectrum Warrior, which aims to train squad leaders in real-life combat tactics of urban warfare (Reuters, 2003).

While these games developed by the US Army have since been introduced into the mainstream gaming community, several COTS games such as Delta Force 2, Steel Beasts, and Falcon 4.0 have also been adapted by various armed forces to enhance their relevance to military training (Macedonia, 2002; Calvert, 2003; Zyda and Sheehan, 1997).

LEVERAGING COTS GAMES THROUGH MODS

Adapting a game for military application typically involves engaging a game developer to create customised game content under strict licensing agreements. However, this may soon be the exception rather than the rule. Game-development toolkits, once the tightly-guarded bastion of game developers, have been made increasingly available by developers, to the delight of an emerging breed of gamers – the technically-inclined gamers are able to create new content – characters, weapons, vehicles, maps, missions – collectively forming modifications (or mods, in gaming jargon) of the commercial game, which they then freely share with other gaming enthusiasts over the Internet.

There are many benefits in leveraging COTS games to create mods for the SAF. First, there is low risk and little cost involved. In developing a game for commercial release, the developers would no doubt have allocated a significant budget towards the research and development of a robust game engine with leading-edge technology. By creating mods of COTS games, we are thus able to leverage the sophisticated game technology already in place for a fraction of the cost.

Secondly, the game-development toolkits released by the game developers provide a layer of abstraction from the underlying code, allowing experienced mod makers to create game assets with a relatively short turn-around time. While the tools may take some time to master, there is a wealth of online resources...
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A good mod will invariably garner plaudits from the gaming community, and the status and acknowledgement awarded its creator is motivation enough for mod makers to spend countless hours creating new content (Herz, 2002). The game developers also stand to benefit as mods become a source of new content that extends the shelf life of games (Smed and Hakonen, 2003). It is this symbiotic relationship between game developers and mod makers borne out of the unique social ecology of games that we wish to leverage in the modification of COTS games for the SAF.

THE DSTA-SAF EXPERIENCE

As a conscript armed force, the SAF has a large pool of young national servicemen, many of whom are eager gamers. Several full-time National Servicemen (NSF) displayed great interest and aptitude as mod makers during various modification trials conducted in early 2003 to identify suitable COTS games that may supplement the SAF’s existing training curriculum. Under the direction of the officers-in-charge, these NSFs embarked on projects to create new game content specific to their respective arms formations, thus enabling the formations to quickly move ahead and incorporate these relevant mods in their training curriculum. In addition, students from Singapore’s Nanyang Polytechnic with skills in digital media design and information technology were engaged to create localised game content for the SAF’s use across the various arms (see Figure 2).

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in the form of tutorials, videos, and forums to help novices shorten their learning curve. Our specific approach of involving NSF and polytechnic students in the process of creating mods for the SAF allows us not only to tap on their interest and skill sets, but also serves as an effective vehicle to reach out to this technology-savvy generation and welcome their contributions towards the SAF’s innovative approach to training.

Whilst COTS games offer proven game technology, the cultural infrastructure of the gaming communities also facilitates an informal yet invaluable source of feedback for the verification and validation of game models. In traditional military simulators, much care is given to verify and validate the accuracy of the simulation models, often requiring many man-hours dedicated to model testing. In the case of COTS tank, naval, and flight simulation games or other combat simulation games, the experienced soldiers amongst the pool of avid gamers will ferret out any inaccuracies in the game models and highlight them via reviews and forums. These errors may then be rectified by the developer in subsequent game patches, resulting in better fidelity game models.

**CONSTRUCTING A WHOLE NEW VIRTUAL WORLD**

Armed with the arsenal of professional game-development toolkits and third party utilities, mod makers have unleashed their creativity in pushing the bounds of the underlying game engines. A salient example is The Chain of Command, a mod of Operation Flashpoint developed by a diverse group of dedicated fans brought together by the common desire to create large scale strategic combat simulations on top of the original section-level tactical first-person shooter. In addition to strategic level gameplay, the mod makers have also created artillery units, torpedoes, mines, and combat divers to extend the spectrum of possible operations in the game.

The exact process of mod-making differs from game to game but they are likely to involve similar steps. The remainder of this section serves to provide an idea of what is involved in the creation of an SAF mod of Operation Flashpoint.

New game assets such as SAF weapons and vehicles as well as localised buildings and vegetation are modelled using Oxygen Light, the official modelling tool released by Bohemia Interactive Studio (BIS), the game’s developers. Photo-realistic textures prepared from actual photographs are then applied to the polygons of the 3D models. Key components of the model are identified with predetermined tags in order for the engine to associate the appropriate attributes with them. For instance, both ends of the SAR21 rifle barrel have to be tagged so that the engine can calculate the bullet’s trajectory.

After the game assets have been modelled, their in-game behaviour is specified in a configuration file that provides information to the game engine via parameters such as vehicle speed, armour values, effective range and damage of ammunition. The daunting task of defining all the parameters of a new game asset is eased considerably by using the parameters defined for an existing similar object. For instance, a new armoured personnel carrier like the SAF Bionix Infantry Fighting Vehicle could inherit the parameters of the existing M113 armored personnel carrier, leaving the mod maker to change only the parameters for which the Bionix differs from the M113.

Custom maps may also be created using Visitor 2 Light, the official terrain editor released by BIS. Geo-specific terrain may be modelled based on the Digital Elevation Model (DEM) of geographical areas. However, there is some pre-processing that needs to be done to the DEM file before it may be imported into the terrain editor. Alternatively, a generic heightmap may be used in the modelling of geo-typical terrain.

Once the elevation profile has been imported into Visitor, ground textures such as grass, rock, or sand are applied to different parts of the terrain. Localised objects such as kampung huts, a Command HQ building, lamp posts, and vegetation such as mangrove, coconut, and banana trees created in Oxygen Light are then imported into the project and may be placed on the island as desired. Lastly, a network of roads is designed.

After the custom map and game assets are completed, everything is put together in the mission editor that is shipped with the game. The mission editor provides a fairly intuitive graphical user interface for gamers to define simple rule-sets in the creation of new missions. More complex scenarios may be designed with additional scripting of the computer-controlled units’ behaviour.

**CHALLENGES**

A strong element of creativity is integral to game object modelling and mission design to make for compelling gameplay. It is this creative aspect that sets COTS games apart from traditional military simulators and it should be pre-eminent in any effort to adapt COTS games to incorporate military training curriculum.

A more difficult challenge to surmount in adapting COTS games for the military is the lack of access to the underlying source code. This presents limitations to the degree that the original game may be modified. For instance, the important phases of mission planning and After-Action Review (AAR) may not be easily incorporated in a game without tweaking the source code. However, there is a glimmer of hope that more developers would embrace the open source movement that has been proven commercially viable by developers such as id Software. The decision taken by id Software to release the source code of Doom and Quake has given rise to a myriad of extensively modified games (Au, 2002). If more game developers adopted the same mantra...
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1 Wilbur is a freeware terrain editor developed by Joseph R. Slayton. The utility tga2ase is developed by Kegen Kotisivu to facilitate terrain heightmap generation for Visitor.
of free information access, it would pave the way for more extensive modifications of COTS games to meet specific military interests.

USE OF MODS IN THE SAF

The versatility of Operation Flashpoint mods has found innovative applications in the various SAF schools to engage trainees in achieving learning objectives. Incorporating these mods into the training curriculum has yielded additional benefits such as savings in training resources and increased realism in conducting drills involving various members of a combat unit. The following paragraphs highlight the initiatives taken by the School of Armour (SOA) and School of Combat Engineers (SOCE) in creating custom game content to suit their specific needs.

The SOA has embarked on an ambitious project to create models of its vehicles such as the Ultra OWS, SM1, Bionix, and Bronco (see Figure 5) for use in custom training scenarios. Played in multi-player mode, the missions provide an environment for trainees to practise the various drills as well as hone their situation awareness and team-fighting skills. The Ultra OWS and SM1 models, along with a simple block mission, may be downloaded from the portal for SAF National Servicemen at http://www.miw.com.sg and played with the COTS Operation Flashpoint: Game of the Year edition.

The SOCE has also created new content such as concertina wire, mines, booby traps, and other equipment specific to their scope of operations and incorporated these in multi-player missions to enhance classroom instruction. This has proven to be an effective way of conducting dry runs as a preamble for actual field lessons or exercises. Trainees are able to quickly gain a clear understanding of the ground picture and their respective roles through hands-on gaming sessions. This translates into cost savings in the conduct of field exercises; for instance, there is less wastage of materials compared to previously when trainees were more unfamiliar with their drills. Besides enhancing classroom instruction, mods are also explored as an alternative to field lessons as a wet weather programme, or to overcome limitations of manpower and resources, and safety considerations that result in unrealistic battlefield scenarios.

FUTURE PLANS

As a repertoire of SAF mods is being built, some of these may be made accessible through the Internet for download and multiplayer online gaming. This would be an effective medium to reach out to NSFs and constantly engage them in tactical decision-making. While mods find even more application for training, we are also exploring its potential for military experimentation. The versatility of mods lends itself as a promising proxy world for the evaluation of war-fighting concepts.

SUMMARY AND PERSPECTIVE

As PC technology advances in response to market demand, COTS games will continue to grow in sophistication and complement military simulators in providing virtual environments that are rich in detail. This trend, coupled with the low cost of games and the ubiquity of PCs, has motivated a closer examination of the relevance of COTS games to the SAF. The release of game-development toolkits by commercial game developers has been a boon in providing us a means to create customised content and mission scenarios to suit the SAF’s training needs with a short turn-around time.

The initial projects undertaken by SOA and SOCE represent the first steps in our commitment to fully explore and harness COTS games in engaging our next generation of soldiers. Overall, the results and feedback have been positive, paving the way for future projects as we seek other ways that this commercial interactive digital medium may cross over to meet the needs of military simulation in the SAF.

REFERENCES


BIOGRAPHY

Gwenda Fong Su-Yi is a Development Engineer (Simulation and Wargaming Solutions Centre). She works with the SAF Centre for Military Experimentation in the design, conduct, and analysis of experiments that explore future warfighting concepts. Her involvements include live experiments that aim to shape the Command Post of the Future, as well as the exploration of operational concepts using agent-based simulation. A PSC Overseas Merit Scholar, she pursued her studies at Stanford University, USA, where she obtained her BSc. (Dist.) and MSc. in Electrical Engineering in 2001.
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