

MSG-101 Simulation in Support of NATO Operations - Technical Evaluator's Report

Summary of Proceedings

1. Purpose: The purpose of this summary of proceedings is to document the NATO Modelling & Simulation Group (NMSG) MSG-101 **Simulation in Support of Current NATO-Led Operations**

2. Objective of the Workshop: The purpose of this workshop is to share current best practice across the Nations and NATO organizations in the use of simulation to support operations. In doing so, it is anticipated that NATO and the Nations will be able to identify potential follow-on collaborative opportunities and understand how simulation might better be exploited.

3. Workshop Agenda

- 0900 – Introduction by Co-chairs (Wayne Buck and Bharat Patel)
- 0910 – Serious Games Support to NMIOTC
- 0930 – Virtual Cultural Awareness Trainer
- 0950 – Identification of Command and Control Gaps
- 1010 – Aviation Tactics Trainer
- 1030 – C-IED Training, VBS2, NLD
- 1050 – Joint Theater Level Simulation
- 1110 – Engagement Coordination through Real-time Exchange
- 1130 – Mission Rehearsal at the Swedish Air Force Simulation Centre
- 1150 – UK Developments
- 1210 – Wrap up by Co-chairs

4. Participants

ANDERSSON Carine (Ms)	Sweden
BAILEY Grant (Mr)	United Kingdom
BLIX Jan Erik (Mr)	Norway
BORGVALL Jonathan (Mr)	Sweden
BRATHEN Karsten (Mr)	Norway
BUCK Wayne (Mr)	ACT
CANTOT Pascal (Lt. Col.)	France
CARPENTER Robert (Mr)	Australia
CASTOR Martin (Dr)	Sweden
DE REUS Nicolaas Martin (Mr)	Netherlands
DIEM John (Mr)	United States
GARGIULO Luca (Lt.Col.)	Italy
GARCIA Johnny	United States
GREGORY Daniel (Mr)	United Kingdom
HALVORSEN Sven Harald (LtCol)	Norway

HUIKAMP Wim (Mr)	Netherlands
JACKSON Peter Michael (Mr)	United Kingdom
LE GRAND Nanne (Col (Rtd))	Netherlands
LO PRESTI Alessandro (Mr.)	Italy
MAHONEY Timothy (Director)	United States
MCRAE James (Mr)	Australia
NEWMAN Paul E. (Mr)	United Kingdom
OLEARY Dennis (Mr)	United States
ORMROD David (MAJ)	Australia
PATEL Bharat (Mr)	United Kingdom
ROLAND Ronald (Dr)	United States
SAN JOSE Angel (Mr)	ACT
SCOTT Joseph (Mr.)	United States
VAN DER WIEL Wouter	Netherlands
VAN WIJNGAARDEN Marius (Mr.)	Netherlands
VARDON Vanessa (Ms.)	United States
VOICULET Adrian (Mr)	RTA
WADLED Wan (Captain)	Australia
COVEY Mark (Mr.)	United States

5. Executive Summary of Presentations:

5.1 Opening remarks by Mr. Wayne Buck, NATO ACT.

Mr. Buck formally opened the meeting with an introduction of the Co-chairs and gave guidance to presenters. The objective of the opening remarks was to ensure all presentations fit into the allotted three-hour window for the meeting.

5.2 NATO Virtual Worlds Investigation

Mr. Wayne Buck, NATO ACT.

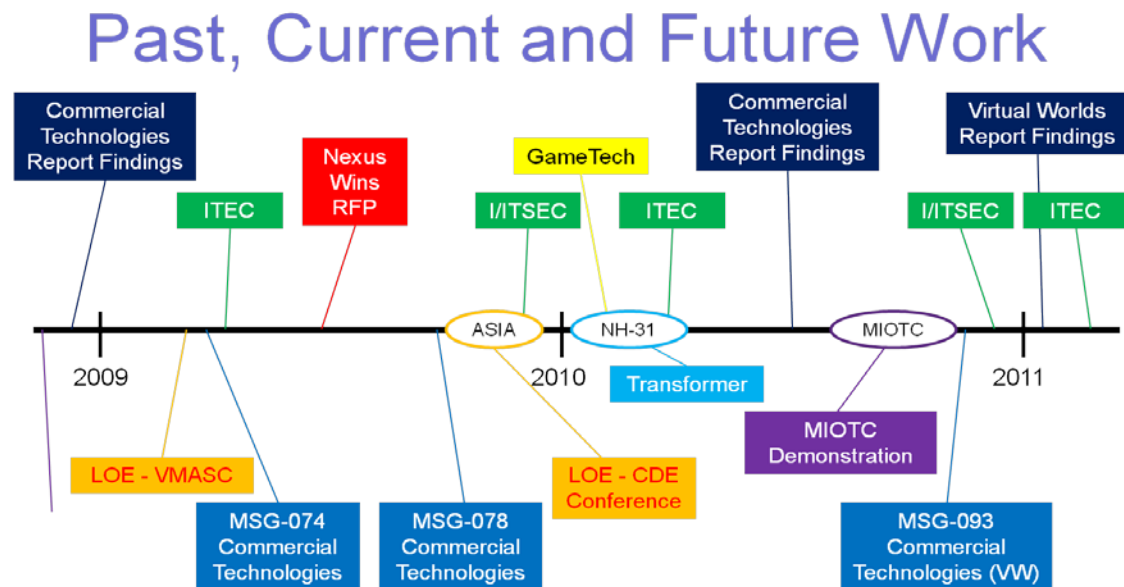
Mr. Buck opened his presentation with the need for Individual Augmentee (IA) training and virtual worlds in support of operations that are not currently adequate to prepare the warfighter for rapid and efficient integration. Mr. Buck proposed that virtual world training capabilities and products can provide a solution to this problem. Mr. Buck also proposed the creation of a line of experimentation to confirm the hypothesis that collaborative virtual world training will better prepare staff officers for integration into an existing multi-national headquarters. Mr. Buck's suggestion of virtual environments and blended learning were broken down into the 4 categories:

- Classroom-based learning
 - Face-to-face instruction, mentoring, role-playing, coaching, and case studies
- Collaborative learning
 - Working with peers, e-labs, virtual field trips, team exercises, group activities, threaded discussions, and wikis
- Interactive learning, simulations, and games
 - Experience and experimentation

- Computer-based training modules, learning objects, interactive games, coaching, and simulations
- Performance support and reference materials
 - Knowledge capture/knowledge management
 - Web pages, pdfs, web lectures, podcasts, videos, and blogs

Further, Mr. Buck suggested a working relationship within ACT and the Joint Force Trainer to generate and gather requirements to develop operational experiments that could lead to developed capabilities for Education and Training Facilities (ETFs). Mr. Buck also discussed the need for returns on investment and benefits of such activities to the customers. Examples were Ship Boarding training using Ships Ahoy - a serious game developed by NATO for under \$100,000.

Mr. Buck also gave a chronological update of the ACT virtual worlds campaign from late 2008 to early 2011. During this time, NATO provided practical solutions by leveraging virtual worlds as a means to support operations, illustrated in the following graphic.



5.3 Virtual Cultural Awareness Trainer

Joe Camacho. USJFCOM Joint Knowledge Development and Distribution Capability (JKDDC)

Mr. Camacho gave a brief introduction of the Virtual Cultural Awareness Trainer (VCAT™) accompanied by three-minute video of VCAT. VCAT teaches cultural skills specific to the Horn of Africa in support of the mission of United States Joint Forces Command (USJFCOM). Trainees learn the most effective ways to complete missions in that region using culturally appropriate behaviours and key phrases. Missions covered are civil affairs operations, security cooperation, and humanitarian operations. The overall objective of the VCAT is to provide cultural awareness training while simultaneously

demonstrating the ability to deliver the training via an innovative training method. This program is a USJFCOM Joint Knowledge Development and Distribution Capability (JKDDC) initiative based on Training Capability Analysis of Alternatives (TC AoA) Alternative 5. The objective of TC AoA Alt 5 is “re-engineering joint training” through innovative training methods rather than use of large scale constructive simulations.

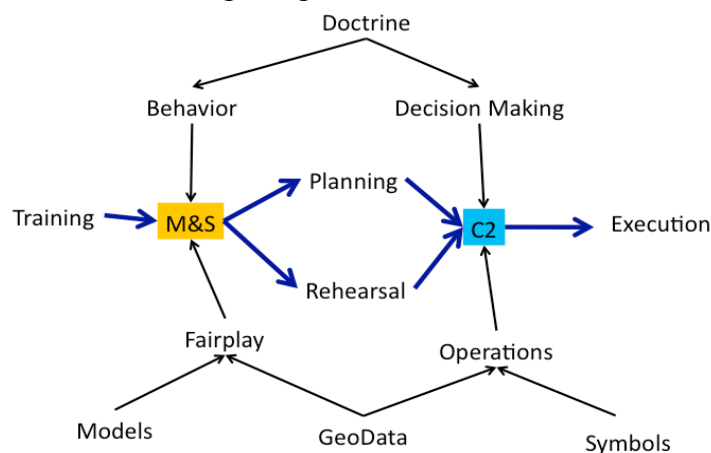
5.4 Identification of Command and Control Gaps
 John Diem and Dr Mike Hieb

Mr. John Diem, Office of the Secretary of Defense M&S Coordination Office, and Dr. Mike Hieb, George Mason University, gave an introduction of the Initial Results of MSG-091 – Identification of Command and Control, M&S Gaps. Mr. Diem discussed how and why M&S should be a more effective part of current NATO operations. He discussed the objective of MSG-091 and its initial assessment in detail, where:

1. M&S is currently not being utilized to its potential in either NATO or national operations
2. Models used for training and testing could be used for operational support
3. Simulation support to operations should be “invisible” to military personnel and this support integral to their C2 systems
4. There should be M&S tools available for supporting NATO coalition operations

Starting assumptions were that C2 and simulation systems are fundamentally the same and C2 and simulation should use the same system, services and underpinning data models. The MSG-091 was divided up into two working groups: an operational group and a technical group. The primary objective of the working groups was to define gaps that directly support operations. Each workgroup was to determine the top five gaps in direct relation to mission planning, mission rehearsal, and mission execution.

As part of the working group, Major Marco Hulleman developed a graphic (below) that shows operational reasons for integrating C2 and M&S.



This graphic describes the operational use of similar components for execution of a mission and training.

Findings of the workgroups were divided into short-term, medium-term and long-term gaps.

Short-term gaps are less than five years and include:

- Rapid generation of 3D terrain (natural / man-made / interior)
- Integrated initialization processes
- Virtual mode for C2 systems
- Time management and simulation control
- Communications/cyber effects
- Standard COA / scenario description
- Standard representation of RoEs / caveats
- Syntax and semantics for digital orders

Medium-term gaps are between five to 10 years and include:

- Simulation to represent complex endeavours
- Full spectrum sensor architecture
- Interface specifications for using simulation in operations
- Real-time generation of 3D terrain (natural / man-made)

Long-term gaps or objectives are greater than 10 years and include:

- Real-time information interoperation of national C2 systems with embedded simulations
- Common framework for both C2 and M&S

Overall, the main message of MSG-091 was that simulation is the same as C2 from the viewpoint of the warfighters and an operational context. Recommendations are still being gathered.

5.5 Aviation Tactics Trainer

Stu Armstrong, QinetiQ.

Mr. Stu Armstrong provided an in-depth brief on the development of a commercial-off-the shelf evaluation unit (COTSEU) for aviation tactical training. Mr. Armstrong discussed the use of an immersive environment for the integration of an operational context for use in training. The objective for the development of an immersive environment was to answer how “current in-theatre commitments have pushed the need for an aviation tactics training solution for all aviation assets currently deployed.” Joint Helicopter Command has requested the COTSEU to investigate a commercial-off-the-shelf (COTS) solution to support theatre-specific tactics training for the Apache, Sea King, Puma, Chinook, Lynxs and Merlin.

Mr. Armstrong went into further details of the environment and recommended the development of task group architecture for virtual immersive environments. This needed highly modular architecture would be utilized when developing these virtual immersive environments. The highly modular design will allow rapid response to new technology and COTS-based hardware and software standards ensure longevity and continued support, as well as the ability to expand systems to accommodate changing requirements and new systems.

Mr. Armstrong gave a short demonstration of the VBS2 engine, illustrating its ability to utilize highly detailed geo-specific terrain to enhance training value and levels of immersion, thus supporting mission specific training. The environment provided a very high fidelity geo-specific terrain (50km x 50km) that incorporates individual behaviours with complex vehicle dynamics to train Joint Fires.

Final conclusions were:

1. Developmental issues
 - a. Availability of hardware (specifically flight control grips) has been the main issue. Although there were grips available they were flight-ready spares and as such could not be modified.
 - b. Graphical performance during the early development of the demonstrator was also an issue. Since this initial period the Nvidia GPUs reached a maturity and has been surpassed by competitors offerings.
2. Developmental insights
 - a. It is possible to create a targeted-fidelity tactics trainer for support helicopters using COTS-based technology at significantly lower cost than traditional simulation methods.
 - b. Development timescales using COTS-based technology are dramatically reduced in comparison to traditional simulation methods.
3. Advantages
 - a. Highly modular design allows rapid response to new technology.
 - b. COTS-based hardware and software standards ensure longevity and continued support.
 - c. Enables coherent tactics and mission training at individual, team, and collective levels for numerous JHC platforms.
 - d. Provides the ability to train crews on different platforms within the same training environment.

5.6 C-IED Training, VBS2, NLD

Mr Wim Huiskamp, TNO Defence, Security and Safety, NLD

Mr Wim Huiskamp presented work carried out by Dr Anja Hulst and her colleagues at the Netherlands' Office of TNO Defence (Security and Safety) on the use of a virtual tactical trainer for C-IED operations. Threat analysis and planning for C-IED is challenging. Very few general principles exist; the tactics of C-IED are based on a thorough understanding of the local environment (terrain, common behaviour of

civilians), the conflict setting, IED history and present intel. Therefore, threat analysis and decision making is largely situated. Field exercises allow for practice in such situated decision-making, yet field exercises have their limitations. A field exercise takes much time. As such, each typical threat situation is practiced just once, it is a 'single shot' experience. Also, the variety of terrains is very limited and generally not mission-oriented. Finally, no realistic cueing from civilians is available to allow students to perform a proper 'in situ' analysis.

In the Royal Netherlands Army (RNLA), It is necessary to do more dedicated 'brain training' to improve the situated decision-making in threat analysis and planning. Mr Wim Huiskamp detailed that brain training is intended to target not only conceptual knowledge, but also the skills of independent and competent problem solving in entirely new situations. Further, brain training instils a 'can do' attitude for tackling complex situations not previously encountered. The aim, therefore, was to integrate the acquisition of conceptual knowledge, skills and attitude and thus strive for development of rich competencies.

Mr Huiskamp described the environment that was created using the VBS2 as a platform as a series of virtual test exercises; threat analysis and planning in a green, an urban, a mission-oriented and a littoral with a pre-planned peace conference (with a timed IED threat). All environments were populated. Initially, the scenarios aimed at platoon-level planning for intermediate search. The students were both provided with a 2D map as well as with the 3D environment and facilities from the so called 'Real Time Editor' (administrator mode) as present in VBS2. Hence, they could use the so called 'default camera' helicopter view to perform an extremely fast reconnaissance in the terrain.

The series of initial scenarios was tested with junior search advisors (platoon level), squad commanders, and privates. The students formed two- to three-man syndicates. The syndicates were provided a task order, history about the conflict, IED history and intel. They use both the 3D (helicopter view) and the 2D representation of the terrain. While doing threat analysis, they scan the terrain for indications of possible presence of IEDs, analyze the presence and the behaviour of civilians. An analysis is compiled prior to operation with an in situ analysis.

The outcomes of the training were very successful in improving the awareness of designing the setting for the threat analysis training; the principles of Job-Oriented Training (JOT) were applied. JOT is a constructivist approach tailored to the development of rich competencies, the integration of conceptual knowledge, skills and professional attitude. In JOT, military students are confronted with a series of quite short cyclic, increasingly complex and challenging exercises to allow them to discover the essential principles of their job. It is crucial that no theory is provided in advance and that theoretical insights are acquired while solving realistic issues. As such, the students have not completed tactics training prior to the exercise, as they are expected to discover the essential tactical principles themselves during the JOT exercises. This simultaneously trains them in problems solving in situations entirely new to them and aims at developing the 'can do' attitude in tackling new situations.

Another essential factor in the development of deep insight in C-IED tactics is the (self) reflection. After each scenario, they explain and defend their analysis to their fellow students and often fiercely debate tactical issues in C-IED. Only after their reflection we show them the OPFOR plan that reveals where the IEDs are located and why. As they use the lessons learned in each subsequent scenario, a rather steep learning curve emerges (see section ‘trails’). After four such scenarios they have come up with a set of generic tactics and also some situation-specific tactics.

5.7 Joint Theater Level Simulation (JTLS)

Dr. R.J. Roland, Rolands & Associates Corporation (R&A[®])

Dr. Roland provided an overview of the history, plans and how JTLS is used for supporting NATO operations and the annual JTLS user conference. He first described the type of services that R&A provides in support of his customers. Dr. Roland went into details on operational context of simulations for operations and how JTLS has been used in over 20 countries for several events. Dr. Roland highlighted the following quotes from the former JWC Chief of Staff to show how important JTLS is to the CAX within JWC.

1. *“..Our most important simulation federation relationship is between the JTLS and two simulations that round out our CAX environment:, JCATS and VBS2...Together form NTF.”*
2. *“...Specifically JEMM and JTLS are the most important CAX support tools in JWC. If JEMM and JTLS were removed from our inventory, we would not be able to deliver exercise support as we can now....”*
3. *“We see no ready alternative to replace JTLS at an acceptable performance level or cost to NATO”*

5.8 Engagement Coordination Through Real-time Exchange

Wouter Van Der Wiel, NLD

The brief discussed the Maritime Theatre Missile Defence (MTMD) Forum which is formed by nine nations to develop maritime missile defence architecture to promote BMC4I, TTPs, planning, and interoperability. Mr, Van Der Wiel detailed engagement coordination to improve force situational awareness, support decision-making, and increase force effectiveness in leveraging simulated systems. He illustrated how the MTMD objectives were used for Force TEWA experiment. TEWA experiment was to take the first step in automated exchange of engagement windows to increase force engagement situational awareness for each participating unit (frigates). It was to demonstrate Force TEWA functionality based on link 16 and explore Force TEWA information exchange needed and explore possible additions to current link 16 STANAG (J9.1 – J9.5). The experiment participants were NLD Navy, DEU Navy (TNO, IABG). The experiment showed that real-time updates of engagement windows were achieved and displayed at all ships (through J9.5 message) it also showed that a Force TEWA algorithm used engagement windows and calculated best engagement option for advice to

operator. For the first time, operators had a real-time overview of coalition engagement opportunities, prompting their positive feedback.

He further detailed the Joint Project Optic Windmill (JPOW). JPOW was a coalition exercise on missile defence that included the following countries: DEU, FRA, GRE, NLD, NOR, SPA, USA, as well as NATO.

Mr. Van Der Wiel gave more details on JPOW that provided an excellent mix of live and simulated weapon systems, operator and planner training, and new concept development. JPOW J9.5 was used by JPOW White Cell to test systems on new unknown messages: all systems responded well. TNO, IABG, NLD Navy and DEU Navy see good opportunities for cooperation and expand experimentation on Force TEWA.

5.9 Mission Rehearsal at the Swedish Air Force Simulation Centre Lt. Col. Jan Svetoft Frisén

Lt. Col. Frisén detailed the Swedish Airforce Combat Simulation Center FLSC. In his description, he explained that pilot stations are not intended to simulate a specific aircraft but rather represent a typical 4th generation fighter aircraft. The models of aircraft dynamics, sensors, and weapons are all generic parameter-driven models that can be easily adapted to emulate any existing or non-existing realization of the function.

However, the Man Machine Interface (MMI), including throttle lever and flight stick of the pilot stations, is similar to the JAS 39 Gripen aircraft to keep the simulator familiar for the pilots of the Swedish Air Force. Lt. Col. Frisen provided examples of how the facility is used by the Swedish Air Force approximately 26 weeks per year to train Swedish pilots to participate in international missions, and has done so since 1999. At the outset, the training was focused missions within Partnership for Peace operations. This has been followed by more complex scenarios for training for the Swedish Air Force Rapid Reaction Unit (SWAFRAP). The FLSC also provided full operations and command chain training, bringing the command chain in to the loop.

5.10 UK Developments Lt. Cdr. Fred Baxter

Lt. Cdr. Baxter presented the UK's current utilization of simulations in operations, opening with a description of the UK's training pressures of a changing threat, requirements, and context.

He further went into detail about the UK's training themes such as:

- C-IED
- C4ISTAR (IS)
- Land/Air & Joint Fires
- Driver Training
- Rotary
- Medical

- Rules of Engagement & Cultural Understanding
- Combat Skills

LCDR Baxter gave a couple of examples of platforms being utilized to conduct operational training the first was the CIED TIGR Situational Awareness Trainer. This trainer supported the MRX with rapid geo-specific generation and a fly-through ‘mode’ a mission rehearsal ‘mode’ which is delivered under the IM/IX package and it looks at the entire C4ISTAR domain.

He also discussed the Aviation Tactics Trainer (ATT) which provides theatre-specific tactics training for the Apache, Sea King, and Chinook. The ATT has targeted fidelity cockpits which will inform JHC on future of aviation command and tactics training. The ATT also provides de-risk for EDA Interim Synthetic Helicopter Tactics Course (ISHTC). The next step for the ATT is to train sensors, weapons, and FJ. Lcdr Baxter suggested collaboration on Defense Terrain Projects and VBS/2 Geo-Specific projects within the MSG.

6. Conclusion and Recommendations

6.1 Central Themes throughout the workshop

During the course of the workshop, several themes or “hard questions” were identified including:

- “Context” – How are we portraying the operational context in our M&S capabilities?
- Workshop intent and purpose – What will the NATO nations do to exploit simulations to support operations?
- Changing environment “context”– The focus on the use or potential use of new technologies is changing, but how are the governments and industry going to adapt?
- Workshop – There is a desire for the government to see more demonstrations and a desire for industry to meet the challenge.

6.2 Conclusion

This workshop was intended to be a venue to explore exploitation of simulation and technology, to provide updates on the nations’ current application of operations simulations, and to provide capability briefings and demonstrations of commercial technologies in use to enhance operations in NATO countries. The demonstrations and presentations throughout this session clearly demonstrated that NATO nations are currently using simulations to enhance operations. Further, based on the remarks from the group, there is a need and desire to continue to use simulation solutions for operations even given current procurement guidelines. NATO and ACT have the organizational infrastructure to facilitate these types of workshops and should continue them.

6.3 Recommendations

- Continue to sponsor and conduct the simulations and operations workshops to provide an enterprise view of examples and use cases of simulations enhancing operations, as well as individual nation's applications of them. Using workshops in this manner facilitate NATO and ACT's role in standards, interoperability, and best practices as well as highlighting new technologies. Amend the call for papers for future workshops to include a section on the identification of requirements to pass on to the NMSG MORS Committee.
- Use the NATO Research and Technology Organization, commercial portals eg wikiCFP, and personal contacts to cast a wider net for participation amongst the countries not represented at the workshop.
- Continue to be an example in the application of new technologies by offering a distributed, collaborative means to participate in the conference from remote locations.

