The Increasing Importance of Alliance Interoperability in the Live Simulation Domain and How UCATT Delivers on its Promise

Mr Mark Chamberlain, CENG, FIET
Leader, Live Training Programme
DE&S, UK MoD
MSG-140 UCATT-LSS Secretary

Captain Sander Cruiming
Staff Officer Knowledge, Innovation & Policy
Royal Netherlands Army / Simulation Centre Land Warfare
SISO UCATT PDG/PSG Chair

1 Introduction

The undertaking of field training exercises (FTX) has always been the foundation of the militaries' preparations for war or for operations other than war (OOTW), like peace-keeping, peace-enforcing or disaster response operations. Even though these exercises are far more expensive than virtual training or on-the-map staff training, they serve an irreplaceable purpose in unit readiness training. Live training offers friction that virtual and constructive training (purposely) doesn't. Friction and logistical problems that a field commander will have to deal with during the deployment of his unit. Field training exercises also offer the training audience the necessary training of the mental component that is delivered by the terrain, weather and sleep deprivation.
Even though 'live' is considered to be a type of simulation, live training is often seen as the opposite of simulated training in everyday practice and planning. However understandable, this is a common misconception that does not fully appreciate what live simulation offers within the whole spectrum of unit readiness training.
This paper will outline the added value of live simulation and live training in current-day and the "post-Afghanistan and Iraq" era. It will also demonstrate what the purpose and return-on-investment is of M&S standards in a very pragmatic way, by means of present-day cases and examples.
Finally, the modus operandi of the MSG-140 UCATT Working Group (and predecessors) will be highlighted, together with an outlook towards future interoperability efforts of the group and its vision on alliance interoperability in the live domain.

2 The strategic role of field training exercises

Even though uncontested in cast-savings, efficiency and time compressing properties, there is one thing that virtual and constructive simulated training can't deliver on: presence.
After the fall of the Berlin wall and the downfall of the Soviet Union-led Warsaw pact, NATO has refocused its efforts elsewhere and away from territorial defence in a purely military sense. Even though it intervened in conflicts close to its borders (e.g. the Balkan conflicts), those interventions were not given in by the military threat of the NATO borders in a way that would invoke an Article 5 operation. The NATO members themselves, contributing forces to missions in faraway regions like Bosnia-Herzegovina, Kosovo, Iraq and Afghanistan, reshaped their armies in line with the nature of those missions. Territory defence became less important and under the influence of severe budget cuts (collection of the so-called peace dividend) choices were made in favour of the expeditionary army over the territorial army.
Subsequently, and in contrast to training during the Cold War, training no longer took place in the projected theatre of operations but the training grounds and Combat Training Centre's (CTC) tried to mimic the (Afghan, Iraqi or Bosnian) area of operations as much as possible.
Training was purely aimed at mission preparation and stopped the minute the unit got on a plane or ship to deploy for operations.
The recent developments in the Crimea, Ukraine and the Baltics, and with Russia reappearing on the European theatre, that situation has once again changed. Most NATO member have pulled out their larger tactical (ground) force elements from the Middle-East and have begun to reevaluate their

(constitutional) task of territorial defence. Deterrence is back[1]. And with it returns a form of training that was gone for a while. Training that comes with one major geo-political attribute: presence.

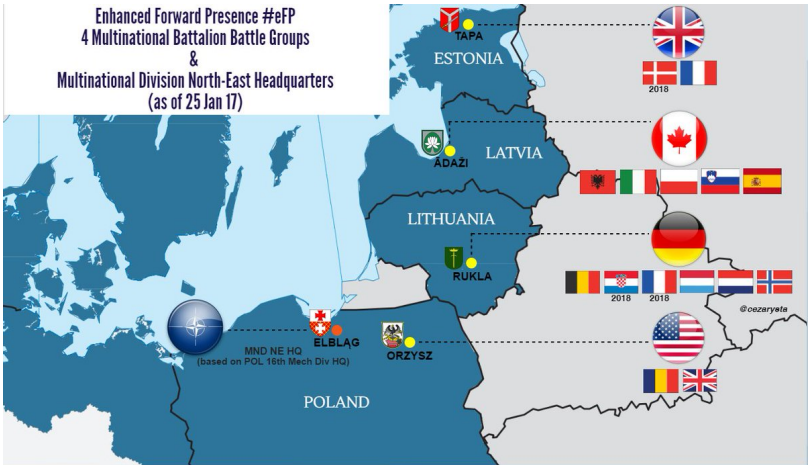

Figure 1 Overview of NATO eFP force proliferation

That presence is shaped by the NATO-led enhanced Forward Presence missions in Lithuania, Poland, Estonia and Latvia, combined with a force presence in Romania. During this mission, a large number of NATO members have committed themselves to, as the name suggests: presence at the borders of NATO territory. This presence brings back memories of exercises like ABLE ARCHER and REFORGER as held during the eighties and nineties of the last century and had a similar purpose. During their deployment in Eastern Europe, the units that are stationed there have the main task of training together and shape themselves into a multinational battlegroup or task group, ready for any threat to the NATO territory. As opposed to the last two decades, that means that training is the new operations.

3 The value of live simulation

Live simulation means that real people operate real systems[2]. Subsidiary to that, real terrain is used as well, versus the synthetic terrain used by virtual and constructive simulations. What is simulated is the effect of those systems, be it direct or indirect fire, CBRNe or counter-mobility (minefields, tank ditches, etc.). There are two types of live simulation: instrumented and non-instrumented (also referred to as duel simulation). With non-instrumented or duel simulation training, only the direct fire effects by means of laser are simulated. With instrumented training, the exercise area is instrumented with a communication infrastructure that allows the communication between players and an Exercise Control (EXCON). That also allows for area weapon effects (AWES) to be projected onto the battlefield and players therein. For the purpose of scoping, in this paper we will only discuss instrumented training, being the most advanced type of live simulated training and most relevant to our case.

Field training exercises are an expensive enterprise. Large quantities of personnel and materiel have to be transported, maintained, fed, fuelled and stocked with ammunition. It is in any armies primary interest to get the maximum output out of these exercises. Instrumented training delivers just that and does so in several ways. Outfitting dismounted personnel and vehicles with laser transmitters, data radios and GPS receivers allows for a lot a data to be gathered, which can be used in several ways:

Measuring of unit performance and unit certification
During and after the exercise, an EXCON facility can present information on troop movement in time and space. With that data, together with information on events (fire, hit, kill, wound, etc) the training staff can get a more complete picture of how operations proceeded from minute to minute. Consequently, unit performance can be evaluated and (when feasible) also certified.

[1] "On deterrence", Dr Kęstutis Paulaskus – NATO Review Magazine 2016
[2] US M&SCO M&S Glossary

Time compression in the units' learning cycle
Due to an overwhelming availability of data, a unit gets a better understanding of its own performance, relative to the operational picture and the actions of opposing or neutral forces. That understanding allows both the training staff and the unit commander to secure lessons identified much quicker and convert them to lessons learned in a next or even the same (instrumented) exercise.

Quantification of technical performance and data analysis
A CTC gathers a lot of data that is not of any immediate interest to the training audience. However, for analysis, data like number shots fired, percentage of hits, chosen types of ammunition, engagement ranges, etc., can be very valuable. Based on that data it is possible to quantify and measure if doctrine is applied correctly or if that doctrine might be in need of reevaluation. That same data can subsequently be used for concept development and experimentation (CD&E).

For the reasons listed above, the use of live simulation within almost any modern army is uncontested and large investments are made to uphold and renew CTC's. These investments sometimes may be sizeable, but still not as sizeable as the price of an inefficiently executed and poorly evaluated field training exercise or, worse – the loss of life on the battlefield.

4 The need for interoperability in relation to instrumented training

The origin of the currently accelerated need for technical interoperability within the live simulation domain, stems from four premises, namely:

1. Training is the new operations, at least in the European theatre;
2. Training is a multi-national affair, as are operations;
3. The use of live simulation is crucial in getting ROI on FTX's;
4. Live simulation systems are procured based on national requirements.

If you combine those premises and take them as a starting point for current-day exercises, the need to enable troops to bring their own live simulation equipment to a combined CTC environment, becomes evident. That need isn't new. It's only being emphasized under the influence of current events in Eastern-Europe and the Baltics. In the late nineties, NATO already recognized the need for interoperability in two studies, by stating *"Wherever possible, training should be focused upon joint and coalition operations in urban areas, featuring all aspects of the '3 Block War'"* and that "*There is also a need to combine these training facilities with simulation system(s) to portray more accurately the complexity of the urban battlespace.*[3]
During the expeditionary period after the fall of the Berlin Wall, operations were equally multi-national as they are now. The adage of "trains as you fight" was relevant then as much as it is now.
In that period however, it was sometimes difficult for nations to train with the troops they were going to deploy with, due to time constraints and geographical dislocation. The Netherlands for example operated side by side with Australian troops in Afghanistan, while being 15000 kilometres apart before deployment.
That situation has changed now with the eFP mission, where European NATO troops deploy together with US and Canadian forces that are stationed here for longer periods. Another trend shows that the demand for interoperability now comes directly from tactical commanders in the field instead of people working in live simulation domain, with the acknowledgment of the crucial added value of instrumentation.
Another catalyst for the demand for interoperability is the far-going integration of European tactical level units. The Netherlands and Germany, as a frontrunner example of how far that integration goes, have permanently integrated tactical unit down to the platoon level and even down to platform level (mixed crews in Leopard tanks). That means that those units train together, independent from temporary unit compositions like the NATO Response Force (NRF), EU Battlegroup or the Very High Readiness Joint Taskforce (VJTF) or the eFP mission for that matter.
Having said that, each country still buys its live simulation equipment based on national requirements in terms of fidelity and training need, but also based on their unit composition in respect to platforms and weaponry. Although the fidelity issues may be overcome in some occasions, it remains impossible to apply Norwegian CV90 equipment onto a British Warrior or a German Puma IFV.

[3] RTO-TR-071 Urban Operations in the Year 2020 / RTO-TR-08 Land Operations in the Year 2020

A solution is needed that allows for interoperability in a way that everybody can bring their own equipment and can fight with their partners in a single instrumented environment, while having the same quality of training and evaluation as they would have in a purely national exercise.

5 The history of UCATT

In 2002, a Team of Experts from NATO NAAG completed a feasibility study in order to investigate the need for a generic set of requirements for NATO/PfP countries in relation to live instrumented training. The conclusion was that a number of potential interoperability areas were identified and assessed to be worthy of further investigation.

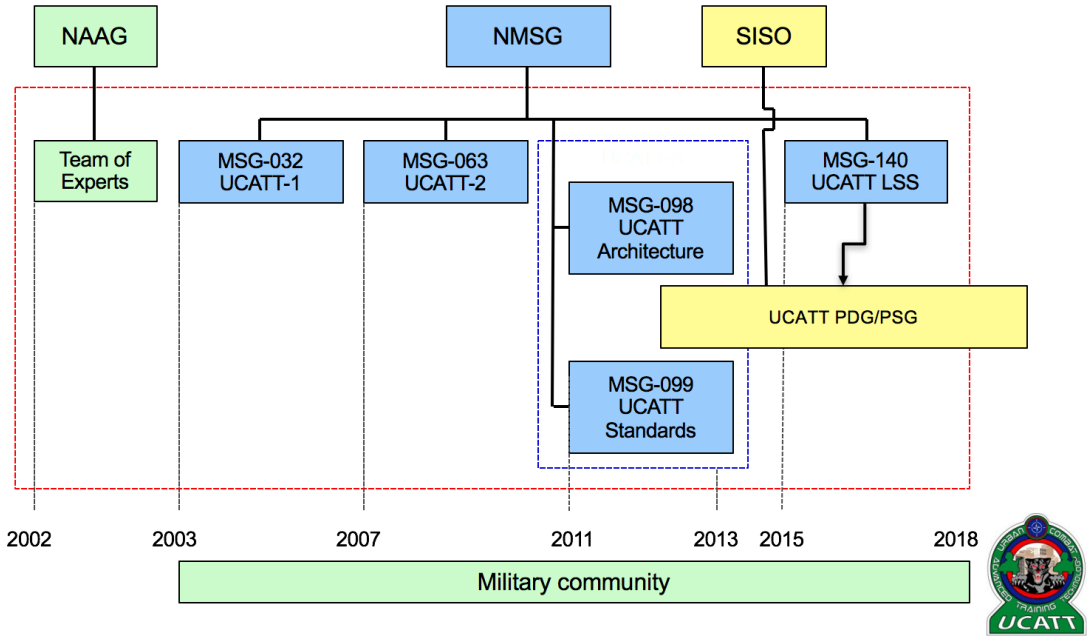

Figure 2 UCATT working groups over time

UCATT-1 (MSG-032)
The first two UCATT groups under the NATO Modelling and Simulation Group (NMSG) can be seen as the study phase of UCATT. The UCATT Task Group (TG) was established within the NATO Modelling and Simulation Group (NMSG) in 2003 as MSG-032 TG 023. It was tasked to exchange and assess information on MOUT facilities and training/simulation systems with a view toward establishing best practice. In addition, it was required to identify interoperability requirements, a suitable architecture and a standard set of interfaces that would enable interoperability of MOUT training components. Uniquely, the UCATT Task Group drew its members from both government and industry.

UCATT-2 (MSG-063)
The success of UCATT-1 led to an extension of the UCATT mandate. The UCATT-2 Working Group was the successor of the first UCATT WG within NMSG and was chartered in 2007 as MSG-063 TG 040. The UCATT-2 WG was tasked to continue the work of the previous UCATT WG; to exchange and assess information on MOUT facilities and training/simulation systems with a view toward establishing best practice. In addition, it was required to organize an interoperability demonstration to prove interoperability value and start the process of defining standards for laser communication, data communication and audio & visual effects.
It did just that, which resulted in a successful technical demonstration in 2011, held at the Marnehuizen MOUT training facility in The Netherlands. During this demonstration, a proof-of-concept was presented, showing systems from multiple manufacturers exchanging information and simulated battlefield effects.

UCATT-3 (MSG-098/099)
The success of the UCATT-2 technical demonstration led to the institution of two new WG's: the MSG- 098 UCATT Architecture Group (AG) and the MSG-099 Standards Group (SG). Since UCATT

had now reached the "delivery phase", the decision was made to split up into two WG's to bring focus to the work at hand.
Both WGs operated in close cooperation, with joint meetings to aid communication and reduce delay. The AG was tasked to revise and develop requirements for each individual interface. It then handed over those requirements off to the SG, which was tasked with standardizing, based on those requirements.
In accordance with NATO policy, a UCATT Product Development Group was instated through SISO, being the mandated standardisation organisation for M&S standards.

As a basis for further standardisation efforts, UCATT developed a set of use cases (Figure 3) and a Functional Architecture (FA) (Figure 4). Both had the purpose of both scoping the work and to get a full understanding of what work had to be done.

#	Title
USE CASE 0	National training on National site
USE CASE 1	Live MOUT training Multinational force on National site (consolidated combined training)
USE CASE 2	Use other nations training facility and staff
USE CASE 3a	Distributed combined training
USE CASE 3b	Combined training in mission area
USE CASE 4	Command and staff training for engagements in different mission areas

Figure 3 The UCATT use cases for live training

It was the purpose of UCATT to set requirements for interoperability, which is the ability of systems to exchange data, information and services to enable them to operate effectively together.
At the same time, industry should have the freedom to propose and implement the most cost-effective solutions, as long as they satisfy the interoperability requirements. So, in fact, the main focus for interoperability is on system interfaces. In this context, an interface describes the characteristics at a common boundary or connection between systems or components.
To identify and define the system boundaries and interactions with other systems (external interfaces), it is sufficient to create and analyse a functional architecture of a Combat Training Centre. This functional architecture must be representative enough to cover all of the use cases and the requirements as set by the military, while not touching specific design or implementation issues. The FA captures what the system can or might do, not how it does or should do it (e.g. the requirement and not the implementation such as communication, which might actually be by wireless transmission or through a cable). Another subject of particular interest is the level of detail of the functional architecture. Too few details will result in insufficient possibilities for interoperability, while too many details will result in losing oversight and identifying irrelevant interfaces for interoperability.

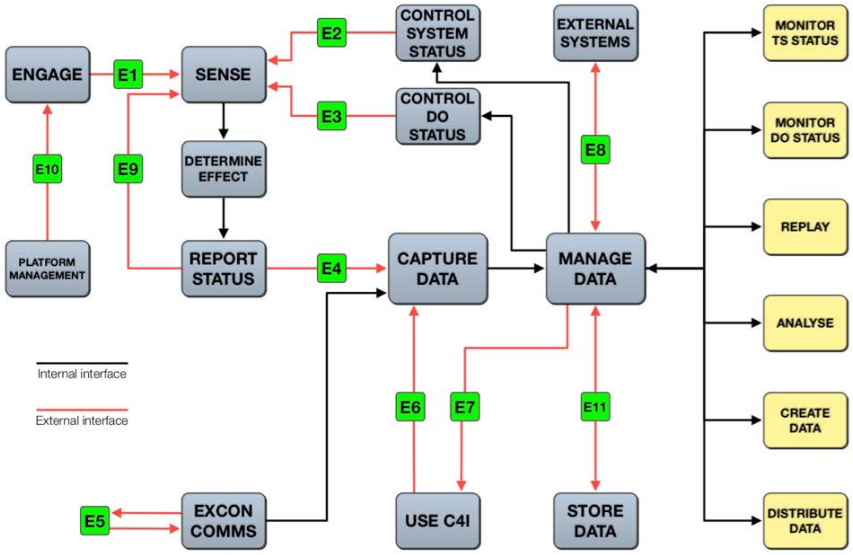

Figure 4 The UCATT Functional Architecture (FA)

Approach, methodology and a family of standards

Defining the scope of work
The FA showed the full picture of interfaces that existed in most or all CTC's, but that did not necessarily mean all those interfaces needed to be standardised. Some functions are unlikely to be replaced by third party components, based on everyday practice and common sense. The core internals of an EXCON for instance, have many interfaces but it is unlikely that a visiting foreign unit will bring his own AAR analysis tools with him. It is very common however, that a foreign nation wants to bring his own vehicle and/or antitank applications, as they are likely to be unique.
Based on that likelihood and mostly fed by the military's everyday practice, UCATT defined the interfaces that were going to be the external interfaces (the red lines in figure 4) and therefore candidates for standardisation.
Through the years and every mandate period of UCATT, the group kept testing the FA against all existing and new use cases to see if it was still valid and relevant. By doing so, 3 new interfaces were added to the original 8 over time.

Prioritization of interfaces
After the scope of work was clear, it had to be decided on where to start and how to progress. Some interfaces were difficult and important, easy and important, difficult and unimportant or outside of the groups' general knowledge (i.e. C4I). A prioritization had to be made, based on military need and achievability. That work led to the following prioritization:

E1; Engage to Sense
The E1 interface is mostly designated as the laser interface. There are other physical techniques that can be implemented but laser is the most dominant and commonly used all around. The interface enables engagement information (player ID, ammunition type and calibre, engagement range, etc.) to be transferred from a shooter to a target. This interface is most important because a. it immediately enables full interoperability for non-instrumented training and b. because it tackles the core functionality of live simulation in general: direct-fire effect simulation. Work would start on this interface first.

E4; Player to EXCON
This interface enables the player (dismounted or vehicle) to transfer information to a central Exercise Control facility and vice versa. That information (position data, hits, kills, minefield locations, etc.) is typically used for after action review or training data analysis. The E4 interface is the second most important interface, as it makes the difference between instrumented and non-instrumented training. It is also one of the more difficult ones, due to the fact that this interface typically involves long-range radio. Radio involves frequency's and

regulations that are outside of the influence of the live simulation community and the member population of UCATT.

E8; System-to-system
The E8 interface is important for two reasons. First of all, because it is a work-around for when the E4 interface isn't available. By connecting two EXCON's together and setting up two communication infrastructures in the field (each country his own) the information that normally travels from player to EXCON (E4), now travels from player to EXCON to (3rd party) EXCON. This is the current solution that enables the Netherlands and Austria to train in the Gefechts Übungs Zentrum (GUZ) Altmark, with and against German troops. Figure 5 shows the difference between a solution based on E1/E4 and E1/E8, mainly characterized by the fact that for an E1/E8 solution the visiting nation still has to bring all his infrastructure and cannot deploy that elsewhere. Secondly, E1/E4 is a 'cleaner' solution.

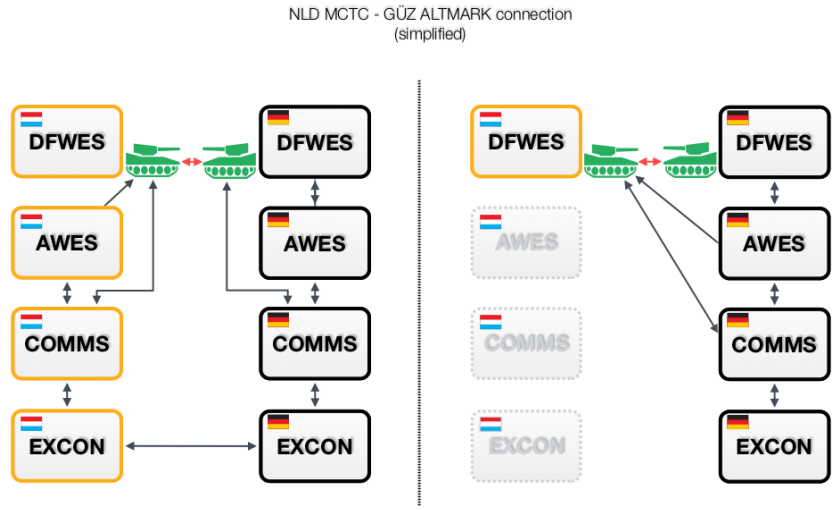

Figure 5 Interoperability based on E1-E8 (left) and E1-E4 (right)

Standardisation approach
After a long study phase, defining the scope and prioritizing of tasks, the group could now get to work on the laser interface. But standardising an interface that is the core of business activity of the industries involved is not easy. First the choice was made that writing something completely new, from scratch, was not possible. The amount of time and money that would need to be invested reached well outside of the feasible. A methodology had to be found to approach the standardisation process. That process, described below, is still the basis of current and future tasks of UCATT and is used for all interfaces alike. Although simple, this methodology is a useful approach for all domains.

1. The government/military group defines the functional requirements for a specific interface, based on the use cases. In the case of laser, those requirements were specified in the form of data tables. At the same time, industry lines up the existing candidates that are in use or are foreseen to be used. All candidates must be openly available and clean of any copyright.
2. The government/military group hands over the functional requirements to the industry group. The industry group now compares the functional requirements to the characteristics (both technical and non-technical) of the candidates.
3. The entire group then studies the results of the comparison and comes to an official decision through a voting process. That can either be done at once or can be a two-stage rocket. In the case of the laser interface, there was a preceding vote to eliminate the 'weaker' candidates before coming to a final vote on the real competitors.
4. The industry group prepares the 'winner' by cleaning up the documents and making them as generic and as free of country or manufacturer descent as possible.
5. The UCATT MSG officially hands over the documents to the SISO UCATT PDG as a candidate for standardisation. The SISO UCATT PDG takes over and is responsible for the process of standardisation. It is hands-off for the MSG until then.

6. After standardisation, the SISO PDG delivers the standard back to the MSG. The MSG then takes the standard to NATO to allow it to go through the process of becoming a STANREC (Standard NATO Recommendation) and ultimately a STANAG (Standard NATO Agreement) if required. Even before that process is finished, the SISO standard is available to be used in Programs of Requirements (PoR) for new projects and products.

By using this methodology, the group can give insight and clarity into its choices and document decisions that are made and on what arguments those decisions are based. That is important for support and a good foundation of trust towards the community. It also clearly marks the boundaries between the MSG and the PDG and between government and industry, so it is clear when it's hands-off for any of these sub-groups.
By following this process, the UCATT group (MSG plus PDG) has delivered the following products over the last 4 years:

SISO-GUIDE-003-00-2016 Guide for UCATT Live Simulation Standards and Architecture
SISO-STD-016-00-2016 Standard for UCATT Laser Engagement
SISO-REF-059-00-2015 Reference for UCATT Ammunition Table

A family of standards
Getting through the SISO process was not an easy task. Especially in the early beginnings, there was a lot of miscommunication in both ways on the approach, understanding of procedures and desired end-result. What UCATT wanted to do had not been done before. Other groups, like DIS, HLA or C2-SIM focus their activities and products on one interface, mainly with a system-to-system approach. UCATT, based on their functional architecture and going down to the component level, wants to standardise not 1 but somewhere between 10 and 15 interfaces(!) and create a whole family of standards. The figure below depicts how that family is projected to be and shows the relationship between SISO GUIDANCE, STANDARDS and REFERENCE documents. The orange shaded areas show the products deliver to date.

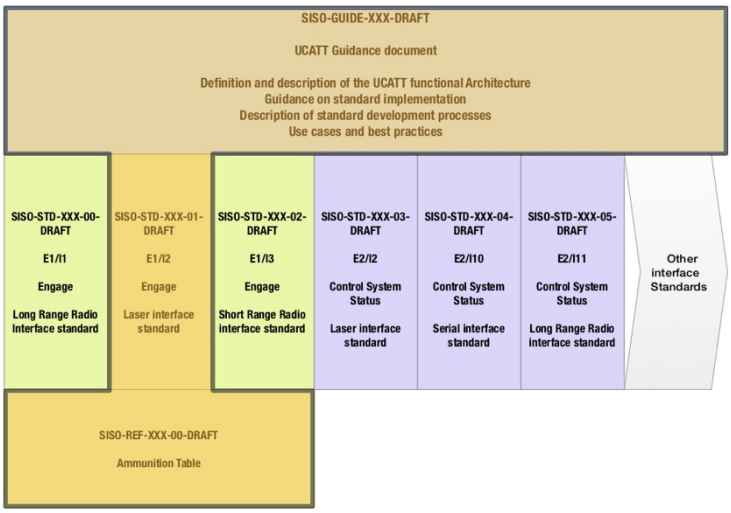

Figure 6 The projected UCATT family of standards

The use of UCATT products in practice

Developing a standard is one, but getting it fielded and in use is another. The UCATT strategy of being successful in the latter is a dual one. By getting industry involved from the very beginning in developing a standard, based on user requirements that come from the group itself, the UCATT group ensures itself of maximum support from both communities. Secondly, UCATT shops from the most viable candidates for any interface that are already out there and in use. By doing so, there is already a solid user base and extensive experience with the proposed candidate. The Standard for UCATT Laser Engagement for instance, based on the OSAG 2.0 laser coding specification, was already in use for years in the German CTC in Altmark and allowed the Bundeswehr to train with their Dutch and Austrian partners. On a national level, the candidate was already in use with countries like Norway, Sweden, Finland, the Netherlands, Germany, United Kingdom, Denmark, Austria and Slovenia.
A remark here is in order though. Even though OSAG 2.0 is the basis for the UCATT Laser Engagement standard, it does not automatically mean that those users are automatically "UCATT certified", due to the fact that OSAG 2.0 wasn't a standard when those systems were bought and were therefore only tested to be fit for purpose and not for compliancy.

The potential of interoperability; the NOBLE LEDGER case

In 2014, the 1st German/Netherlands Corp (1GNC) was to be certified as the Land Component Command (LCC) of the NATO Response Force (NRF) during a large CREVAL (Combat Readiness Evaluation) exercise in the south of Norway. A secondary objective of that exercise was to increase cohesion within the ground component, a multinational brigade led by 11(NLD)Air Assault Brigade and which consisted of Dutch, German, Danish and Norwegian troops. During the planning phase of the exercise, that was to be held in the Norwegian training area of RENA and its surroundings, it was decided that the exercise was to be instrumented. For the CTC personnel of the Dutch Mobile Combat Training Centre (MCTC) and the Norwegian Army CTC, as being the respective lead nation and host nation, this was a huge challenge for several main reasons:

- RENA CTC is a battalion sized training area, with limited communication coverage;
- Unknown and untested interoperability between nations;
- Extremely short preparation time;

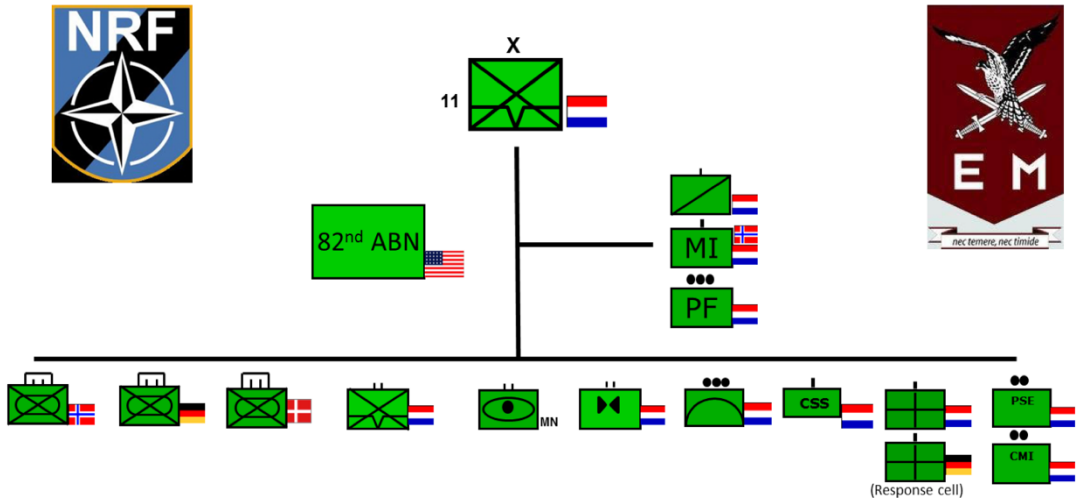

Figure 7 ORBAT of the NRF Brigade during NOLR14

The upside was that 3 of the 4 participating nations had equipment from the same vendor, the German army being the odd one out. However, due to specific national requirements and regulations that does not ensure interoperability at all.

Close cooperation and hard work by the CTC personnel in the end turned a battalion sized training area in a brigade sized training area where troops from 4 nations executed an instrumented exercise. The US 82nd Airborne only made a short appearance and was not instrumented.
After the exercise a thorough analysis was made based on the UCATT functional architecture, to see how many of the 11 interfaces were used during the exercise (figure 8).

Interface	Result
E1 – Laser engagement	SUCCESSFUL
E2 – Control system status	SUCCESSFUL
E3 – Control DO status	SUCCESSFUL
E4 – Report status	SUCCESSFUL
E5 – EXCON Comms	UNSUCCESSFUL
E6 – C4I to EXCON and E7 – EXCON to C4I	NOT USED
E8 – EXCON to External systems	NOT USED
E9 – Report Status to Sense	NOT USED, PLAUSIBLE COMPATIBILITY
E10 – Platform management	NOT USED, HIGLY UNLIKELY
E11 – Manage data to Store data	SUCCESSFUL

Figure 8 Overview of NOLR interoperability, based on the UCATT functional architecture

With 5 of the 11 interfaces actually used and 1 theoretically being compatible, the Noble Ledger exercise shows the huge potential of interoperability between live simulation systems for multinational exercises. Functionally, the following was achieved:

- Direct fire engagements between all players;
- Indirect fire engagements between EXCON and 3 of the 4 nations (German players were physically umpired);
- Plausible engagement outcomes based on usage of the same ammunition tables;
- Administrative control (reset, monitoring system functions, etc) from EXCON over 3 of the 4 nations (excluding German players);
- Reporting status and position information to EXCON for After Action Review from all players (German vehicles outfitted with Dutch Personnel Detection Devices (PDD));
- Delivering an integrated After Action Review;
- Extending the Norwegian CTC infrastructure (3 comms masts) with Dutch MCTC infrastructure (6 comms masts) and 1 additional manufacturer-leased comms mast.

Even though only two UCATT products were used in the exercise, Noble Ledger 2014 demonstrated what can be achieved by technical interoperability and how that interoperability can greatly improve the quality of the exercise itself and the After-Action Review.

Bridging the laser gap; the US MILES case

Besides a number of success stories, there are challenges too. As stated earlier: having a standard is one, fielding it is second. That challenge is greater for some than others. Those that were already using OSAG 2.0 Standard at the time of publication of the UCATT Standard for Laser Engagement had an easy adaptation process and head start, limited by certification only. Others, like the US, have a bigger challenge.
The US, being a supporter of the UCATT effort from the very beginning, actively chose to eliminate MILES as the basis for the UCATT laser standard to ensure the ability for future growth and voted in favour of OSAG 2.0 Standard. Transitioning from MILES to the UCATT laser standard however, is an entirely different challenge to the US than, for instance, countries like Denmark or Belgium would have. The sheer number of MILES systems (+/- 200.000) make that transition a whole different story, as nobody would be able to replace that number of systems all at once. Secondly, the US trains with a lot more partners that are not NATO or PfP (and do not necessarily adopt the NATO Standards) in for instance the Pacific, Africa and the Middle-East.
Fuelled by a renewed need for combined training in Europe and to bridge that gap eventually, PEO-STRI has ordered the MITRE Corporations to execute a study on how to create that interoperability roadmap. The Multinational Live Training Interoperability Study (MLTIS) started in November of 2016 with a first meeting in Amersfoort, the Netherlands. A second meeting was held in Ottawa recently.

From the outside, it may appear that MLTIS has overlapping goals with UCATT or competing ones even, but that is not the case. Besides nations from the ABCANZ treaty nations (America, Britain, Canada, Australia and New Zealand), a delegation from the UCATT steering group (MSG and SISO PDG) is part of the study team. This way, MLTIS is able to leverage the knowledge and experience of more than 15 years of standardization work that has already been done by UCATT.
MLTIS does not focus on technology, as UCATT does. It has a strong focus on transitioning to standards while not losing existing capabilities, both nationally and internationally. Secondly, MLTIS seeks to create more awareness and support on the higher military command levels. By deconfliction and interaction, the two groups (with overlapping membership) ensure themselves of synergy instead of competition.

What is next?

With the publication of its first SISO approved products, UCATT has made an important step in delivering capabilities to the military and live simulation community. There is a lot more work to be done to maximize the usage and effectiveness of live simulation equipment during multinational exercises. To shape the efforts towards that goal, priorities have been set to which interfaces have the highest interoperability yield and necessity. After E1 ((laser)engagement), the E4 interface (Player to EXCON) and E8 interface (system-to-system/LVC) have been targeted as the most important interfaces to be standardised in the near future.

E4 (Player to EXCON)
The E4 interface is the long-range radio interface that delivers data to and from players to EXCON, such as position information, event data, indirect fire (artillery) events, minefields and CBRN effects. This interface is more difficult to standardise than the laser interface, since there are hardware implications involved as well and not just coding. To deliver a solution on a short term, UCATT has made the E4 cut between the radio and the TESS equipment (Tactical Engagement Simulation System, the player instrumentation of laser transmitter and sensors). A protocol will be developed to standardise the communication between TESS and the CTC proprietary radio, to allow a host CTC to connect a radio to a visiting nation's TESS equipment. For the meantime, while dealing with legacy equipment, adaptors will have to be developed that translate vendor specific (TESS) protocols to the UCATT protocol and back to vendor specific (radio) protocols. For the next generation of systems, the UCATT E4 protocol will be ready to be part of equipment engineering without the need for an adaptor.

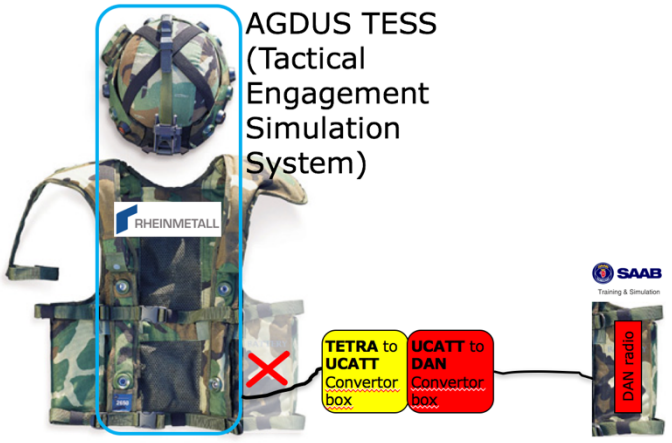

Figure 9 Example of a UCATT E4 intermediate solution, based on the GER-NLD case

E8 (EXCON-to-EXCON/LVC)

The third prioritized interface is an interface that is more common to virtual and constructive simulators as well. The system-to-system interface aims to exchange information on a system level, where data exchange on a component level (all the other interfaces) isn't feasible. It's no surprise that for this interface the group is investigating proven M&S system-to-system standards like HLA, DIS, TENA, etc. Of course, being a NATO working group, UCATT approaches this interface with an "HLA, unless…" attitude, following NATO AMSP-01.
Being a live simulation group first, investigations focus on meeting the live system-to-live system requirements first (or at least). The LVC concept however, which is no longer an innovation but considered mainstream now, is definitively taken into account. Early research shows that live simulation, being a bit of an "odd one" within the M&S community, has not been serviced well in current versions of HLA and FOM's like NETN or RPR. It is therefore possible (or even likely) that UCATT will develop and publish an extension of an existing FOM.
Finally, the UCATT group keeps a very close eye on the MSaaS concept, having members in both groups to do so and make sure live simulation is not forgotten in architectures to be developed by the groups in that arena.

UCATT legacy and promise for the future

The NATO Urban Combat Advanced Training Technology working group has been around now for a good 17 years and has shown sustained potential and enduring growth. During those years, the group has not only delivered valuable products but also built up considerable experience in "being an MSG" and effectively organizing yourself as such. UCATT has grown to be a powerhouse of (live) simulation knowledge, sustaining an ironclad network within het M&S community with members staying in the group for longer periods of time, well transcending NMSG mandate periods of 3-4 years.

When it comes to alliance interoperability there are many forms, be it technical, procedural, cultural, or lingual. But in relation to warfare, all of those forms of interoperability culminate during only one activity (other than war itself): the multinational field training exercise. It is the live simulation equipment that is used during those exercises that exposes and indiscriminately logs how good the troops and their commanders are in reaching all those other forms of interoperability. For that reason, the ongoing efforts of UCATT are crucial to the theme of alliance interoperability within NATO and UCATT will continue to contribute to alliance force development.