Battle Management Language: History, Employment and NATO Technical Activities

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ABSTRACT

This paper is one of a coordinated set prepared for a NATO Modelling and Simulation Group Lecture Series in Command and Control – Simulation Interoperability (C2SIM). This paper provides an introduction to the concept and historical use and employment of Battle Management Language as they have developed, and the technical activities that were started to achieve interoperability between digitised command and control and simulation systems.

1.0 INTRODUCTION

This paper provides a background to the historical employment and implementation of Battle Management Languages (BML) and the challenges that face the military forces today as they deploy digitised C2 systems and have increasingly used simulation tools to both stimulate the training of commanders and their staffs at all echelons of command.

The specific areas covered within this section include the following:

- The current problem space.
- Historical background to the development and employment of Battle Management Languages (BML) as technology evolved to communicate within military organisations.
- The challenges that NATO and nations face in C2SIM interoperation.
- Strategy and Policy Statements on interoperability between C2 and simulation systems.
- NATO technical activities that have been instigated to examine C2Sim interoperation.

2.0 CURRENT PROBLEM SPACE

> *"Linking sensors, decision makers and weapon systems so that information can be translated into synchronised and overwhelming military effect at optimum tempo"*
>
> (Lt Gen Sir Robert Fulton, Deputy Chief of Defence Staff, 29th May 2002)

Although General Fulton made that statement in 2002 at a time when the concept of network enabled operations was being formulated by the UK and within other nations, the requirement remains extant. The problem faced then with increasingly networked structures using the latest innovations in information technology (IT) playing a major role in military transformation and the modernisation of military capabilities is an ongoing process. In this digital battlespace nations are striving to build a System of Systems in which the components are interlinked in a unified network, consisting of trained personnel, digitized platforms, sensors, effectors and command and control (C2) systems which are located across a widely dispersed battlespace at different echelons of command. Effective secure IT supported networks enable military operations to be conducted faster, more effectively and efficiently.

From 2000 Network-enabled capabilities, or NEC, formed "the technical basis for enhancing the effectiveness of joint operations and interoperability during multinational missions. NEC enables the joint exploitation of information by coalition forces, accelerating decision-making at all levels of command while simultaneously improving the precision and pace of military operations." [1] The term NEC is less in use today but its basic premise underpins NATO's new initiative in developing a Federated Mission Network (FMN).

Today we live in an increasingly digitized age and need to not only move information faster and with more accuracy over widely dispersed areas, but also a need to control autonomous/robotic forces, conduct rapid military planning including Course of Action Analysis (COAA) and wargaming, and Mission Rehearsal. In the case of the latter two the use of simulation can greatly enhance mission effectiveness. In addition by acquiring more capable digitised C2 there is an increasing need to train military commanders and their staffs on these systems and simulation systems provide not only the stimulus to C2 systems and participating staffs but support the military decision making process.

3.0 HISTORICAL BACKGROUND

Military forces have always needed to communicate information on operations and they have sometimes operated from dispersed locations. Through the ages mechanisms to relay information or orders that were clear and concise were developed. They needed to be understood so that the recipient(s) could take the appropriate action. These were all forms of Battle Management Languages and various technologies were used to convey the messages and would often be accompanied by a code to ensure that an adversary could not understand the message.

3.1 Smoke Signals

One of the oldest forms of long-distance visual communication is the use of smoke as a mechanism for conveying messages. In general smoke signals were used to transmit news, signal danger, or gather people to a common area. For example in Ancient China, soldiers stationed along the Great Wall would alert each other of impending enemy attack by signalling from tower to tower. In this way Chinese soldiers were able to transmit a message over long distances and as far away as 750 kilometres in a few hours.

In Ancient Greece, Polybius, a historian, was apparently able to devise a more complex system of alphabetical smoke signals around 150 BC, this system converted Greek alphabetic characters into numeric characters. It enabled messages to be easily signalled by holding sets of torches in pairs. This is known as the "Polybius square", and also lends itself to cryptography and steganography.

In North American, native tribes also communicated via smoke signal. Although smoke signals do not have a clear code to decipher the smoke signals, there are a couple of messages that are common. Sending only one puff of smoke is usually a call of attention. Sending two puffs of smoke in smoke signals is usually a sign that everything is okay. In contrast, three puffs of smoke can be a signal that something is wrong. Each tribe each had their own signalling system and understanding. The location of the smoke along the incline is also believed to convey a meaning. If it came from halfway up the hill, this would signify all was well, but from the top of the hill it would signify danger. A signaller started a fire on an elevation typically using damp grass, which would cause a column of smoke to rise. The grass would be taken off as it dried and another bundle would be placed on the fire.

Smoke signals are still in use and in Rome, the College of Cardinals still use them to indicate the selection of a new Pope during a papal conclave. A secret ballot is conducted by those members of the college who are eligible to vote until a candidate receives a vote of two-thirds plus one. The ballots are burned after each vote. Black smoke indicates a failed ballot, while white smoke means a new Pope has been elected. [2]

3.2 Roman Military Signalling

Although a number of historians have cast doubts to the extent that various technologies were employed by the Roman military there are some who believe that they developed a relatively sophisticated system of communicating information. [3] [4]

An example of a Roman Signalling tower from the 3rd century located near Scarborough in the United Kingdom is shown in Figure 1 below; it relied on the use of fire and smoke.

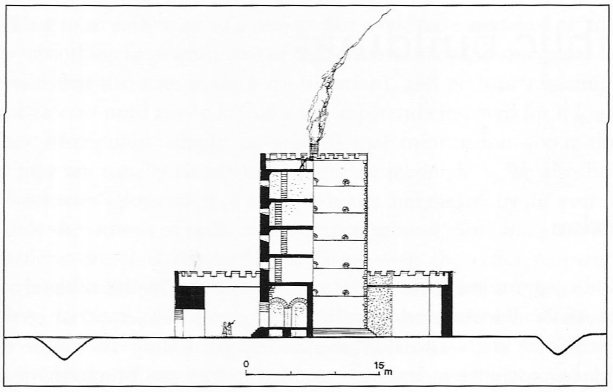

Figure 1: Roman Signal Tower.

It is speculated that in Roman Britain every mile castle and fort along Hadrian's Wall was in line of sight with signal towers and they used a more technical means to send messages. This method of communicating was to use flags known as the 5-flag method. They used two groups of 5 flags to signal with an alphabet on a crib sheet for interpretation. For example, two flags raised; one on the left and one on the right might mean the letter 'A'. The messages were short and to the point as this method was naturally slow in use.

These were used in conjunction with a master list of the alphabet which was laid out as illustrated in Table 1.

Table 1: Roman Military Master List for 5-Flag Method of Signalling.

	I	II	III	IV	V
I	A	B	C	D	E
II	F	G	H	I	J
III	K	L	M	N	O
IV	P	Q	R	S	T
V	U	V	W	X	Y

The rows of numbers applied to each group of five flags.

Beacons were also used in conjunction with amphorae/jar of water. Each signal station would have an identical receptacle containing a float with graduated marks which indicated certain messages, e.g. "send for the cavalry." At the signal of a lighted beacon the stopper would be removed and water poured out until the appropriate marker was reached. The beacon would be waved again and both signal stations should have the float at the same point in the water and each read the same message. The assumption however is each receptacle was the produced to the same standard.

In addition to the type of communication described above the Roman Army also used musicians. The cornicen a respected junior officer played a cornu and a tubicen would play a tuba. The former not only played salutes to senior officers but also conveyed orders. The latter's main function was signalling orders in battle; the attack and retreat. These would not be able to convey orders over anything but a short distance.

The principal of codes used by the Romans is used in electronic communications today however the Romans never really managed to establish an effective and efficient method of communicating over large distances. But they did at least have a range of approaches that they used to solve the problem.

3.3 Optical Signals: 17th – 18th century

In the 17th century the invention of the telescope made it possible for a wide range of optical signalling systems to be developed. One of the earliest to be developed is that of flags at sea. This was pioneered in England in 1653. As a result the complexity of the messages which could be sent became steadily better over the years.

3.4 Naval Signalling

Navies required instructions to be communicated when in battle or entering ports and the semaphore method of signalling would become a favourite of the Navy because it was the fastest way of sending messages by flags and is even faster than flashing light. It could only be used in the daytime and at distances of less than 2 miles. Nevertheless it was considered more secure than light signalling because there is less chance of interception by an adversary. Flags were designed to convey the message with each flag representing either a letter or set message. In 1782 Lord Howe, who was the British admiral of the fleet, had at his disposal a total of twenty-eight flags to be used in conjunction with a printed code issued to all his officers. In different combinations, used either as whole words or single letters, the flags can form any sentence. Over time the availability of different flags expanded the message set as is illustrated by Figure 2 which illustrates 36 flags.

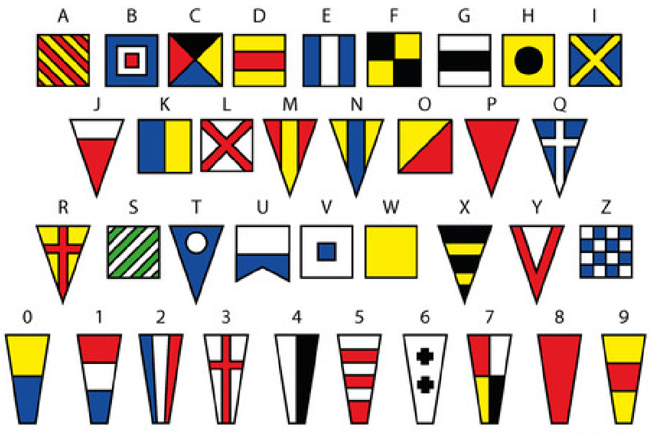

Figure 2: Signalling Handbook from 1913.

This system of flags was finalised during the Napoleonic wars as the *Signal Book for the Ships of War*, issued by the Admiralty in 1799. It was this code that Admiral Nelson used in 1805 at Trafalgar, to fly from his masts the message “England expects that every man will do his duty”. Apparently his signals officer later stated that Nelson had instructed him to transmit “England confides …”, but he suggested the change because “expects” was a word in the code book but had he used “confides” the word would have to be spelt out.

3.5 Army Signalling

Efforts were made to establish a similar technique for sending messages on land. The lead in this endeavour was taken by the French. In 1791 Claude Chappe developed the idea of a line of hilltop towers; each would bear a structure with two hinged arms. He called this method of communicating the telegraph semaphore.[1] The pair of arms could be moved to any of 49 recognisably different positions, seven for each arm. Every tower had two telescopes, fixed and focussed on its neighbour in either direction – the towers were between three and six miles away. Messages, made up of a few frequently used words and others spelt out from the alphabet, could be rapidly passed from tower to tower. Napoleon realised the full potential of the semaphore telegraph and the system became so important to French generals and diplomats that it became known as the Napoleonic Semaphore.

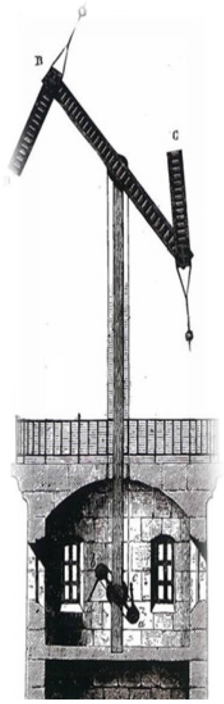

Figure 3: Illustration of French Signalling Tower with the two hinged arms.

In Britain a similar device is developed a year or two later by the Reverend Lord George Murray, an aristocratic clergyman. On his towers he places a structure with six sections, each of which can be either open to the sky or closed with a black panel. The six black-white options provided 64 elements in Murray’s vocabulary, in place of the 49 in Chappe’s.

[1] Telegraph (from Greek for “far write”) and semaphore (Greek for “sign bearer”).

3.6 19th Century Innovations

3.6.1 Wired Telegraph

The next major innovation was the use of the wired telegraph. In 1836, three Americans; Samuel F. B. Morse, Joseph Henry, and Alfred Vail developed an electrical telegraph system. The system sent pulses of electric current along wires which controlled an electromagnet that was located at the receiving end of the telegraph system. In order to transmit natural language using only these pulses, a code was developed which used the silence between each pulse to determine the letter being sent. It used a series of dots and dashes. Morse therefore developed the forerunner to modern International Morse code.

In Britain in 1837, William Cooke and Charles Wheatstone also used an electrical telegraph that used electromagnets in its receivers. Their system of instead of making sounds of clicks, used pointing needles that rotated above alphabetical charts to indicate the letters that were being sent. In 1841 they built a telegraph that allowed the letters to be printed from a wheel of typefaces struck by a hammer. Unfortunately they could not find any customers for this system. As a result it would be the system developed by the Americans that would be widely used from 1844. They relied on the impulses being printed as a series of indentations on a tape which could then be read by an operator.

In the 1890s, Morse code began to be used extensively for early radio communication, before it was possible to transmit voice. Figure 4 shows the American Morse code as originally defined. The modified and rationalised version used by Gerke on German railways and the current ITU standard.

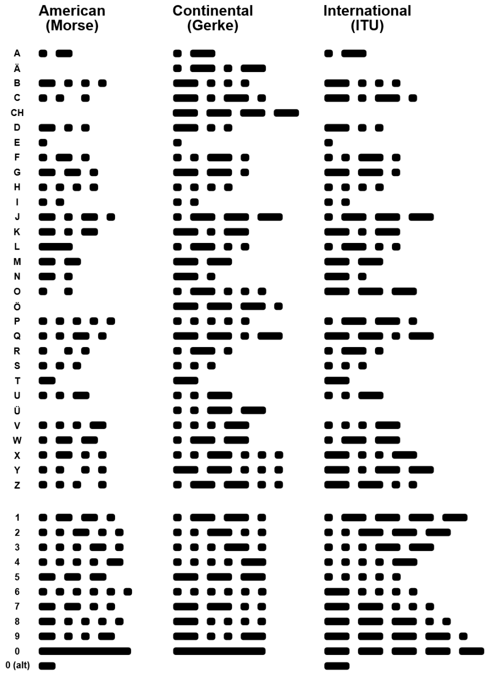

Figure 4: Morse Code with two other codes.

3.6.2 Flashing Lights

The use of flashing lights with a code were first adopted by the British Navy in 1867 and continued in use for seven years until the adoption of Morse code as the international standard. The lights were used to produce a series of dashes and dots in a similar manner to that used in the electrical telegraph system. Various light systems would be developed and the modern day navies still show lights.

By the 1870s two methods of signalling families were in use:

- Wired (Telegraph-lines).
- Wireless (Flag, lamp, heliograph, mechanical telegraph or semaphore, beacons, cannon or firework and later "Verey pistols", the horse and later motorcycle dispatch riders, and often forgotten, the dispatch cyclist and the human runner or animal messenger).

In the army the use of mechanical semaphore telegraph although was subject to the problems of fog and darkness, it was quite effective for a reasonable amount of the time.

The heliographs and flag-wagging were only employed to keep the signallers skill in these alternatives up to scratch, and rarely (other than when defects occurred to the mechanical tower) used for real traffic. The telegraph having arms between nine and twelve foot long and the salt-spray affecting the grease on the chain linkage was often broken or being given routine maintenance so the fall back on flags and heliographs was a valid option.

3.7 Development of Radio

In 1905 the emergence of wireless telegraphy (W/T) transformed naval warfare. Ships could now communicate beyond visual range. Senior naval officers became convinced that wireless communication presented great potential. The interest in this new technology was at the beginning of the 20th century one that mirrored the fervour that resulted in the development of e-mail, text messaging and chat services today. Notwithstanding this enthusiasm it did not prevent a naval officer submitting a post exercise report on the use of the new technology that cautioned "The working of W/T was most inefficient, not because it didn't work, but because of the enormous number of useless and obsolete messages transmitted." [5] It was also recognised that while visual signals and cable communications were reasonably secure, wireless messages in plain language were not, and could be read by anyone with receiving equipment. Consequently, far from falling into decline, visual signals continued to be used widely.

The development of radio enabled information to be passed over greater distances by military forces but military radio by 1914 was crude. Antennas were obvious targets, and equipment was fragile, cumbersome, and vulnerable to weather or enemy action. There were few trained operators and never enough radios available. The biggest drawback was the lack of senior commanders willing to use or trust it in battlefield conditions.

Army radio users also suffered from security breaches such as sending vital messages in the clear rather than in code. All radio signals were subject to being potentially heard by the enemy and thus required effective systems of message coding.

To allow short-range telephony with little chance of being overheard, the British introduced the use of the Fullerphone in trench warfare. Despite its name, the Fullerphone was not a telephone. It was actually a portable telegraph signalling device that would be used in the British army during World War 1 and 2. It could be used over either telegraph or telephone lines and was exceedingly difficult for an enemy to overhear. However wire communications were often cut, so the German signals in World War 1 used three types of optical Morse transmitters called *Blinkgerät*, the intermediate type for distances of up to 4 km (2.5 miles) at daylight and of up to 8 km (5 miles) at night, using red filters for undetected communications.

The need to send messages in code resulted in SLIDEX being introduced into the British Army in 1943/44, and by virtue of radio monitoring was broken by the German Intelligence fairly rapidly. In spite of that, it continued in use until at least the early 1980's before being replaced. The system relied on a card, each of which was specific to arm, and a set of plastic cursors which were a vertical one on the left and the other one horizontal on the top. The first 4 spaces had 2 letters and were used to set up the code pad, much as a map reference is used. Each square had phrases which were specific to arm, and letters which could be used to spell out messages. It was, as many who served in the British Army at the time will remember, a time consuming activity Apparently the East German Armed Forces had a similar device which they called "SPRECHTAFELN" (Talking Tables) which worked on an identical principle, they inherited it from the Soviet military.

BATCO, short for Battle Code, is a hand-held, paper-based encryption system used in the British Army and is still classified. A BATCO sheet is composed of a double-sided sheet of about A5 that fits in a specially made wallet, and was used at unit and formation level. Each single side being valid for 24 Hours. In addition to the code card there was; an Authentication table, Callsign Indicator chart and Spelling box. BATCO was made obsolete due to the introduction of secure radio Bowman. Until recently BATCO was still taught to Royal Signals operators as part of the syllabus. It is supposedly a back-up should secure equipment fail or be unavailable.

3.8 Battle Management Languages Today

From our historical analysis the concept of a BML it is not new. Today they are found in each nation's military manuals and publications. In coalition organisations such as NATO they are used on a daily basis by military personnel. Unfortunately they often lack:

- Structure;
- Clearly defined rules governing its use (semantics and syntax);
- Are riddled with ambiguity and overlapping definitions.

As such they are incapable of transitioning to the full range of automation that many seek and will not support the advanced modelling and simulation with digitized C2. There was therefore a view that this required development of a language that could address this capability gap as military forces increasingly used simulations to support training and with aspirations to use them for mission planning and rehearsal.

4.0 THE CHALLENGE

In looking forward to where we are seeking to go in the future it is interesting to note that in 1968 Captain D. F. Hesey of the Royal Canadian Signals made the following statement in an article on future military communications for the British Army Review.

> *"Future communications systems will not only be compatible with each other but they will be integrated with automatic data processing (ADP) systems."* [6]

He went on further to state that:

> *"the integrated system will require a common language a problem which the needs of the computer resolves in favour of digital code, the digital language will be readily translated into the language of the users."* [6]

The timeframe he was looking at was 1980-2000.

So is the solution easy. In theory yes … but in practice it was proved more challenging. Why? In part because C2, training systems, simulations and autonomous/robotic systems are not developed coherently and quite often use proprietary solutions that either cannot be accessed by another system or require translators to be developed in order to achieve a degree of interoperability. Nor with regards to the many simulations how in use or development they do not have the capability of directly interfacing with C2 systems.

In addition they require significant non-training audience intervention in order to support digital battle staff training and they will continue to do so unless and until a standardized capability is developed for communicating between these systems.

The current refinement and standardization of a BML was the proposed solution to this problem. However the requirement is not national but multi-national hence a need for what was described as a Coalition Battle Management Language (C-BML) in 2006.

5.0 STRATEGY AND POLICY STATEMENTS

National strategies have recognised this problem. The UK have emphasised the requirement as the following statements from the UK Ministry of Defence and British Army illustrate.

In 1998 the British Army Simulation Equipment Strategy stated:

> *"The central place of Digitization in the Equipment Programme implies that simulation will have to: take into account the architectures and data standards prescribed for operational CIS (OpCIS); replicate systems used in the digitized joint battlespace sufficiently well to allow comprehensive and realistic training; and be configured in such a way as to allow direct interaction with OpCIS."*

Similar statements were made again in 2008 by the MoD Central Staff:

> *"**Interoperability**. Many of our current simulation capabilities lack interoperability as a result of incompatible proprietary standards. This severely constrains the delivery of collective, joint effect; it also requires the Department to invest in the same basic service (such as geospatial representations) many times. Addressing interoperability issues piecemeal, whilst the simplest approach, would not harness the considerable potential of commercial investment or encourage market-led open standards."*

> *"In order to better adapt simulation systems for mission rehearsal, Defence requires deployability, a rapid database generation capability, linkage to OpCIS and a change in acquisition/support behaviour to ensure platform and collective training simulations are always modified in step with the latest operational standard."*

This was reiterated in the UK Defence Policy for Simulation paper in May 2015 that highlighted that:

> *"Simulation is a key enabler for Defence. While there has previously been an emphasis on training and education, which will remain the principal user of simulation capability, simulation is increasingly embedded in operational systems and supporting decision making, mission rehearsal, acquisition, operational analysis and experimentation."* [7]

More recently at a UK industry meeting a similar statement reflecting the need to OpCIS interoperable with simulation was reiterated in a presentation by staff from Joint Forces Command. [8]

In 2012 the NATO Modelling and Simulation Master Plan (NMSMP) (Version 2) replaced the 1998 version. The vision is to exploit modelling and simulation (M&S) to its full potential across NATO and the Nations to enhance both operational and cost effectiveness. As result of the vision a NATO-wide cooperative effort is guided by the following principles [9]:

- Synergy: Capitalise on, leverage, and share the existing NATO and national M&S to enable more effective and affordable capabilities for NATO.
- Interoperability: Direct the development of common M&S standards and services for simulation interoperability and foster interoperability between C4ISTAR and simulation systems.

- Reuse: Increase the visibility, accessibility, and awareness of M&S to foster sharing and ensure its best exploitation across all NATO M&S application areas.
- Affordability: Employ and develop readily available, flexible and cost-effective M&S to improve NATO effectiveness to address the changing nature and increased complexity of the Alliance strategic environment.

The M&S application areas include, but are not limited to: Support to Operations, Capability Development, Mission Rehearsal, Training and Education, and Procurement.

The need to exchange simulation data with C2 systems remains a key objective.

6.0 NATO TECHNICAL ACTIVITIES

In addressing the C2Sim challenge the NATO Modelling and Simulation Group (NMSG) have approved a number of technical activities since 2002 that built on early developments of BML in the US Army and the Simulation Interoperability Standards Organization (SISO). The activities have included Exploratory Teams (ET), Technical Activity Programmes (TAP) and in addition a number of outreach events that have included workshops, demonstrations and presentations/tutorials at events such as the NATO CAX Forum.[2]

6.1 Exploratory Teams and Technical Activity Programmes

The main technical activities in support of C2SIM have been either an ET which runs normally for a period of 12 months but can be longer and the other is a TAP that will be a three year programme of work with the potential to extend by a further 12 months. An ET is to determine whether establishing a Technical Team for a specific project is feasible. If satisfied a project is feasible and value-added to the Nations, the ET will advise the Panel, write the Terms of Reference (ToR) and the TAP.

6.1.1 ET-016

The first of these was ET-016 Pathfinder Project which had been approved in 2004. It was established on the back of work in the USA by the US Army and through SISO to examine feasibility of adapting early BML within NATO. Uniquely as an ET it demonstrated capability at the NMSG business meeting in Warsaw, Poland in 2005 with USA and French C2 and simulation systems. A number of lessons were identified and it proved the feasibility of conducting multi-national activities

6.1.2 NMSG-048

A follow on TAP was approved, and NMSG 048 started in May 2006. The TAP defined a programme of work with four main activities:

- Substantiation of the requirements for NATO C-BML;
- Design for a NATO C-BML demonstration;
- Implementation of C-BML interface standard in C2 and simulation systems;
- Experimentation and assessment of C-BML, including final demonstration.

The latter activity also called for education to the community of the findings of the MSG-048 Technical Activity which would organised through a workshop.

[2] CAX is Computer Assisted Exercise.

6.1.3 NMSG-085

The success of NMSG-048 led to the approval for a second TAP, NMSG-085 which began in June 2010. It had received a strong endorsement with 10 NATO member nations having voted in favour of this activity, including: Canada, Denmark, France, Germany, Netherlands, Norway, Spain, Turkey, United Kingdom, United States of America, NC3A. It had been recognised in NMSG-48 that it was necessary to examine the use of the Military Scenario Definition Language (MSDL) as a means to initialise systems and this was incorporated into the programme of work. Its mission statement was to:

> *Assess the operational relevance of C-BML while contributing to C2-Simulation standardization and assist in increasing the Technical Readiness Level of C-BML technology to a level consistent with operational employment by stakeholders.*

The final demonstration took place at Fort Leavenworth, Kansas, USA in in December 2013.

6.1.4 NMSG-106

NMSG-106 was a follow-on activity from NMSG-068 that covered the need to establish a persistent NATO Education and Training Network (NETN) capability. Based on the recommendations from that technical activity, NMSG-106 focussed on the following topics:

- A methodology of planning, executing and evaluation of CAX, particularly the relationship between Exercise Control (EXCON) and Simulation Control (SIMCON).
- Support for NATO, multinational and national exercises.
- Technical topics; simulation interoperability patterns, common data formats, and connectivity with other systems. Examples were as follows:
  - Common ORBAT format and initialisation, combat adjudication, Federation execution control, Transfer of modelling responsibilities, Real-Time Platform Reference - Federation Object Model (RPR-FOM) modularization, scalability and fault tolerance, Chemical, Biological, Radiological, Nuclear (CBRN) and C-BML FOM modules.
- Development of a technical baseline and supporting tools and services; a reference CAX architecture, technologies, processes, standards, exercise management, distributed simulation testing and certification, tool repository, classification of information, etc.
- The governance and a long term maintenance process for MSG-106 products including technical baseline, certification, standardization, security, commercial, legal issues, quality assurance and risk management process.

From a C2SIM perspective the area of interest was the development of a C-BML FOM, which provided two versions; a High-Level BML and a Low-Level BML FOM. In addition members of NMSG-106 experimented with MSDL for initialisation and made some recommendations to enhance its functionality.

6.1.5 ET-038

NMSG-085 had concluded with a successful demonstration at Fort Leavenworth. Nevertheless it was necessary to explore if nations wanted to conduct a third TAP. As a result on the conclusion of NMSG-085, ET-038 was established. It will deliver a new TAP and TOR to the NMSG Business Meeting and if it gets the requisite support from four nations it will begin a new TAP on C2SIM in 2016. The key objectives of the new TAP are to operationalise C2SIM and support SISO in developing the proposed C2SIM Standard as a NATO STANAG.

6.2 Outreach Programmes

Since 2002 there have been a number of outreach programmes that have sought to demonstrate C2Sim interoperability capability and to also present findings in a series of workshops or forum such as the NATO CAX Forum. Demonstrations have not only been the culmination of each TAP but have taken place at; Interservice/Industry Training, Simulation and Education Conference (I/ITSEC), International Training Equipment Conference (ITEC) and Eurosatory.

6.2.1 NMSG-079

NMSG-079 was a workshop held over two days in Farnborough, United Kingdom on 24-25 February 2010, on the subject of C-BML. An audience of approximately 60 persons attended the workshop, with representatives from NATO, NATO/Partners-for-Peace (PfP) and other nations. The audience was diversified and was composed of attendees from the military, government Research & Development (R&D) laboratories and a significant representation from industry. A total of twenty six (26) presentations were provided during the two days, preceded by three keynote presentations. A Technical Evaluation Report was provided at the end of the workshop [10].

It concluded that:

> *"C-BML has undergone many transformations since its inception. Its technical readiness level is not yet sufficient for operational deployment. However, the initial experimentation concerning the use of C-BML in support of military activities shows great promise – and in many instances even a rudimentary C-BML capability proved better than the alternative of no C-BML at all."* [10]

6.2.2 NMSG-119

NMSG-119 took place in Orlando, USA on 5 December 2012 on the topic of C2Sim interoperability. The workshop aim was to address the combined use of C-BML and MSDL: MSDL for initialization and C-BML for execution. The Technical Evaluation Report main recommendations were to:

- Create a Combined Scenario Initialization & Execution C2Sim Interoperability Standard;
- Establish an agile requirements-driven phased, controlled, evolvable, sustainable process capable of producing this standard;
- Develop a comprehensive set of operational requirements to drive this process;
- Leverage existing interoperability solutions, processes and tools, such as those available from the Multilateral Interoperability Programme (MIP);
- Promote the definition of a Distributed Simulation Engineering & Execution Process (DSEEP) Overlay for C2-SIM Federations.

6.2.3 NMSG-138

This workshop took place in October 2014 and presented findings from the work conducted under the NMSG-085 TAP that included:

- Overview of Key Military Enterprise Activities (addressed by C2SIM Interoperability);
- Update on C-BML and MSDL Standardization;
- Summary of MSG-085 Technical Activity;
- Highlighted use-cases leveraging C2-SIM interoperability;
- Introduction to the Scenario INitialization and EXecution (SINEX) Initiative;
- Proposed new NATO MSG C2SIM interoperability technical activity.

It reinforced the recommendations made at the December 2012 workshop in Orlando.

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