Lecture Series - MSG 141

C2-Simulation Interoperability (C2SIM)

Battle Management Language: History, Areas of Employment, & NATO Technical Activities

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Outline of Presentation

- Problem Space

- Historical Background

- Easy Challenge?

- Strategy/Policy Statements

- NATO Modelling & Simulation Group Technical Activities

Problem Space

The Digital Battlespace

"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)

The problem is …

- The military need to move information:
  - ➢ faster ,
  - ➢ with more accuracy , and
  - ➢ over a widely dispersed battlespace,

- but increasingly also need to:
  - ➢ control autonomous/robotic forces,
  - ➢ conduct rapid Mission Planning including Course of Action Analysis (COAA) and wargaming, and
  - ➢ conduct Mission Rehearsal.

- Equally important is the need to train commanders and their staffs using new C2 applications.

… but

- Both C2 and simulation systems have been standalone,

- The simulations are uncoupled from the digitized Command and Control (C2) systems,

- Both often require specialist skills when deployed.

Historical Background

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The need to pass information is not new

- Military forces have always needed to communicate information and orders.

- Mechanisms were developed to relay information that provided clear and concise output.

- So that they could be understood and the recipient take the appropriate action.

- These were all forms of Battle Management Languages (BML).

Smoke Signals

Native American Indians
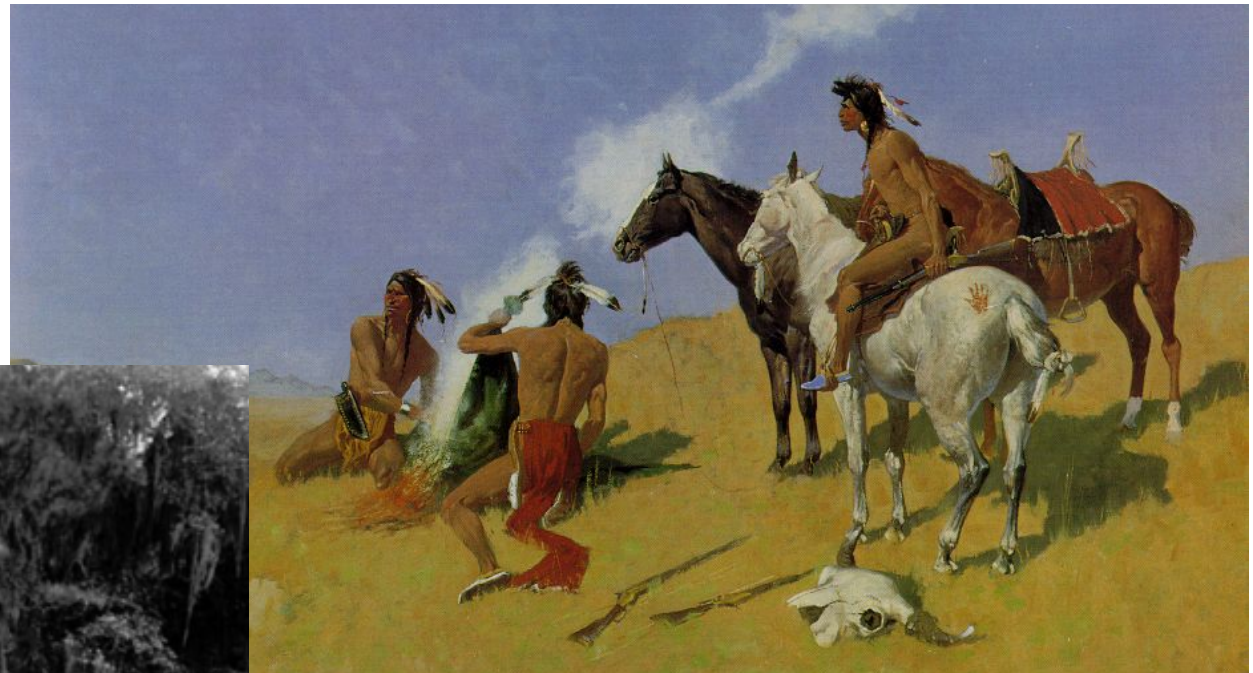
American Boy Scouts

Roman Military Signalling (1)

- Roman's required reliable communications to relay instructions.

- In Britain along Hadrian's Wall there were installations every mile and in line of sight. It is believed that they had signal towers and used two groups of 5 flags to signal with an alphabet on a crib sheet for interpretation.

- Beacons were also used in conjunction with amphorae of water to communicate messages.

- The principal of codes used by the Romans is used in electronic communications today.
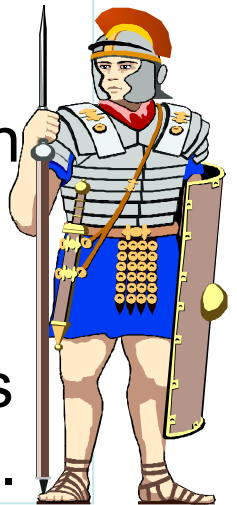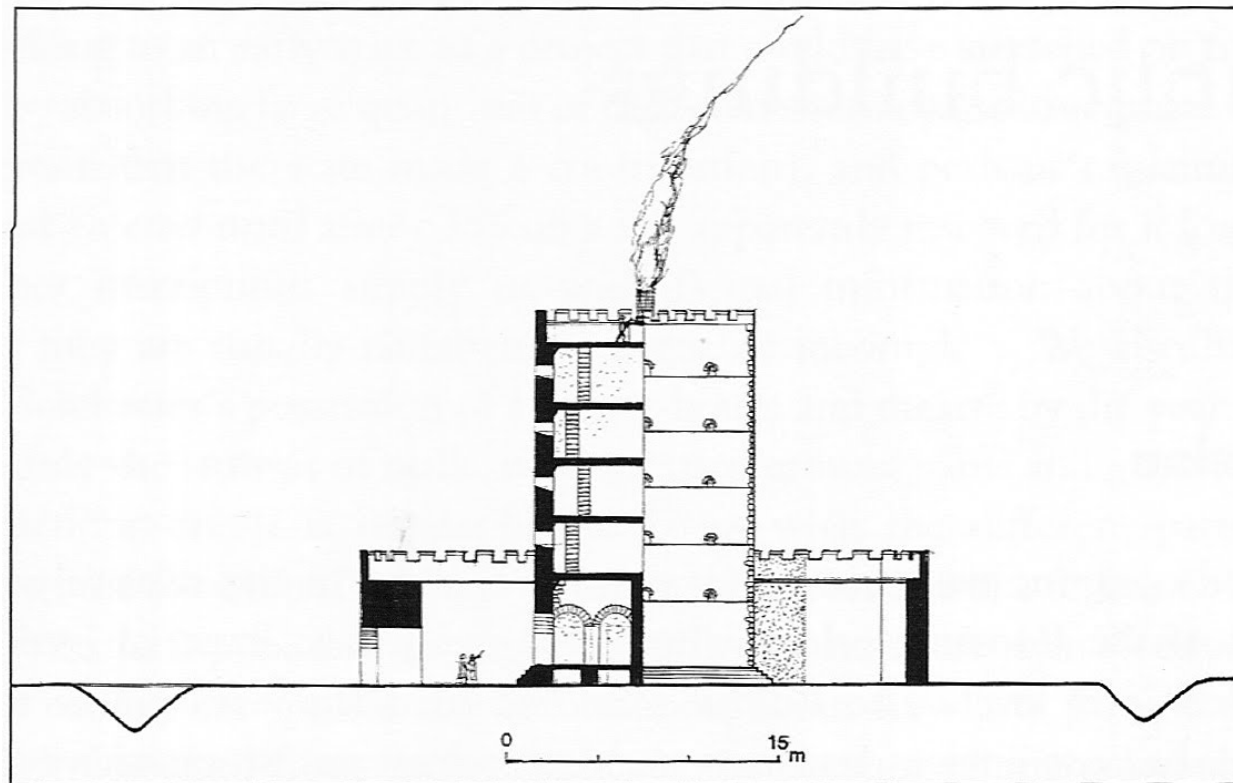
Roman Military Signalling (3)

Illustration from Guy de la *Bédeoyère's The Buildings of Roman Britain*. This was a 3rd century tower situated at Scarborough. All examples of such towers appear to have had a walled courtyard and outer ditch.

Roman Military Signalling (3)

The Roman Army also used musicians to signal orders. The Cornicen was a junior officer whose job was to signal salutes to officers and sound orders to the legions. He played an instrument called the cornu.

The Roman soldier on the left is a **cornicen**, a player of cornu (shown on left of illustration).

The **tubicen** (figure on left), the player of tuba, had a different role. He played at the beginning of a attack. He also plays the retreat. Tuba orders seemed to be more global.

Naval Signalling

- Semaphore method of signalling was a favourite of Naval forces because it was the fastest way of sending messages by flags and faster than flashing lights.

- It can be used only in the daytime and at distances of less than 2 miles. It was more secure than light signalling because there is less chance of interception by an adversary.

Army Signalling

By the 1870s two methods of signalling families were identified:

➤ WIRED Telegraph-lines

➤ WIRELESS included 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.
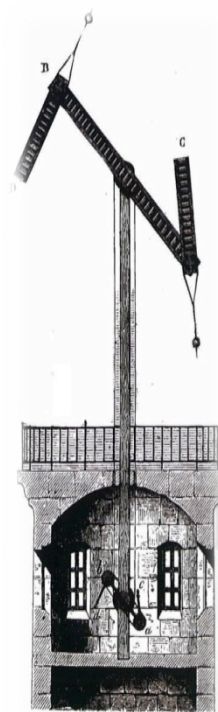
Above A contemporary illustration of a French semaphore station.
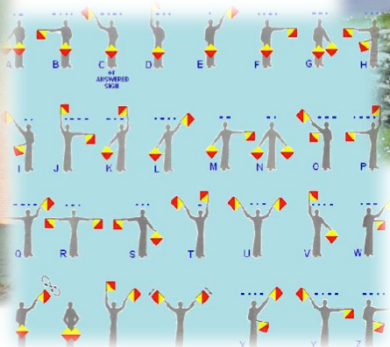
The Dutch Six-Disc Telegraph System

Open position

Closed position
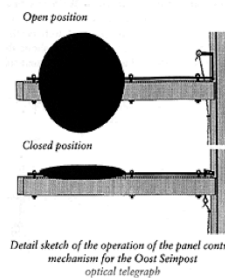
Detail sketch of the operation of the panel control mechanism for the Oost Seinpost optical telegraph

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The Development of Military Radio

- The development of radio enabled information to be passed over greater distances by military forces.

- Not secure.

- Resulted in development of encryption and coding devices. For example SLIDEX and BATCO in the British Army. Other nations had similar systems.

SLIDEX   BATCO
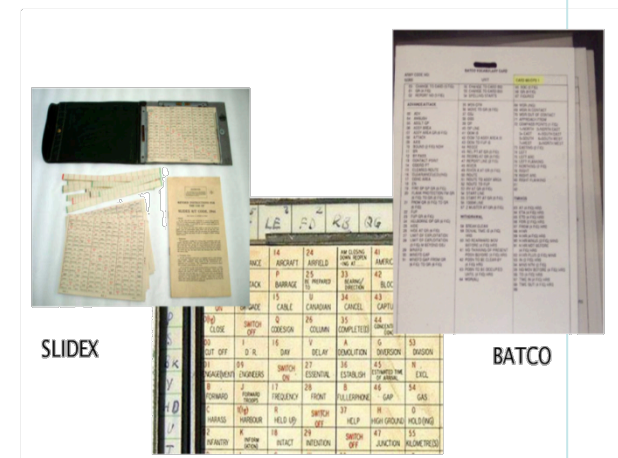
Battle Management Languages exist today

- Battle Management Languages (BML) are not new, and today they are found in:
  - Doctrinal publications
  - Military manuals

- Unfortunately they often lack:
  - structure
  - clearly defined rules governing their use (semantics and syntax), and
  - riddled with ambiguity and overlapping definitions.

- As such they are not capable of transitioning to the full range of automation.

- There was a view that the development of a structured language could address this problem

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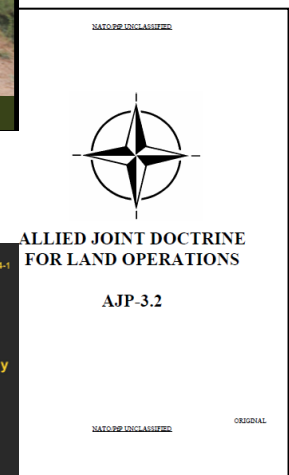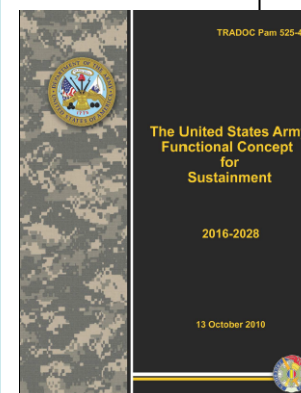
Easy Challenge?

An Observation

- 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 journal.

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

- 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."

- He was writing in 1968 and looking at the timeline 1980-2000.

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C2 Interoperability with other systems – Easy Challenge to Solve?

- In theory yes … in practice more complex because:
  - ➤ C2, training systems, simulations and autonomous systems are not developed coherently.
  - ➤ Few simulation systems have the capability of bi-directional exchange of data with C2 systems.
  - ➤ Not all C2 systems can exchange data with other C2 systems.
  - ➤ Require significant intervention in order to support military staff.
- The refinement and standardisation of a BML was a proposed solution to this problem for C2 to simulation interoperability.
- Requirement is not just national but multi-national and gave rise to the development of a Coalition BML (C-BML).
- NATO and National research has supported the development of C2SIM standardisation work.

UK National Policy

British Army Statement 1998

"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.**"

1998 British Army Simulation Equipment Strategy

UK MOD Strategy Statement 2008

"**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."

MOD Strategy for Simulation 2008

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More recently …

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."*

The commander of Joint Forces Command (JFC) has also re-emphasized the need for operational CIS to be interoperable with simulation systems.

NATO M&S Master Plan

NATO Modelling and Simulation Master Plan

- **NATO, the Modelling and Simulation Master Plan (Version 2) replaced the 1998 version.**

- **It has 4 guiding principles to support the vision:**

  ➢ 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.

NATO Modelling and Simulation Master Plan

Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
Establish a Common Technical Framework	Provide Coordination & Common Services	Develop Models & Simulations	Employ Simulations	Incorporate Technological Advances

Sub-objectives

- Develop NATO standard interoperability architecture and supporting material
- Establish recommended standards pertaining to data interchange for M&S and C2 systems, promotion of true interoperability, pursue trust in M&S
- Establish a NATO wide (incl. National Stakeholders) technical environment for distributed networked M&S application areas

Sub-objectives

- Develop common process and procedures to guide actions and decisions regarding M&S application
- Compile M&S information
- Establish capability to share M&S education resources with NATO organizations and Alliance nations
- Promote the sharing of M&S resources through a knowledge management process and system
- Establish a help desk to facilitate the development and use of M&S

Sub-objectives

- Identify and prioritize M&S requirements
- Identify the most effective strategies to satisfy each simulation requirement
- Allocate resources to satisfy the highest priority simulation requirements
- Execute the selected and resourced development strategy
- Provide information to the larger NATO community regarding the resultant simulations and any lessons learned during development

Sub-objectives

- Plan employment
- Provide resources to operate simulations
- provide databases
- Operate simulations to improve all aspects of NATO/national military activities
- Conduct impact assessments and document lessons learned to guide further development / investments

Sub-objectives

- Monitor M&S related technological advances
- Conduct R&D, experiments and pilot projects as needed to support Alliance requirements
- Share information on realized advances to facilitate incorporation
- Implement technological advances

Objective 1 – Establish a Common Technical Framework

- A common standard interoperability architecture and supporting material;

- Common standards that promote common understanding of data across models, simulations and live systems (e.g., C2 systems, Communication and Information Systems (CIS), weapon systems on instrumented ranges, hardware-in-the-loop, etc.);

- Common standards that promote "true" interoperability, i.e., interoperability up to the conceptual level including a common understanding of the static and dynamic representation and the context of the piece of the world to be simulated (thereby guaranteeing a fair fight in training and exercise applications);

- Common standard processes and recommended practices, (e.g., Verification, Validation and Accreditation (VV&A) to pursue a level of trust in simulations); and a NATO-wide, including national stakeholders, technical environment for distributed networked M&S application areas.

NATO Exploratory Teams and Technical Activity Programmes

C2 to Simulation Interoperability in NATO (1)

- On the back of work in the USA by the US Army and through the SISO an Exploratory Team – 016 (ET-016) was established to examine feasibility of adapting early BML within NATO in May 2004.

- Uniquely a demonstrator was built as part of the study.

- The demonstration took place in Warsaw, Poland in 2005.

C2 to Simulation Interoperability in NATO (2)

- **NATO MSG-048: Standardization for C2-Sim Interoperability (2006-10)**
    - ➤ This group used the products being developed within SISO to examine C-BML as an enabler for NATO.

- **Four main activities:**
    - ➤ Substantiation of the requirements for NATO C-BML;
    - ➤ Design for a NATO C-BML demonstration;
    - ➤ Implementation of C-BML interface star simulation systems;
    - ➤ Experimentation and assessment of C- demonstration.

MSG-048

C2 to Simulation Interoperability in NATO (3)

- **NATO MSG-085: C2-Sim Interoperation (2011-14)**

  ➢ MSG-085 was a follow-on Technical Activity to MSG-048 which is focused on assessment and requirements for both C-BML and MSDL on advancing toward an operational employment.

  ➢ <u>Mission Statement</u>: 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.

- **10 NATO member nations voted in favour of this activity: Canada, Denmark, France, Germany, Netherlands, Norway, Spain, Turkey, UK, USA.**

- **They were joined by Belgium and Sweden in the technical activity.**

NMSG-085
C2 - Simulation
Interoperation

C-BML MSDL

C2 to Simulation Interoperability in NATO (4)

- **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.**

- **It covered a number of topics that included the investigation into the development of C-BML FOMS. Two versions were developed.**

  ➢ High-Level BML FOM
  ➢ Low-Level BML FOM
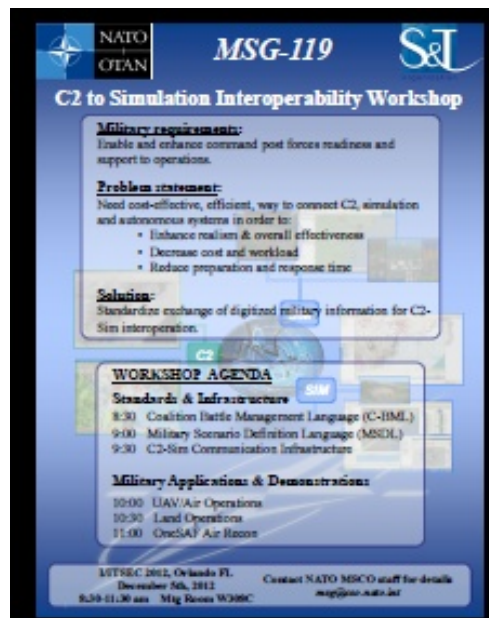
C2 to Simulation Interoperability in NATO (5)

- ET-038 was established to develop a new TAP and TOR for a follow on activity to MSG-085.

- 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.

- The key objectives of the new TAP are to operationalise C2SIM and support SISO in developing the proposed C2SIM Standard as a NATO STANAG.

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NATO Workshops

NATO MSG-79: C-BML Workshop

- Workshop took place in Farnborough, UK in February 2010 over a two-day period.

- A number of presentations were delivered including keynote addresses.

- A Technical Evaluation Report 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."

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NATO MSG-119: C2-Sim Interoperability Workshop

- **Workshop took place in Orlando, USA in 5 Dec 2012**
  - ➤ Technical Evaluation Report Main Recommendations:
    - ▪ Create a Combined Scenario Initialization & Execution C2-SIM 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;
    - ▪ Promote the definition of a Distributed Simulation Engineering & Execution Process (DSEEP) Overlay for C2-SIM Federations.

NATO MSG-138: C2-Sim Interoperability Workshop

- Overview of Key Military Enterprise Activities (addressed by C2SIM Interoperability)

- Update on C-BML & MSDL Standardization

- Summary of MSG-085 Technical Activity

- Highlighted use-cases leveraging C2-SIM Interoperability

- Introduction to the Scenario INitialization and EXecution (SINEX) Initiative

- Present the new NATO MSG C2-SIM Interoperability Technical Activity

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Questions