Coalition Battle Management Language (C-BML) and C2SIM History and Development

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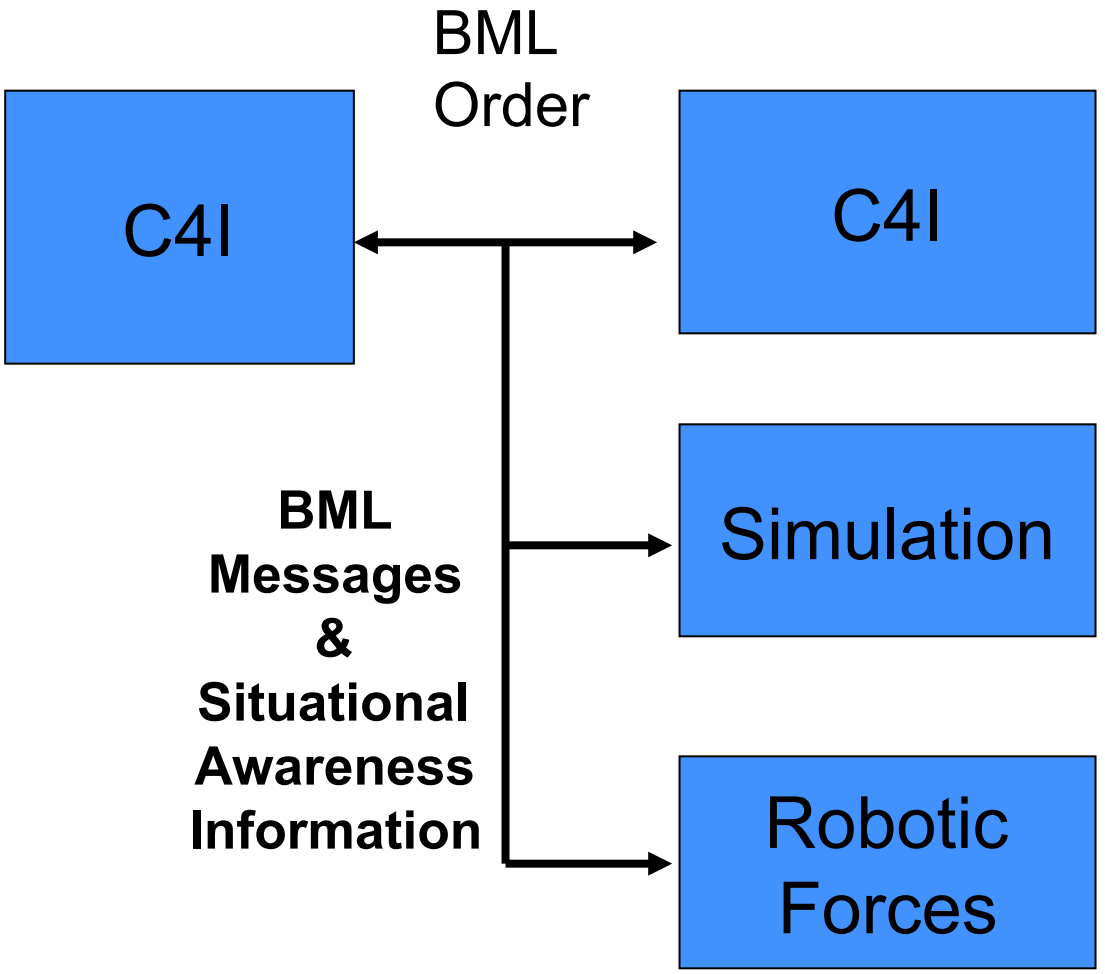
APPROVED FOR PUBLIC RELEASE

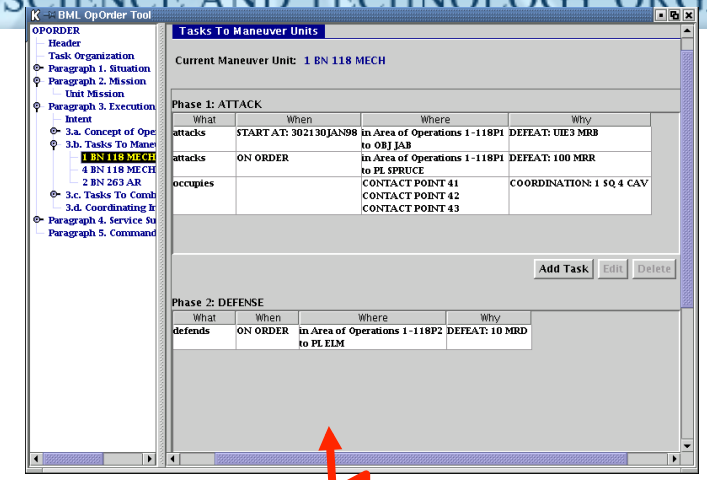
C-BML Precursors

- Various ad-hoc interfaces between C2 and simulations supporting "train as you fight" concept
  - ➢ Motivated mostly by cost of human "puckster" interface
- 1995 DARPA Synthetic Theater of War (STOW) sponsored Command and Control Simulation Interface Languge (CCSIL)
  - ➢ Good first step but proved complex to use
- 2003 US Army Simulation to C4I (SIMCI) sponsored Battle Management Language (BML) experiment
  - ➢ Focus on eliminating ambiguity in task description
  - ➢ Successful proof of principle
  - ➢ Simulated NATO MSG and SISO development

BML Scope


BML
Order
C4I
C4I
Simulation
Robotic
Forces
BML
Messages
&
Situational
Awareness
Information

US Army BML Proof of Principle



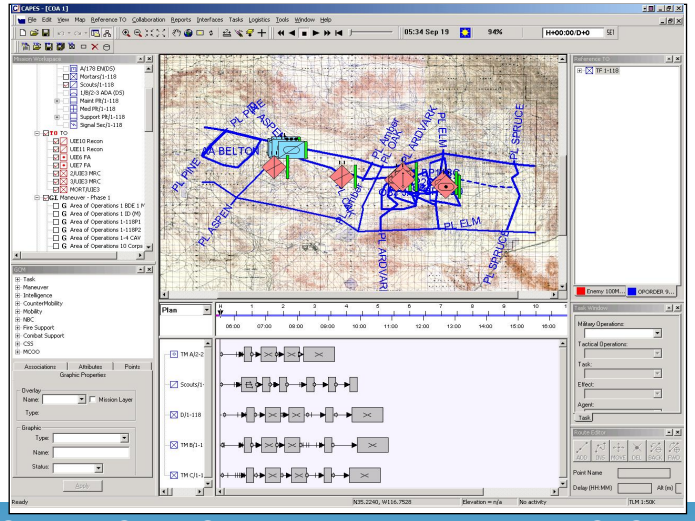
BML GUI

XML – BML Parser

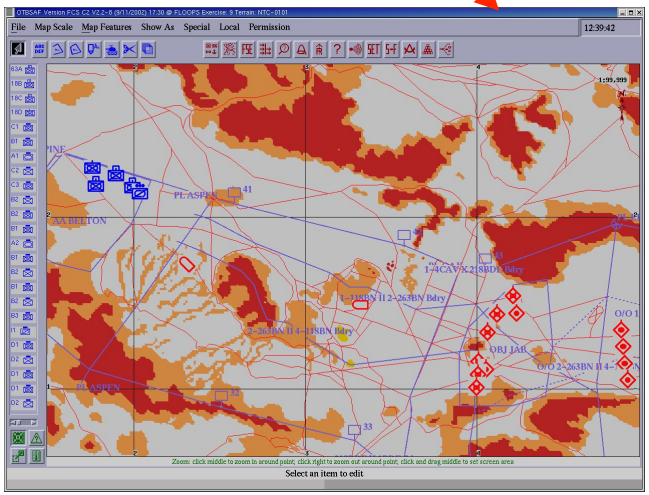
Multi-Source Database Augmented with BML

C4ISI

CAPES



OTB



BML acts as the common denominator

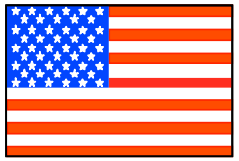
Development of C-BML

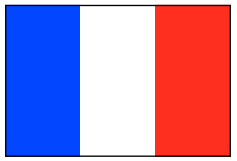
- Coalition BML (C-BML) grew out of early US and French experiments in C2-simulation interoperation
- These led to parallel interest and development in
  - NATO Modelling & Simulation Group: experimentation and validation
  - Simulation Interoperability Standards Organization (SISO): codified consensus standards
- Some of the NATO team also participated in standards process

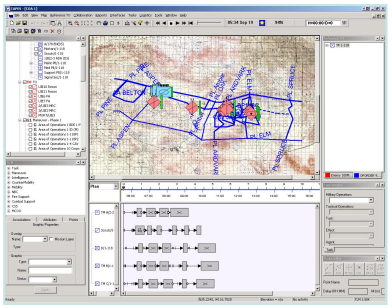
France and US Precursors

- US Defense Modeling and Simulation Office (DMSO) sponsored research to understand Web-based M&S
  - Initiative called Extensible M&S Framework
  - GMU C4I Center teamed with Naval Postgraduate School
  - Produced XML-based BML "Extensible BML" (XBML)
  - Used a supporting Web service to link C2 and simulation
- XMSF demo at I/ITSEC 2005 drew attention of French DGA
  - France also had C2-simulation linkage (SICF-APLET)
- US and French teams decided to collaborate
- Produced interoperating C2-simulation prototype and demonstrated it for NATO MSG

US-France Demonstration Architecture

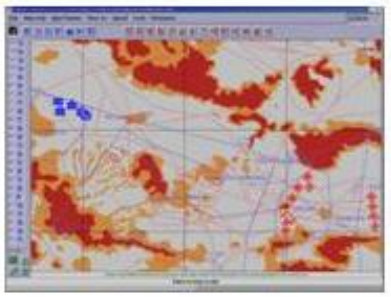






CAPES COA Definition

Push COA



JSAF Simulation

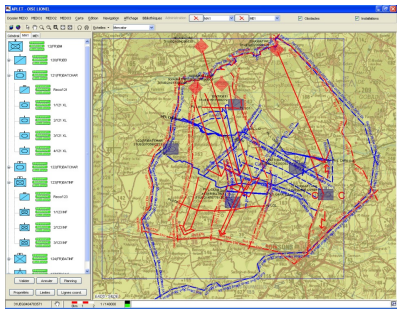
Pull COA

BML Web services

C2IEDM+ Database

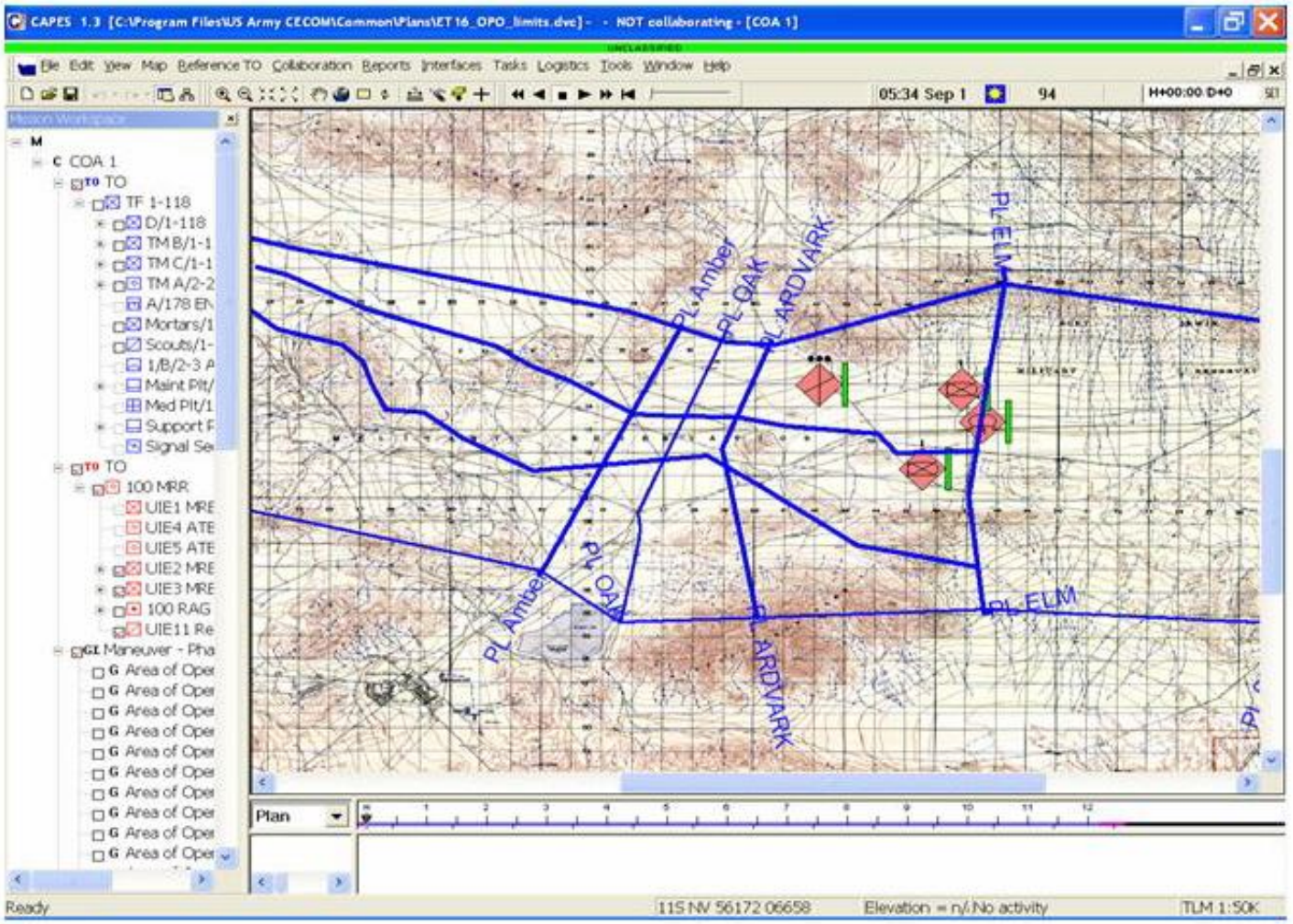
Push COA

Pull COA

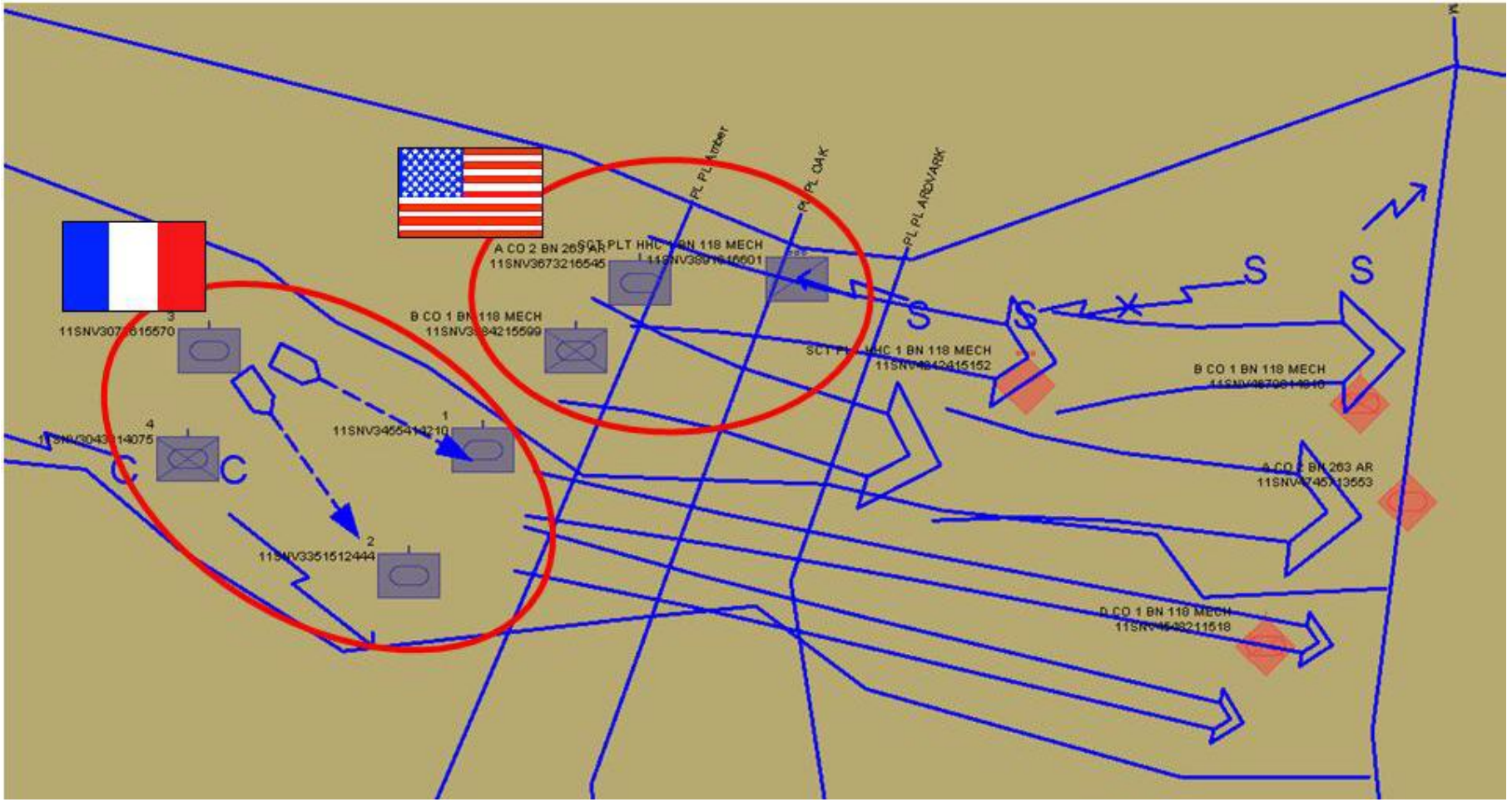


APLET
COA Definition
Simulation

Initial Conditions (CAPES view)

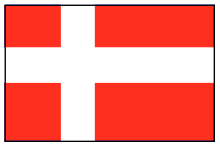


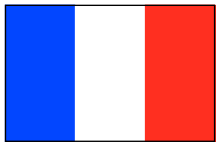
Combined Plan (APLET view)



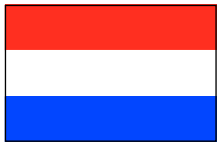
NATO MSG Exploratory Team ET-016

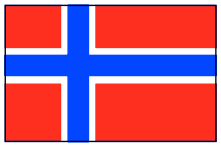
- France & US early work seeded interest in NATO early adopters
- Led to formation of MSG-048
  - ➢ Coalition Battle Management Language


Denmark


France (Lead)

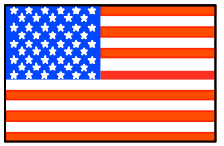

Germany


Netherlands


Norway


Spain


UK

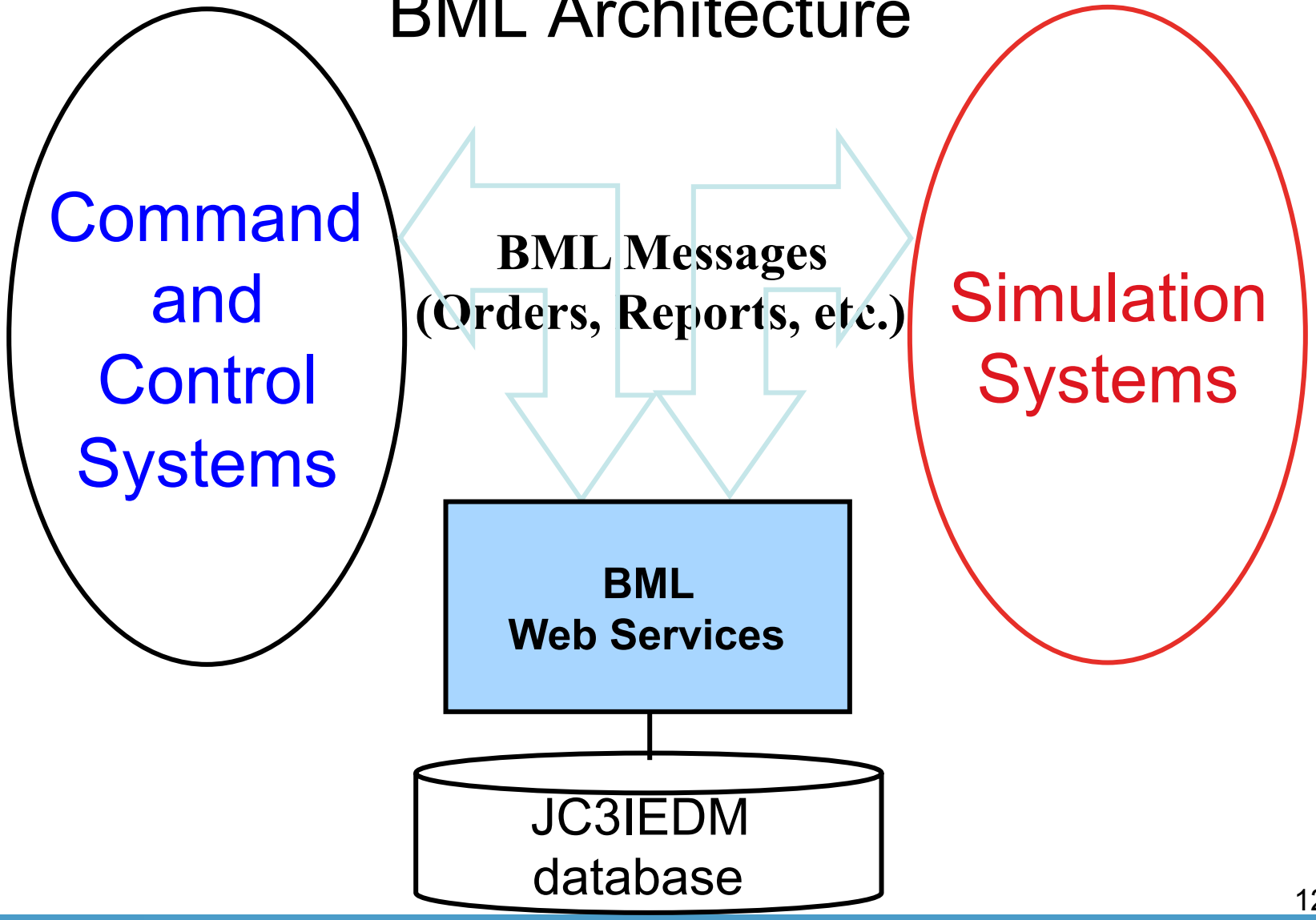

USA (Co-Chair)

NATO C3 AGENCY

NATO MSG-048

- ET-016 stimulated a multinational effort to show technical feasibility of Coalition BML (C-BML)
  - Canada, Denmark, Germany, the Netherlands, Norway, Spain, Turkey, UK and USA
  - Open framework to establish coherence between C2 and M&S
  - New open, system-independent, community standards and protocols.
- Work areas:
  - Establish requirements for the C-BML standard
  - Assess its usefulness and applicability of C-BML in support of coalition
  - Educate and inform the C-BML stakeholders

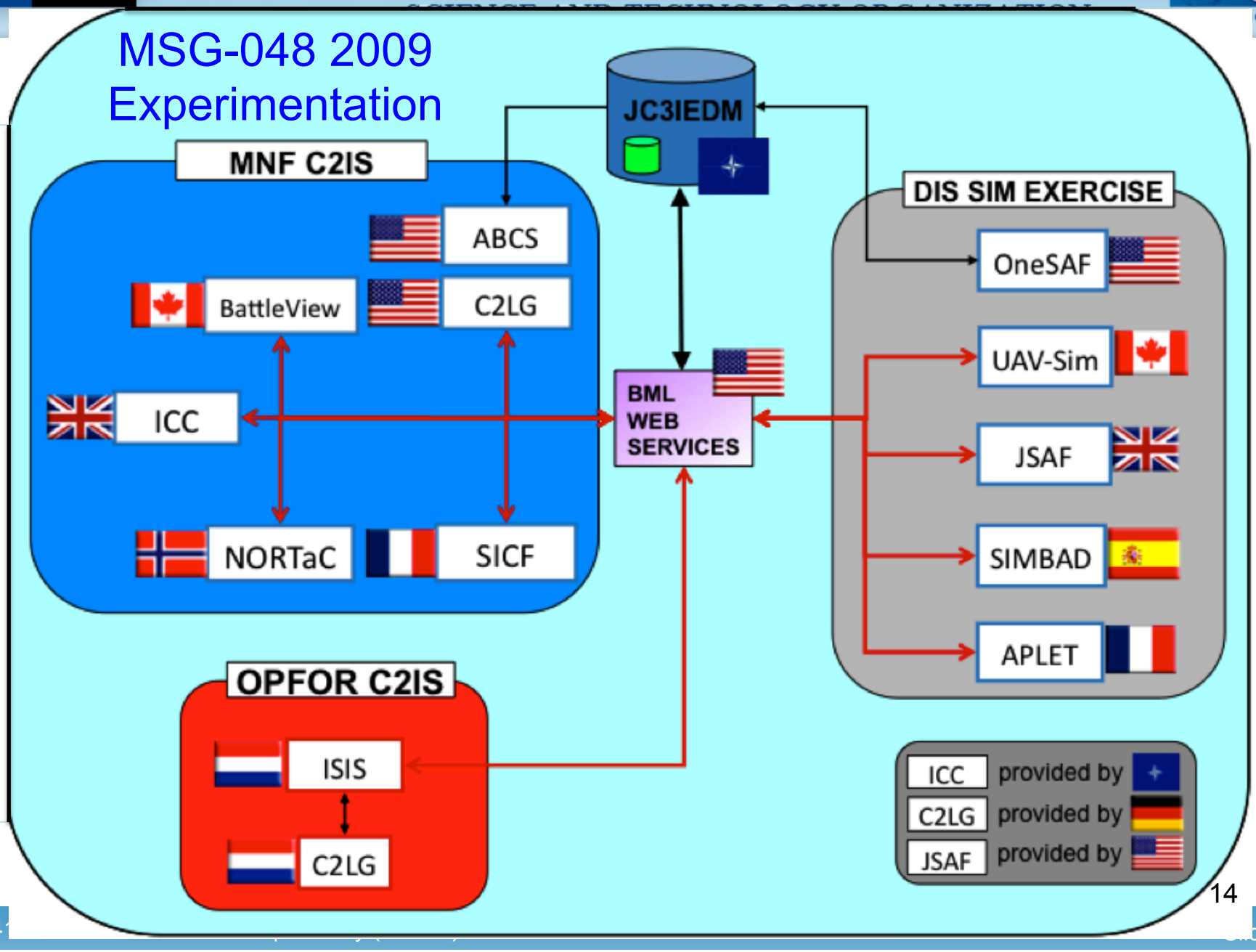
BML Architecture



MSG-048 Technologies

- Server-based architecture
  - Simplifies development environment - each client can be tested individually
  - Provides a measure of fault-tolerance - does not require that all C2SIM system-of-systems are constantly available
- C2 systems
  - Battle View (Canada), SICF (France), ISIS (Netherlands), NORTaC-C2IS (Norway), ICC (UK), ABCS (USA)
- Simulation systems
  - UAV-SIM (Canada), APLET (France), SIMBAD (Spain), JSAF (UK), OneSAF (USA)
- Supporting software
  - C2LG GUI (Germany), SBMLserver (USA)

MSG-048 2009 Experimentation



Role of Grammar in C-BML

- While ET-016 was considering a possible NATO MSG Technical Activity in BML, a SISO Study Group was considering how BML might be standardized
- The SISO Study Group concluded that BML should be standardized in three phases:
  1. An XML schema for interchange of data
  2. A grammar to define syntax of a formal language
  3. An ontology to define the semantics of BML

Command and Control Lexical Grammar

- The preferred grammar, developed by Schade and Hieb, is known as *Command and Control Lexical Grammar (C2LG)*
- Form of C2LG expressions:
  - OB –> Verb Tasker Taskee (Affected|Action) Where Start-When (End-When) Why Label (Mod)*
- For example:

  pursue BtlC CavB En **towards** Z **at** now

  in order to destroy En label_3_15;
- During development of the standard the grammar phase got folded into the other two
  - C-BML Phase 1 is an XML schema structured with C2LG

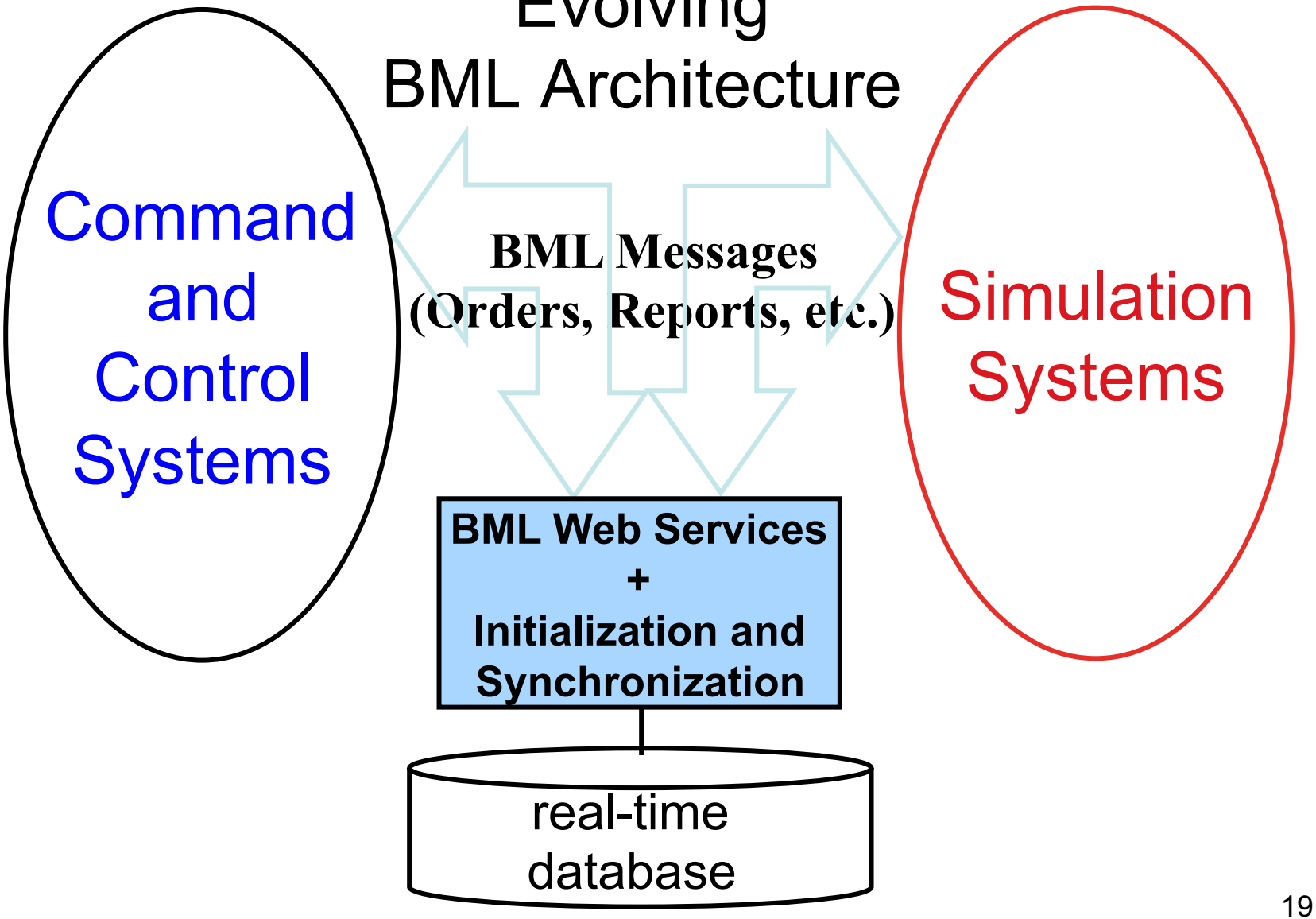
MSG-048 Results

- Parallel activity by SISO C-BML PDG to define a standard
  - Progress made but not as smoothly
  - Slower than most stakeholder found satisfactory
  - Produced results during following phase
  - MSG-085 used schema from a US effort
- Final Experimentation 2009
  - Work with operational military SMEs acting as brigade staff
  - Intensive preparation over Internet (new approach at the time)
  - Integration events in Portsmouth, UK and Paris, France
  - Counter-insurgency scenario with Canadian, French, Norwegian, UK, USA simulated units
- Succeeded as Proof of Principle despite difficulties
- Won NATO Scientific Achievement Award 2013

NATO MSG-085

- Follow-on TA chartered near end of MSG-048
  - To support standardization and show operational relevance
  - Added participating nations: Belgium and Sweden (also interest by Italy and Australia)
  - Also added operational military expertise
- Organized into Technical and Operational Subgroups
  - Also, orthogonally, Common Interest Groups:
  - Autonomous/Air, Land, and Maritime Operations; Joint Mission Planning, and Infrastructure
- Recognized need to add MSDL to C-BML
  - In first year (2010), participants implemented MSDL
  - Which in turn showed MSDL/C-BML incompatibility

Evolving BML Architecture

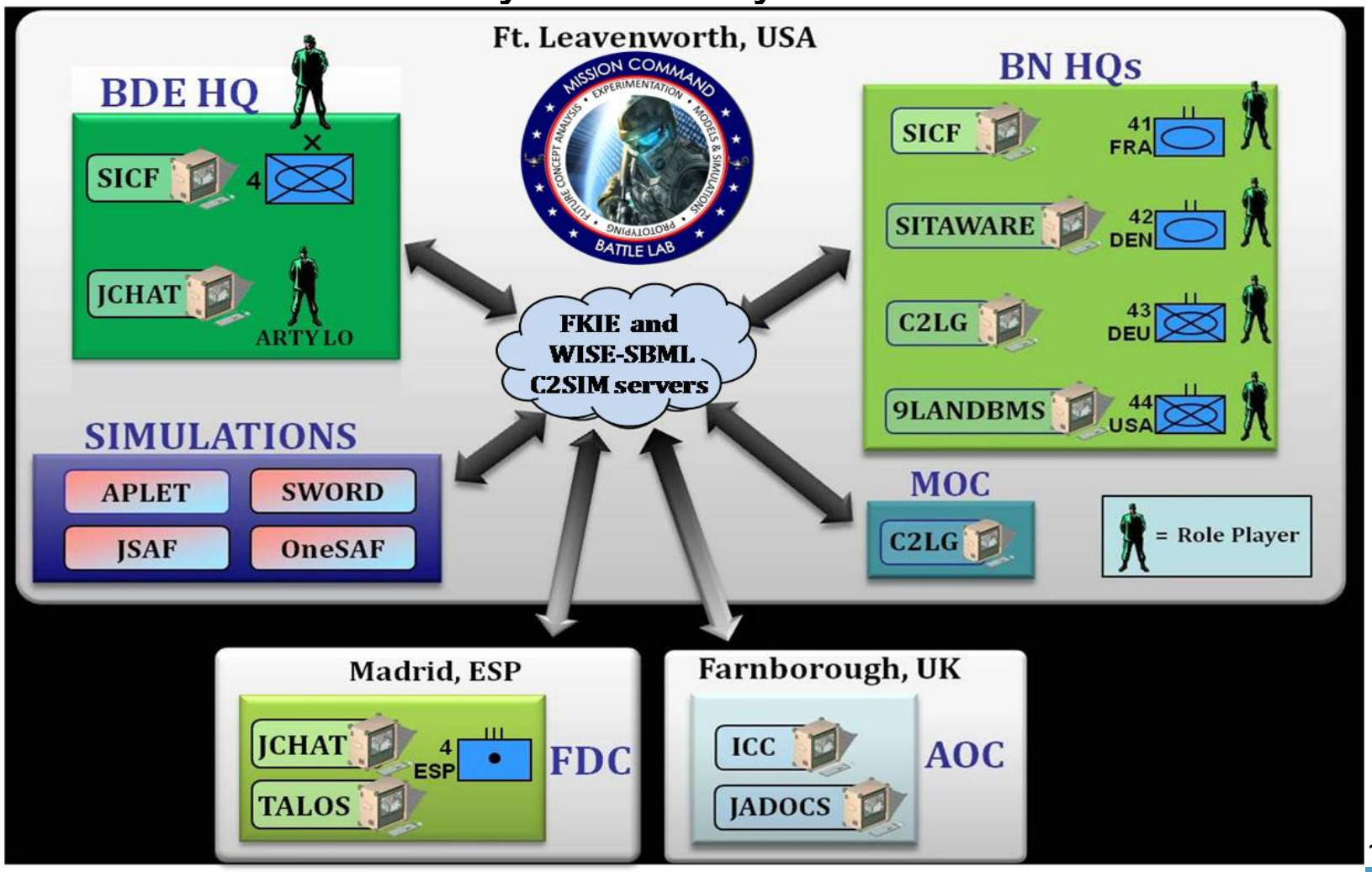


SISO C-BML Standard

- MSDL standard was approved in 2009
- In 2012 SISO completed balloting C-BML Phase 1
- Two versions approved:
  - "full" intended to address very wide range that can be represented by the JC3IEDM
  - "light" facilitates rapid implementation
- Standard approved May 2014
- Delays in approval resulted in MSG-085 nations having 3 different schemas implemented

MSG-085 Final Demonstration

System of Systems



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MSG-085 Final Demonstration

- Conducted at Fort Leavenworth Kansas
  - In collaboration with Mission Command Battle Lab
- Featured Joint and Combined Mission Planning
- Complexity similar to MSG-048 but with major differences:
  - Network sophistication: two linked servers; three schemata; two sites participated via Internet
  - Setup process: where MSG-048 was chaotic; MSG-085 "just worked"
  - Audience impression: MSG-085 worked very well
- Proved concept: C2SIM in the form of MSDL and C-BML ready to be tested in real coalition operations.

Path to STANAG: 2nd Gen SISO C2-Simulation

- MSG-085 showed that MSDL and C-BML could work together effectively, but with some difficulty
  - They should be converged/harmonized
- Experience with C-BML "Full" schema indicates it is cumbersome to use
  - Yet it only covers maneuver warfare – not all types of operations
- MSG-085 technical work indicated that the approach taken by Multilateral Interoperability Programme (MIP) is more useful
  - Define data to be exchanged as data model, expressed as UML (not XML schema)
  - Extend data model to new domains as needed
  - Derive XML schema from the data model

SISO C2SIM

- SISO MSDL and C-BML Product Development Groups agreed to merge, forming C2SIM
  - A single Product Development Group with multiple Drafting Groups
  - And a Product Support Group to maintain MSDL and C-BML
  - Reduced administrative overhead
- New approach in SISO: PDG and PSG form a lifecycle product group empowered over the product lifecycle to develop and support products.
  - Membership common to both PDG and PSG

C2SIM Officers

- **Co-Chairs (two) provide overall leadership**
  - Ensure PDG products form an integrated whole
  - No specific role in drafting; contribute like others
- **Vice-Chairs associated with specific functions**
  - Logical Data Model
  - Initialization
  - Tasking-Reporting
- **Lead Editor**
  - Ensure documents form adequate, coherent suite
  - Not responsible to develop technical concepts (but must understand)
- **Secretary**
  - Manages information necessary for PDG process (not product)
- **C2SIM PSG Co-chairs**
  - work closely with the PDG Co-chairs to maintain effectiveness of previously released standards
  - Ensure that PDG products take transition into account

Combining MSDL and C-BML

- C2SIM-LDM (Logical Data Model)
  - Core set of data elements
  - Standard way of extending the core
- C2SIM-Initialize
  - Intended to supersede MSDL version 1
  - Defines startup and checkpoint information
- C2SIM-TaskingReporting
  - Intended to supersede C-BML phase 1
  - Major issue: be able to expand to new domains without being cumbersome
  - Derived from extended LDM

C2SIM Products

- C2SIM Logical Data Model (C2SIM-LDM)*
- C2SIM Initialization XML Representation* (C2SIM-Initialize)
- C2SIM Tasking and Reporting XML Representation (C2SIM-TaskingReporting)*
- Guideline for C2SIM-Initialize Implementation
- Guideline for C2SIM-Tasking Reporting Implementation

* standards document