LS-141

C2 to Simulation Interoperability (C2SIM)

- Benefits of C2SIM

APPROVED FOR PUBLIC RELEASE

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Agenda

1. Definitions
2. Goals, Rationales & Benefits
3. Use-cases
Definitions

• **C2 systems** ease the commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission via situational awareness and shared common operational pictures. They provide a bi-directional flow of information between a commanding officer and subordinate military units.

• Without effective command and control systems, combat units had to be operated "the old way", relying on slow and unreliable voice communication and hand drawn maps.
Definitions

• **Simulation** is the imitation of the operation of a real-world process or system over time. The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors/functions of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time. (Wikipedia)

A method for implementing a model over time (MSCO)

• **Model:** A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process. (MSCO)
Bi-directional flow of information between C2

COMMANDER

Interoperability
Medium of communication
Vocabulary
Communication procedure

SUBORDINATE
Bi-directional flow of information between C2 and SIM

Interoperability
Medium of communication
Vocabulary
Communication procedure

COMMANDER

SUBORDINATE
Systems Interoperability

C2 Systems

Simulations

Simulation 1

Simulation 2

Problem Space

standards

standards
Current Interoperability status

• Interoperability issues in the M&S and the C2 domains are addressed but separately
  - **C2 to C2**: National C2 standards (MTF, SICAT)
  - **C2 to C2**: International C2 standards (AdatP3, MIP, JC3IEDM)
  - **SIM to SIM**: Simulation standards (DIS, HLA)

• Need for a common approach to address C2SIM Interoperability
  - **C2 to SIM**: Issue an international standard that is acceptable by both the M&S and C2 domains
1. Definitions
2. Goals, Rationales & Benefits
3. Use-cases
C2SIM GOALS

• Develop a mechanism by which the connection between C2 and simulation systems becomes
  ➢ Automated or semi-Automated
  ➢ Unambiguous
  ➢ Easy to sustain
  ➢ Independent of applications
  ➢ Expandable to include new domains
  ➢ Available in Theater
  ➢ Persistent low cost
  ➢ Applicable to different levels of command
Bi-directional flow of information between C2

COMMANDER

ORDERS
REQUEST REPORTS

SUBORDINATE
Bi-directional flow of information between C2 and SIM
Information exchange between C2 and SIM

Commander

Automatic exchange

SUBORDINATE
Military requirements:
Enable and enhance command post forces readiness, support to operations and armed forces acquisition life cycle

Problem statement:
Need cost-effective, efficient, way to connect C2 system and simulation in order to:
- Enhance realism & overall effectiveness
- Decrease cost and risk
- Reduce preparation and response time
- Refine requirements and statement of needs

Solution:
Standardize exchange of digitized military information for C2-Sim interoperability
Benefits - Enhance realism and overall effectiveness by faster, more consistent information exchange among systems

- Faster restart/backup system of systems
- Increase realism by approaching real life
- Better consistency of information between systems
- Reduce risk of mistakes: Automatic validation of messages according to receiver capabilities/format
Benefits – Decrease cost and risk

by reducing manual input, reduced number of supporting personnel and equipment

- Save resources with an automatic swivel Chair
- Save resources by reducing workload of required operators
- Save on development and maintenance of gateways
Benefits – Reduce preparation and response time

with rapid configuration, initialization of systems and validation of scenario

- Reduce time to feed systems with initial data (Theatre/Battlefield)
- Faster validation of scenario to meet training objectives
- Offer a flexible process to back and forth information from systems to systems
Benefits – Refine requirements & statement of needs

- Develop C2 surrogate fed with simulation data
- Experiment new capabilities with end-users in the loop
- Assess different tactics and procedures with legacy systems in the loop
- Capitalize scenarios for further use during the CADMI V cycle acquisition process
## Multiple Domains of benefits

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C2SIM Technical Reference Model

C4ISR System

Simulation Service Interactions
- Simulation Metadata
- Execution Control
- Visualization
- Data Collection
- Simulation Effects

Non-Persistent Data
- Orders
- Reports
- Imagery
- Tracks
- Unit Data

Persistent Data
- Mission & Plan Information
- Communications Plan
- Weather Data
- Terrain Specification

C4ISR System Service Interactions
- System Health/Heartbeat/Status
- Component Service Protocols

Simulation System
- Simulation Control Module
- Visualization Module
- Simulation & Models Module
  - Behavior Models
  - Physical Models
  - Communication Models
  - Environmental Models
- Run-Time Framework
- Simulation DB
- Scenario DB
Systems Initialization

Scenario

MSDL
(Military Scenario Definition Language)

Sand Box

OOB

Initial Situation
(Location, Logistics, Manning)

Weather conditions

Limits

Phase Lines
Systems Execution

- On time, on event, on request -

CBML
(Coalition Battle Management Language)
Use-Cases

• Forces Readiness
  ➢ Command Post Training
  ➢ Fault Tolerance

• Support to Operations
  ➢ Briefing
  ➢ Planning
  ➢ Back-Brief
  ➢ Mission rehearsal

• Acquisition
  ➢ Assess new C2 capabilities and procedures
Forces readiness – CP Training – Current Situation
Forces readiness – CP Training – C2SIM Situation

- HICON
- Primary Training Audience
  - C2
  - C2
- Secondary Training Audience
  - C2
- MSDL / CBML
  - Simulation
  - Simulation
  - Simulation

OPORD
ATO

OPTASK
Training Audience
Response Cell
Forces readiness – Fault Tolerance

C2 System

Simulation

Initialisation (MSDL)
Forces readiness – Fault Tolerance
Forces readiness – Fault Tolerance

C2 System

Simulation

Initialisation (MSDL)

Orders (BML)
Forces readiness – Fault Tolerance

C2 System

Simulation

Initialisation (MSDL)

Orders (BML)

Simulation
Forces readiness – Fault Tolerance

C2 System

Simulation

Initialisation (MSDL)

Orders (BML)

Simulation

Save COP (MSDL)
Forces readiness – Tolérance aux pannes

C2 System

Simulation

Initialisation (MSDL)

Orders (BML)

Reports (BML)

Simulation

Save COP (MSDL)
Forces readiness – Fault Tolerance

C2 System

Simulation

Initialisation (MSDL)

Orders (BML)

Reports (BML)

Save COP (MSDL)

Simulation

Save COP (MSDL)
Support to Operations – Briefing

Provide quick and automatic reports in order to get an impression how the commander envisage the future operation.

Exchanges:
- Verbal exchanges
- C-BML and MSDL
Support to Operations – Backbrief

Provide quick and automatic reports in order to get an impression how subordinates orders match with the commander’s intent.

Exchanges
- Verbal exchanges
- C-BML and MSDL
Support to Operations – Mission Rehearsal

Subordinates gain accounted to execute the expected course of action and react to unexpected events.
M&S along the Programs V-cycle

- Concepts/Feasibility
- Req. capture/Specifications
- Battle Lab
- Development
- Tests/Validation
- Training/RT Embedded Simulators
- Test & Evaluation Facilities
  - Distributed env. Mixing Real Systems simulation
  - Gov. Interop. Check
  - Hybrid Simulation Mixing real And virtual tracks
  - Contractor's Integration testbed
  - Software Dev. Realization
  - Detailed conception
  - Functional simulation System Architect – Doors
  - Demonstrators of future Systems
  - Capabilities Simulations

Leadership Forces + DGA
Leadership Industry
Leadership DGA + Forces
Acquisition – Assess new C2 capabilities/concepts
Descending and climbing the V-cycle

- **Initialization:** Capability studies (new syst., improvement of existing syst., …)
  - Capability simulations
- **Orientation:** Feasibility studies and operational concept of use development
  - Mock-up, Demonstrator, Experimentation
- **Elaboration:** System and detailed Specifications development and validation
  - Define and check performances against operational requirements
- **Realization:** Components, systems and interoperability qualification
  - Create a virtual T&E environment
- **Utilization:** Provide education and training devices to support use of the new system
  - An enabler to provide low-cost distributed simulations for armed forces end-users
Acquisition – Integrate new C2 systems within the M&S

Emulated or real human in the loop C2 System
Additional requirements

- Be routed via radio devices on the field
- Compliant with military standards, procedures and CP organization

Additional benefits

- VV&A process could be more efficient if one common language is used for military experts to understand model’s behaviour based on formal inputs and outputs
- Simulated Forces can be substituted by a real force (vice versa) without any change or adjustment
- ...
QUESTIONS