Exchanging PMESII Data to Support the Effects-Based Approach (EBA) to Operations

Presenter

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The original document contains color images.
Outline

• Stability Operations
• Effects Based Approach to Operations
• Joint Consultation, Command and Control Information Exchange Data Model (JC3IEDM)
• State of the Art Simulations
• Illustrative Urban Scenario
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• Multinational Federation
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Introduction

Problem:

Today’s **virtual environments** focus chiefly on **attrition** and the causal effects associated with **kinetic interactions**.

Premise:

By using **simulations** to generate new data types that support **non-kinetic aspects** of Stability Operations (SO) and Effects-Based Approach (EBA), C4ISR developers can use this data for improving their components to better serve the **warfighter**.
Stability Operations

- Stability Operations (SO) are required, even after achieving political goals.

- Reconstruction
  - Provide security
  - Humanitarian assistance
  - Limited governance
  - Restore public services

- Goal: Facilitate transition to a local civil governance.
Today’s adversary is a dynamic, adaptive foe who operates within a complex, interconnected operational environment.
Effects-Based Approach to Operations

Changing the Way We Think ...

Objective

Destroy Global Terrorist Networks

Actions

Diplomatic
(build & sustain coalition)

Information
(“not a war on Islam” message)

Military
(remove Taliban regime)
(destroy terrorist cells)

Economic
(cut off funding)

Resources

Integrated DIME Actions

PMESII Elements

Effects

Key Elements & Vulnerabilities

What has to happen to Red to achieve Blue objectives
(no longer able to operate as an adaptive network with global reach)

Instruments of national power: DIME = Diplomatic, Information, Military & Economic
JC3IEDM

• JC3IEDM is an evolving data specification to enable information exchanges among national command and control systems.

• Represents years of data modeling efforts under the administrative management of the Multilateral Interoperability Program.

• JC3IEDM is the result of the merging of Command and Control Information Exchange Data model (C2IEDM) and the NATO Corporate Data Model (NCorpDM).

• Significance of JC3IEDM is highlighted as the U.S. Army recently adopted C2IEDM as the standard for information exchanges among command and control applications.

• Leveraging years of cooperation from among dozens of participating nations and organizations, JC3IEDM has the potential to become a truly robust information repository to support combined joint operations.
State of the Art Modeling

• Attrition simulations **synchronize** on causal effects to model conventional combat operations.

• Processes of acquiring and engaging entities in the virtual environment are modeled as independent and **explicit occurrences**, enabling a quantified comparison of engagement protocols.

• Military organizations and **civilian populations** are represented for target identification and measure effectiveness of **kinetic actions** against targets.

• **Behavior** of civilian populations and reactions of the population to kinetic actions are subject to an operator’s discretion.
State of the Art Modeling

- **Joint Semi-Automated Forces (JSAF):**
  - Federation of simulations, uses High Level Architecture (HLA).
  - **CultureSim:**
    - Light-weight model of movement in urban environment.
    - Pedestrians & vehicles.
  - **Dynamic Terrain Simulation (DTSim):** Collateral damage & building repairs.
  - **ModStealth:** 3D visualization.

- **SEAS: Synthetic Environments for Analysis and Simulation**
  - **Virtual International System (SEAS-VIS):**
    - Intra and inter-nation dynamics, leaders.
    - Citizens’ expectations, goals, and desires for well-being.
  - **Near Real-Time (SEAS-NRT):** Irregular actions of individuals.
Illustrative Urban Scenario

- Demonstrates that population mood and subsequent behavior are influenced by kinetic actions.
- Urban area was divided into two regions.
- People initialized as neutral with regards to both Foreign Security Forces (FSF) and insurgencies.
- Explosions caused building damage, representing local events that influence the population.
- Building repairs represent actions taken by military decision makers in support of SO.
- Population perceived all detonations and repairs as related to the presence of FSF.
- Civilian behavior surfaced in the formation of curious or volatile crowds.
Hostile Environment
Addressing JC3IEDM Taxonomy

• Within the JC3IEDM data specification, the **entity** is the basic concept.

• Different attributes among the 194 JC3IEDM entities allow them to be **distinguishable**, 15 are **stand alone entities** and are grouped into information concepts.

• Of the JC3IEDM’s **five fundamental information concepts**, two are central for discussions to extend the model for EBA:
  – Object-type
  – Object-item
Addressing JC3I EDM Taxonomy

Diagram showing the hierarchy of object types and item types, including:

- **OBJECT-TYPE**
  - **ORGANISATION-TYPE**
    - **PERSON-TYPE**
  - **MATERIEL-TYPE**
  - **FEATURE-TYPE**
  - **FACILITY-TYPE**

- **OBJECT-ITEM**
  - **ORGANISATION**
  - **MATERIEL**
  - **FEATURE**
  - **FACILITY**
Addressing JC3IEDM Taxonomy

• Associated with the measure of effectiveness for stability are seven normality indicators.

• Some of these indicators map directly to the JC3IEDM topic area of Environment Conditions – Civil.

• Within this topic area, there are several related IERs known as the Peacetime Support Operations that later evolved into the Crisis Response Operations (CRO).

• This set of IERs was created from the information exchange needs to coordinate and integrate the joint use of lethal and non-lethal assets, which extended earlier terrestrial-centric versions of the JC3IEDM like the C2IEDM.
Addressing JC3IEDM Taxonomy

- A taxonomy consists of a tree classification for an established set of objects usually starting at a single classification that relates together all other objects.

- Based on the identified need for CRO, the object-type can be considered the root node for extending the JC3IDEM from a kinetic to a non-kinetic realm.

- Since each CRO IER is supported by corresponding operational level message types, then these IERs serve as a method to exchange information on non-kinetic objects.

- Additionally, it is possible to relate selected object subtypes to the previously mentioned illustrative scenario and CRO IERs.
Addressing JC3IEDM Taxonomy

• JSAF represents the kinetic simulation aspects of the battle-space by rendering crowds that display well-being as either anger or curiosity.

• **Person-type** represents regional, ethics and demographic characteristics of populations, JC3IEDM can be a means to relate these characteristics to a virtual crowd.

• Since crowds’ respective moods can be visualized in a virtual environment, then the region’s general state of well-being can be inferred by inspection.

• Crowd formations can be identified under the organization-group to provide indicators of potential demonstration or riot formations due to the leaders influence and the mood of the region.

• Thus via a combination of object-type specifications can capture simulation generated data that models different types of population groups and their perceived well-being.
Addressing JC3IEDM Taxonomy

• Simulations can generate visual cues to emulate battle-field assessments of the progress of actions to achieve that desired end state.

• Many of these EBA assessments can be transmitted via the reporting-data and its subtypes specification that captures temporal status updates and the reporting source information.

• The observed well-being of a region is not easily transmitted via the reporting-data specification in the JC3IEDM.

• A method to display perceived well-being is the user graphics attributes as specified in the feature-type specification.

• User graphic features, such as lines and overlays with differentiating color shaded regions, can capture simulation generated data.
Addressing JC3I EDM Taxonomy
Multinational Federation

• A major J9 experiment to investigate EBA was Multinational Experiment 4 (MNE4).

• MNE4’s aim was to explore concepts and supporting technologies for EBA within a coalition environment involving SO with increasing levels of violence to assist the development of future processes and tools at the operational level of command.

• Simulating the characteristics and traits of battle-field entities was necessary to enable the stimulation of C4ISR systems.

• Simulations parsed data into structured messages formats to emulate unit location and status reporting by stimulating the Common Operational (COP).

• Web-enabled components of the Global Command and Control System (GCCS) allowed remote international users situational awareness and situational understanding (SA/SU).
Multinational Federation

• **Four constructive simulations** provided the MNE4 virtual environment:
  – Previously mentioned kinetic JSAF and non-kinetic SEAS
  – France’s ALLIANCE (Application Logciele InterArmees Nationale pour l’entainement Au Commandement d’un Engagement militare)
  – Germany’s JOANA (Joint Operations Army, Navy, Air Force).

• **ALLIANCE, JOANA and JSAF used bridges** to send emulated message traffic to the GCCS server.

• All three kinetic simulations stimulated **GCCS with OTH-Gold reports while a JSAF bridge (JLVCDT) generated TADIL-J detentions**.

• **Track management occurred** to correlate the various tracks at the GCCS server called **TOPCOP**.
Multinational Federation
Exchanging Commander’s Intent

- MNE4 simulations sent free text message associated with the reporting features of the respective simulation entities.

- JSAF implemented this feature after the operator fills out the mission attribute option via the JSAF Plan View Display (PVD).

- JSAF orders assigned to a simulation entity were passed as free text messages through the JLVCDT to become viewable in the GCCS/WebCOP remarks field of the respective track.

- ALLIANCE and JOANA had a similar capability to report commander’s intent via their respective bridges to GCCS.

- These free text messages were viewed as a means to communicate commander’s intent via the C4ISR displays which were stimulated by the M&S.
Exchanging Commander’s Intent
Exchanging Commander’s Intent
Exchanging Commander’s Intent
Future Work

• Potential to do more complex population modeling by providing a means to relate an insurgent population’s characteristics to the number of human generated intelligent reports, and the impact of leaders on the general public mood.

• Extending the refugee and displaced persons camp representations in JOANA to allow regional leaders to be influenced by the media’s reporting of the perceived camps’ frustration level based on shortages.

• Combine the capabilities of the JC3Iedm and Coalition –Battle Management Language, the resultant may actually evolve into a multinational knowledge base of the future.

• Serve as a standard to allow other technologies canvas the world's media and C4ISR sources to dynamically capture cultural information.
Conclusions

- **Agent-Based simulations** may be useful to evolve the **taxonomy** of the JC3IEDM to further the advancement of JC2 IERs.

- Proposed extensions to the JC3IEDM can tie **commander’s intent to tracks** in a web-enabled C4ISR environment, and help to assist in **visualizing regions** that non-kinetic effects are occurring.

- **Normality indicators** not currently support by current day C4ISR systems can be investigated using M&S to help identify and prioritize, and the JC3IEDM has the extensibility to support these investigations.

- **JC3IEDM** can assist in evolving **multinational knowledge bases**.

- A closer **relationship between M&S and C4ISR** can assist in evolving systems that provide greater SA/SU for the warfighter, and the JC3IEDM may help to foster that tie leading us closer to the realization of a **GIG enabled environment**.