



Integrating Air and Ground Operations Within a Common Battle Management Language

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Overview

- What is BML
- Need for a BML
- Project Overview
- Air Operations Extension
- C2DIF
- Integration Into Existing Ground Ops BML
- Alternatives
- Demonstration Overview
- Example

BML

- BML = Battle Management Language
- Command and Control
- State of the Art
 - Human-to-human language
 - Essence of Orders and Operation Plans often in the FREETEXT section
 - Lack of data standards coping with new requirements
- Where do we want to go
 - Digitised system
 - Automated systems consuming information (not simply data)
 - Data/Information oriented communication

Problem

- All simulation and C4I systems has a BML
 - Each is specific to that system
 - Some are integrated, not interoperable
 - An Enterprise Application Integration versus an Interoperable Solution
 - Leads to $\Sigma(N-1)$ Solutions
 - Does not scale
 - A common vocabulary must be based on common definitions



AO XBML Project Overview

- Begin with existing Ground Operations focused BML Effort
- Include Air Operations
- Must be C2IEDM capable
- Must use Web Services for Transport
- Prototype must be demonstrated
- XML Schema (XSD) to be published in DoD Repository



• AO XBML Requirements

- Establish an Air Operations oriented common command language for use by any system within the domain
- Simulations and C4I Systems need an Air Battle Plan processor.
- Providing a Usable Standard would allow an ABP processor to be employed by many systems
- Keyword is Usable



• Participating Organizations

- Alion Science and Technology
- Atlantic Consulting Services Inc (ACS)
- Virginia Modeling And Simulation Center (VMASC)
- George Mason University
- Gestalt LLC
- Northrop Grumman



• Air Operations Extension

- Begin with C2DIF (Command and Control Data Interchange Format)
- AO XBML - Includes the Following Categories
 - Air Battle Plan (ABP)
 - Air Tasking Order (ATO)
 - Airspace Control Order (ACO)
 - Special Instructions (SPINS)
- BML – Air Missions
 - Realistic Routing
 - Rear Area
 - Threat Area
 - Rules of Engagement (SPINS)



Example - ATO Ambiguity

AMSNLOC/START/STOP/LOCATION NAME/ALTITUDE/PRIORITY/LOCATION

ATO Snippet:

```
/-/-/DEPLOC:KSTN/ARRLOC:KSTN AMSNDAT/4560/-/-/CAS//  
MSNACFT/1/OTHAC:XAV8B/BUTTERCUP36/BEST/-/35636//
```

```
AMSNLOC/181445ZJUN/181615ZJUN/ECHO9/280//  
Go to ECHO9, Select your own point of entry
```

```
AMSNLOC/181445ZJUN/181615ZJUN/ECHO9/280-/LATM:3510N07901W//  
Go to ECHO9, Enter at this Lat/Long (Minute)
```

```
AMSNLOC/181445ZJUN/181615ZJUN/ECHO9/280-/LATM:3510N07901W/  
LATM:3512N07901W/...//  
ECHO9 is being redefined
```

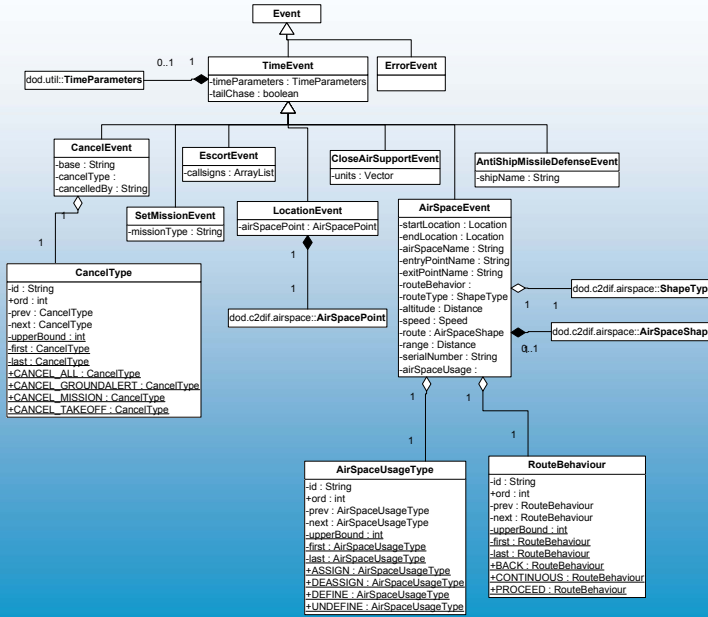
```
AMSNLOC/181445ZJUN/181615ZJUN/ECHO9/280-/LATM:3510N07901W/  
LATM:3512N07901W//  
Go to ECHO9, Enter at 1st point, Lat/Long (Minute), Exit at Second
```



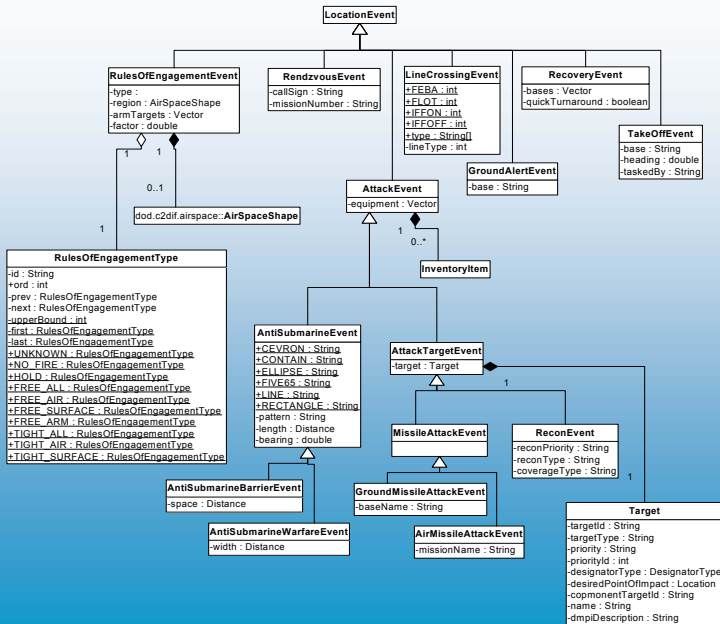
C2DIF – Command and Control Data Interchange Format

- Definition begun in 1998 with TBMCS Interface
- Need to isolate gateway from externally, little controlled changing systems
- Began with an analysis of existing simulations and C4I systems
 - Simulations
 - JTLS, AWSIM, NASM, JWARS, ENWGS, and RESA
 - C4I Systems
 - TBMCS, CTAPS
- Analysis uses spreadsheets to capture data requirements for air mission tasking
 - Separate sheets distilled to one
 - UML Class Diagram developed

AO XBML Class Diagram – 1 of 2



AO XBML Class Diagram – 2 of 2



Integration Into Existing BML

- Previous BML Effort – Defined the 5 Ws
 - Who, What, When, Where, Why
- Focused on the US Army OPORD
- Analysis of C2DIF determined that the 5Ws concept could be adapted to the Air Mission
- A common methodology, a common syntax and semantics, seems to be feasible.
- Service unique characteristics
- For SISO's Coalition BML efforts, Nationally unique characteristics must be taken into account.
- BML must be flexible enough to accommodate these differences

• Alternative Considered #1 Service Specific BMLs

- Each Service would define its own BML and XML vocabularies for command
 - The situation that exists with the current XBML effort
- Disadvantages:
 - Separate Web service for each XBML dialect
 - Greatly increase the maintenance effort for each system as well as serve to fragment the offerings, creating barriers to adoption
- Advantages
 - Each Web service would have be more responsive to the domain represented by the military Services

• Alternate Considered #2 Joint Common BML

- A Common BML and XML Schema developed
 - Used across commands and environments with extensions where needed
 - Similar to the approach in the C2IEDM
 - The goal is to create an abstraction that will allow as many tasks as possible to be completely described and remain usable to as broad an audience as possible.
- Advantages:
 - The ability to coordinate across Service elements
 - Single Web Services Created for all Service command vocabulary
- Disadvantages:
 - Would not be as responsive to service changes as service specific vocabularies

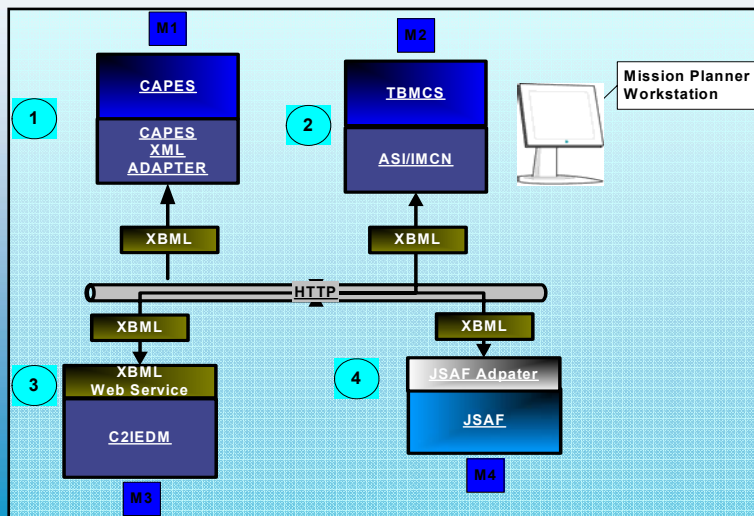
• Alternate Considered #3 - Native C2IEDM

- Use the C2IEDM schema natively for BML and the associated XML messages.
- Replace the 5 Ws with standardized data elements described in the C2IEDM.
- Advantages:
 - A great deal of coordination that has already occurred in developing the C2IEDM
 - Active configuration control process in place.
- Disadvantages:
 - The use of C2IEDM data elements must be accompanied by the extension and enhancement of the model must reach consensus among the 27 nations supporting C2IEDM.
 - Current implementations utilizing a relational databases which exchange data using a database replication mechanism.
 - Adds technical constraints and a somewhat inflexible data protocol.
 - C2IEDM provides an abstracted view of C2 data that comprises entities, actions and relations.
 - Elegant but difficult model to understand and thus demands a high degree of skill to use.

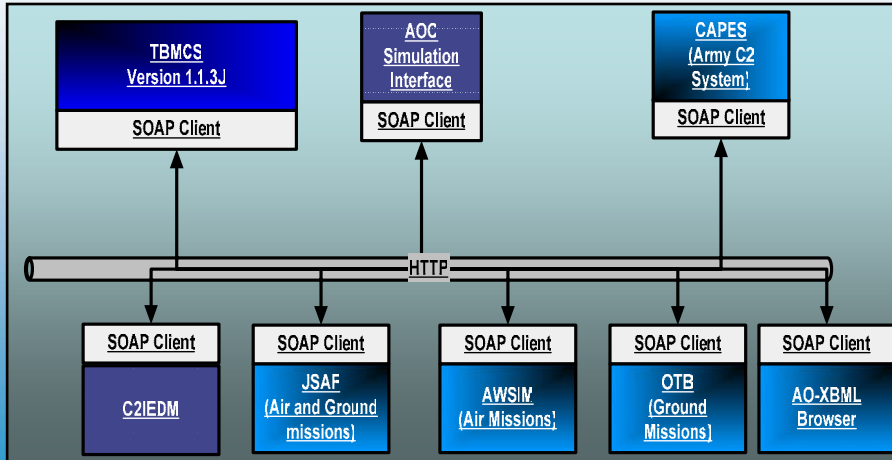
- Selected Approach
Joint Common BML

- The approach selected uses the 5Ws approach
- The constructs can be directly mapped to the language familiar to the warfighter
- Understood more easily by the engineers
- However, by mapping these elements to the standardized elements of the C2IEDM, we avoid the danger of setting up a new language independent of already accomplished agreements

ITSEC 2004 Demonstration Overview



JATTL Lab Demonstration Overview



ABP Map – C2IEDM

TO Be added

Summary

- C2 information must be represented at three levels
- Each level capable of being mapped into the next level down:
 - The C2 *ontology*, which at present takes the form of human knowledge, but in the future is likely to be formalized in a standardized fashion. There is still much work to be done in this area
 - The *unambiguous human and software interface* provided by BML itself, used wherever it is necessary to communicate with the warfighter. This is the current focus of the SISO working group.
 - The *system interface data model*, used for universal communication across system boundaries, for which the most evident candidate is the C2IEDM.