

## **Joint Battle Management Language (JBML) – US Contribution to the C-BML PDG and NATO MSG-048 TA**

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## **Who is Part of JBML Phase I**

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- Dr. Stan Levine, GMU, Project Manager
- Dr. Michael Hieb, GMU, Technical Lead
- Dr. Andreas Tolk, ODU, Standards Lead
- Dr. Harry Keeling, HU, Testbed Lead
- Mr. John Roberts, ACS, Ground Lead
- Mr. Curt Blais, NPS, Maritime Lead
- Mr. David Perme, Gestalt, Air Lead
- Mr. John Kearley, DRC, Scenario Lead
- Ms. Shea Smith, JATTL, JFCOM Coordinator

## Presentation Outline

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- History of JBML / Relation to other BML Efforts
- JBML Architecture
  - Layers of JBML Services
  - BML Domain Configured Services
  - BML Base Services
  - BML Common Data Access Service
- Results
- Contributions to C-BML

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## History of JBML

Relationship to other BML Efforts

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## Objective of Current Efforts

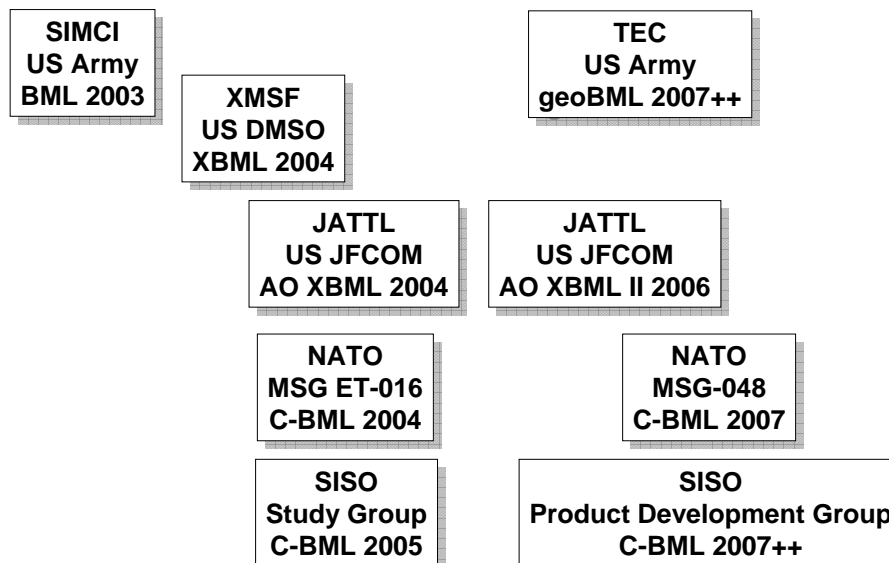
- Build and demonstrate
  - an initial Joint Battle Management Language Capability
  - to transmit Digital Orders to Joint (and Combined) Forces
  - using a Battle Management Language Specification

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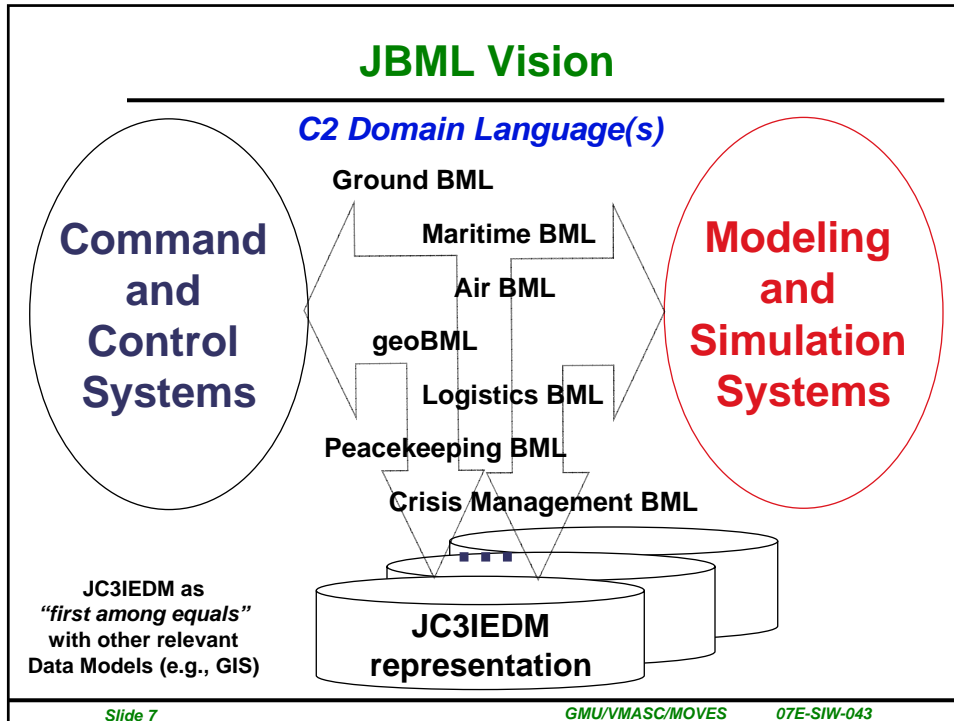
## Genealogy of JBML



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- ## Tasks in JBML
- 
- Develop an initial Joint BML capability for
    - Ground BML
    - Air BML
    - Maritime BML
 in one common language
  - Define this common Language with several (Service specific) interoperating domains
    - Common components for shared information
    - Service-specific components for unshared information
    - Shared common controlled vocabulary (based on the JC3IEDM definitions)
    - A Lexical grammar constraining the structure
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## JBML Architecture

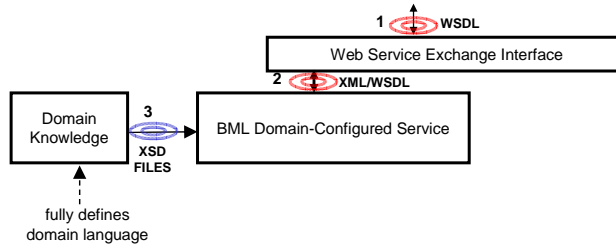
Layers of JBML Services  
BML Domain Configured Services  
BML Base Services  
BML Common Data Access Service

## Earlier C-BML Recommendations

- Web Services for C-BML Protocol
- JC3IEDM for C-BML Representation
- Grammar to capture C-BML Doctrine
- Ontology to capture C-BML Doctrine
- Layered Web services
  - Atomic web services for propertied concepts (tables)
  - Composite web services for associated concepts (view, transactional)
  - Aggregate services for system access (data mediation)

**JBML supports these ideas and modifies them to fulfill the objectives of the project**

# JBML Service Architecture

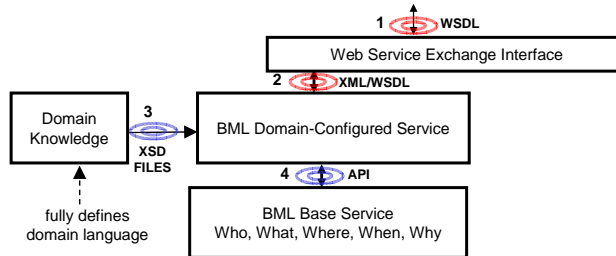


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# JBML Service Architecture

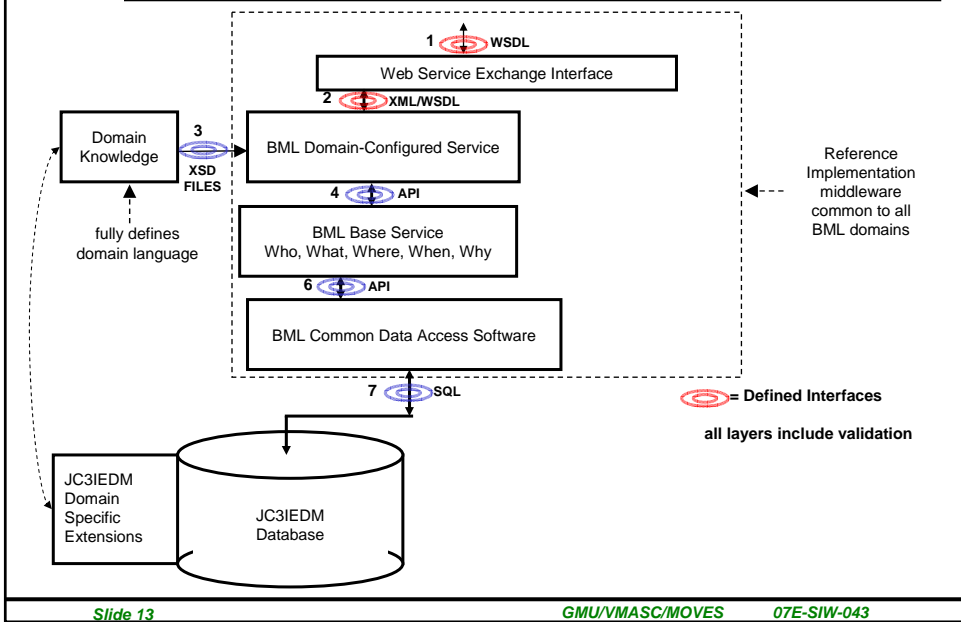


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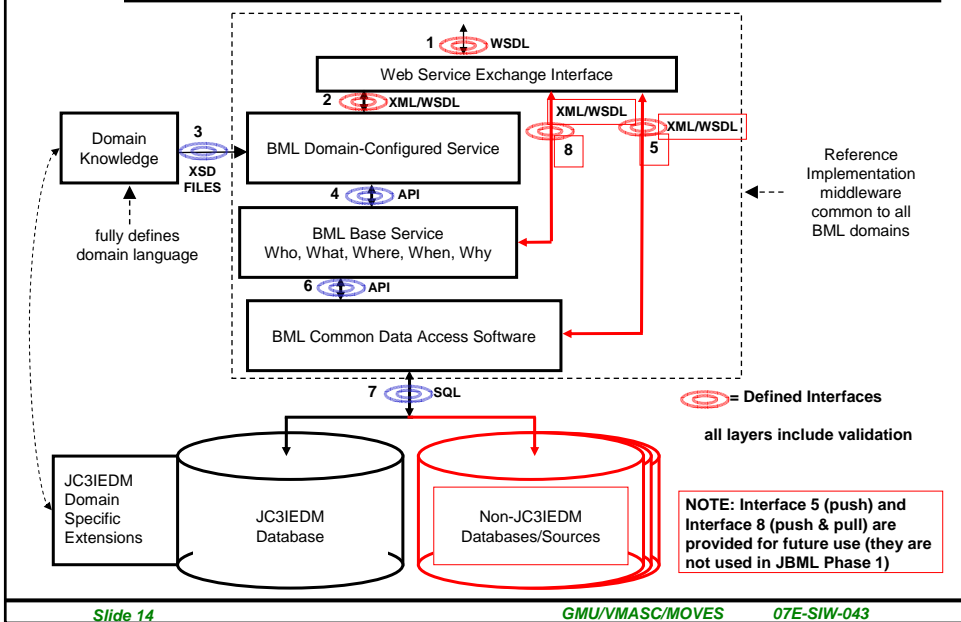
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# JBML Service Architecture



# JBML Service Architecture



## Web Service Overview

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- The **BML Domain Configured Services (DCS)** represent the domain-specific language in form of schemas, inspired by grammar-based research, that are implemented by Web services
- The grammar uses the **BML Base Services (BBS)** which represents the information element groups that are necessary to specify the information objects of interest, such as the 5Ws (who, what, where, when, why) and other constructs of interest
- The lowest layer represents the information exchange of information elements. This layer is normally hidden from the user. In JBML, these are **BML Common Data Access Services (CDAS)**

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## BML Domain Configured Services (DCS)

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- The DCS is implemented in the Document-Literal mode by a generic Web service that is driven by an XML schema
- The initial lexical grammar used is formally described in terms of a number of primitives, that are labeled with
  - <task> (verb)
  - <tasker-who>
  - <taskee-who>
  - <affected-who>
  - <what> (action)
  - <where>
  - <start-when>
  - <end-when>
  - <why>
  - <label>
  - <modifier>
- These primitives are represented in the BML Base Services
- The Domain knowledge produces
  - the XML file defining the DCS information
  - extensions to representing data models (such as JC3IEDM)

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## XSD Joint Task Type

```
<xsd:complexType name="TaskType">
  <xsd:choice>
    <xsd:element name="GroundTask"
      type="GroundTaskType"
      minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="AirTask"
      type="AirTaskType"
      minOccurs="0"
      maxOccurs="unbounded"/>
    <xsd:element name="MaritimeTask"
      type="MaritimeTaskType"
      minOccurs="0"
      maxOccurs="unbounded"/>
  </xsd:choice>
</xsd:complexType>
```

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## XSD GroundTaskType

```
<xsd:complexType name="GroundTaskType">
  <xsd:sequence>
    <xsd:element name="TaskeeWho"
      type="WhoType"/>
    <xsd:element name="What"
      type="GroundBMLWhatType"/>
    <xsd:element name="Where"
      type="WhereType"/>
    <xsd:element name="StartWhen"
      type="WhenType"/>
    <xsd:element name="EndWhen"
      type="WhenType"
      minOccurs="0"/>
    <xsd:element name="AffectedWho"
      type="WhoType"
      minOccurs="0"/>
    <xsd:element name="Why"
      type="GroundWhyType"
      minOccurs="0"/>
    <xsd:element name="Label"
      type="LabelType"/>
  </xsd:sequence>
</xsd:complexType>
```

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## BML Base Services (BBS)

- BBS provides **composite BML elements** – such as Who, What, When, Where, and Why – as primitives to the DCS
- Other elements may be introduced for new and existing BML domains as required
- The BBS accesses all of the database tables relating to the composite elements through software that implements the Common Data Access Services
  - Mapping between BBS data elements and CDAS data elements
  - Data mediation – where needed – within the implementing web services
- The standard at this layer will identify the **information objects exposed by the database tables** to be updated for each BML information element and the validation conditions to be applied

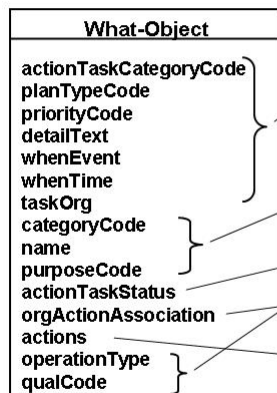
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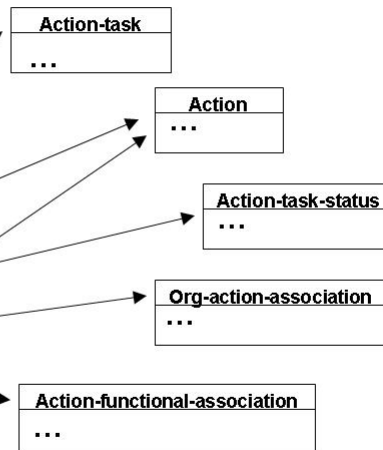
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## XBML Example of Mapping

### BML What Object



### C2IEDM Tables



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## Common Data Access Services (CDAS)

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- Provide a mechanism for the BBS to both read and update the database tables directly
- For testing and debugging purposes, an inspection mode is implemented
- Generic web service for data access
  - Parameter: table name and attributes
  - Advantage of generic service
    - Efficient access to the JC3IEDM database
    - No updates needed if data model is extended
  - Disadvantage of generic service
    - Data validation only at higher layers
    - Can't provide JC3IEDM interface without database
- Use of database supports asynchronous access (good for development) but precludes faster synchronous C2-simulation connect

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## JBML Data Representation

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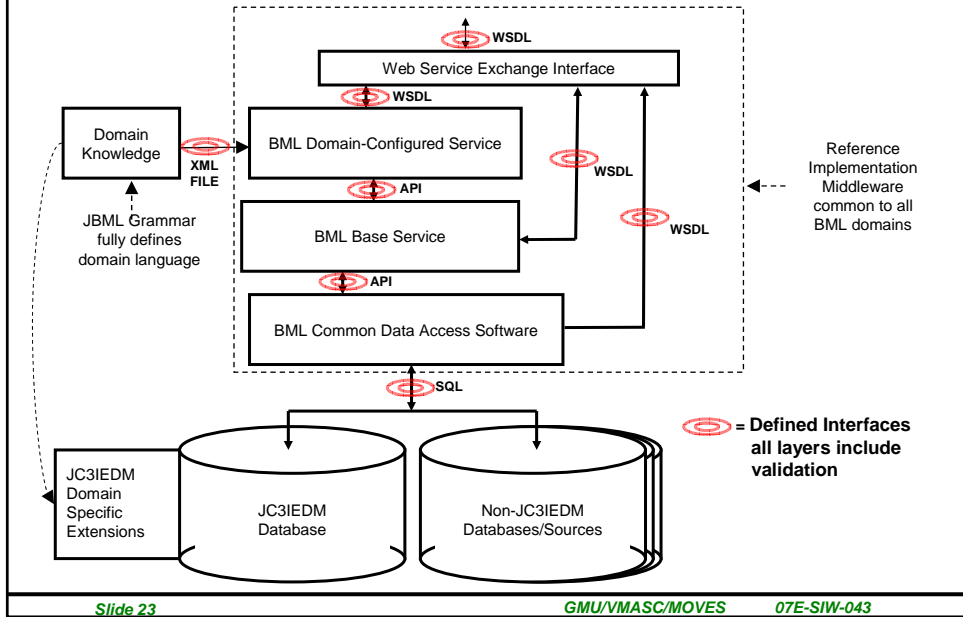
- Joint Command, Control and Consultation Information Exchange Data Model (JC3IEDM)
- Extensions and Enhancements derived from the Domain Knowledge
- Additional operationally relevant data models – such as used within Geospatial Information Systems – may be used in addition to the JC3IEDM
- BBS collective update of all tables associated with a given business object (who/what/when/where/why etc) via CDAS ensure consistency
  - Don't allow BBS transactions to be interleaved – can result in inconsistent database state
  - If update is impossible, roll back to original state

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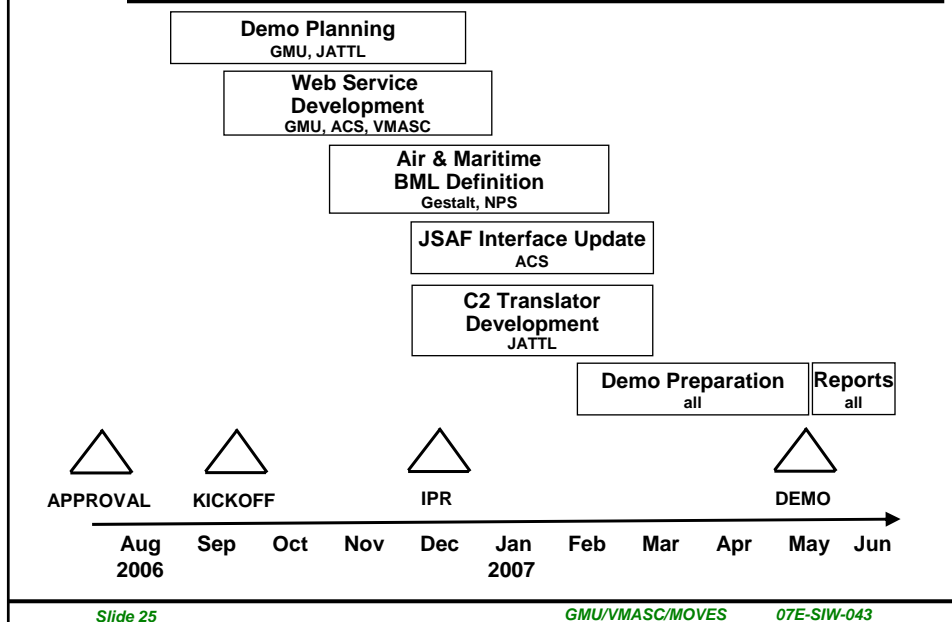
# JBML Service Architecture



## Results

Where are we  
Where do we want to go

## JBML Phase 1 Plan



## Demo Concept of the Operation

- **Army** units proceed through **Urban Areas**, seizing designated objectives and destroying enemy forces, in order to reestablish an international border.
- They are preceded by:
  - **Navy** and **Air Force** strikes on key C2 and communication nodes
  - Close Air Support strikes
  - Pre-planned Navy Tomahawk strikes

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## JBML Demonstration Scenario

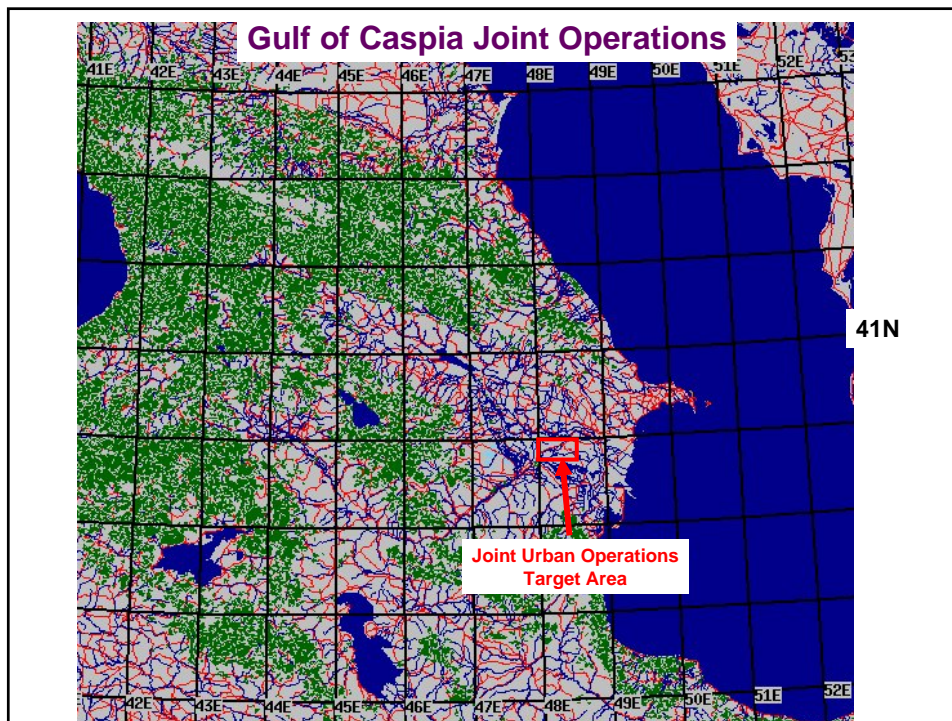
### CJTF-CS Joint orders to component commanders

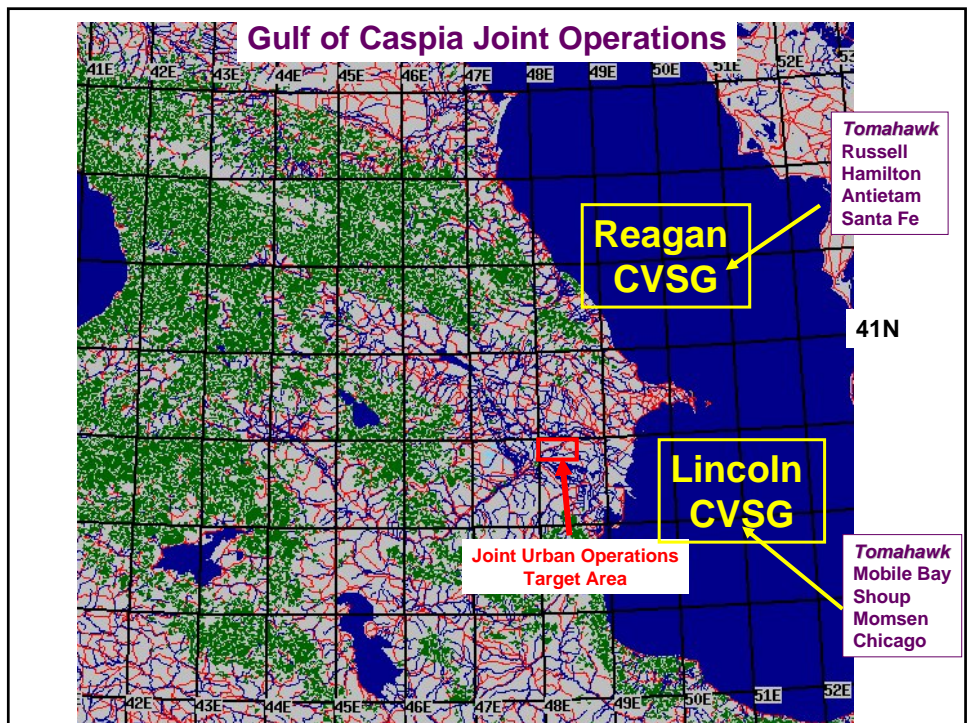
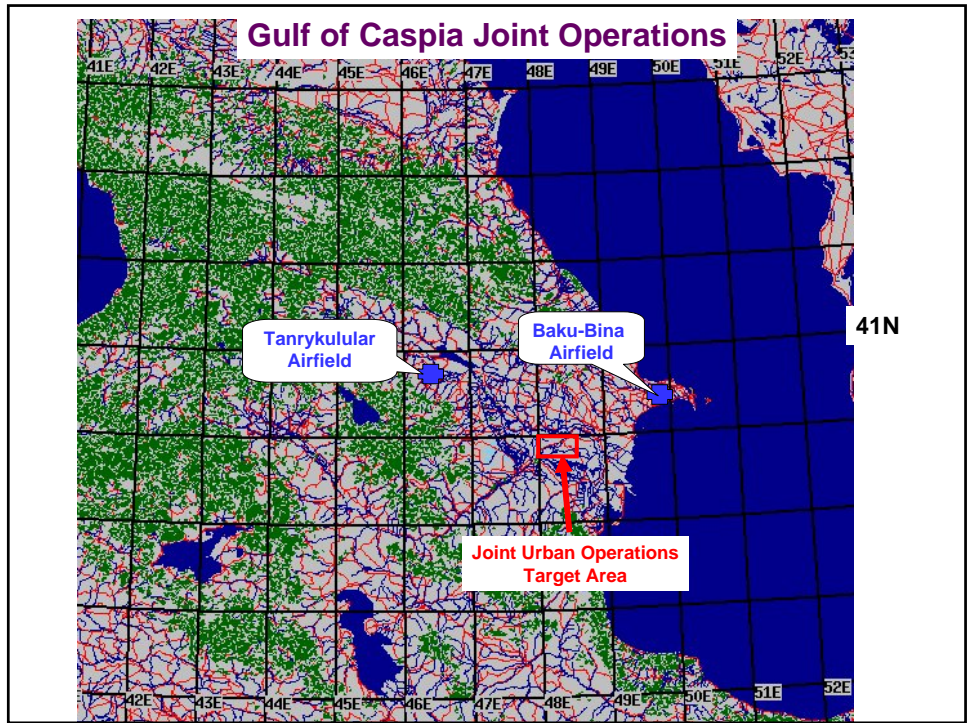
- JFLCC as supported commander directs:
  - 2nd ID to conduct major ground operations:
    - 1-66 CAB to re-take strategic towns, airfields, railheads, and restore border
  - JFACC will conduct offensive operations:
    - Deep strike
    - Close air support
  - JFMCC will conduct offensive operations:
    - Provide forces (air and cruise missile) to JFACC for deep strike, close air support

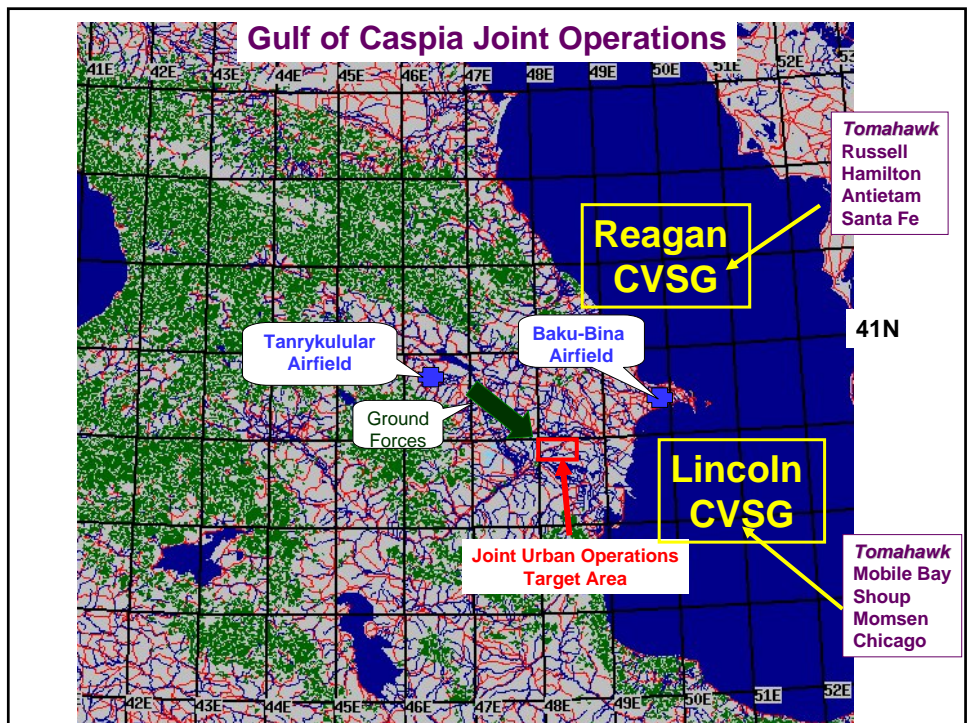
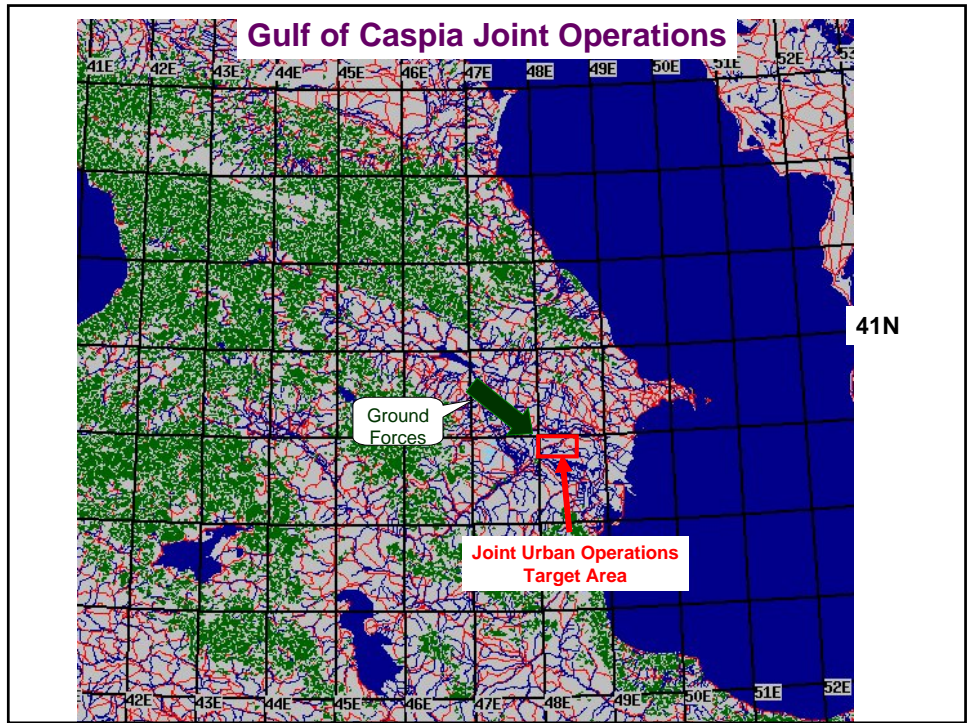
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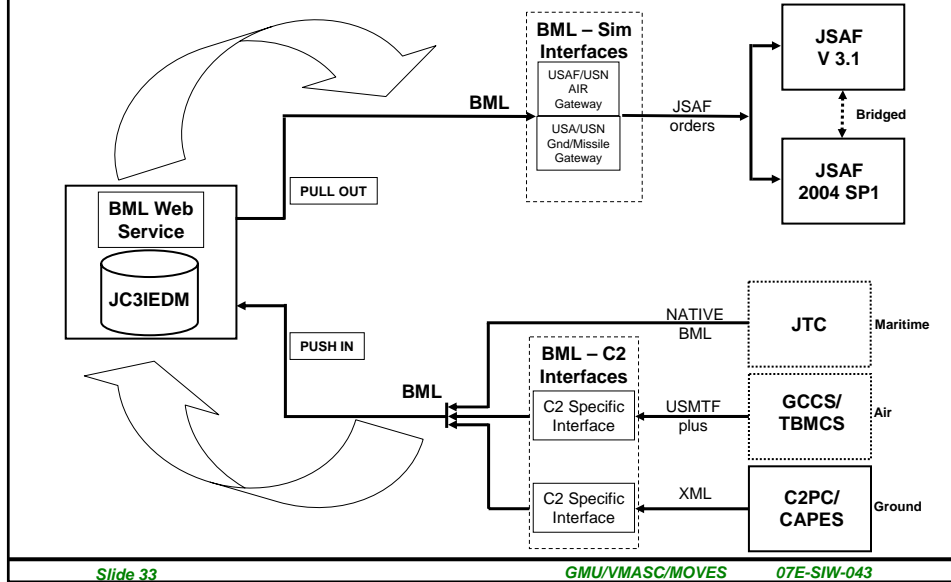








## JBML Demo Environment



## JBML Follow-on Phase 2

- Phase 2
  - Basic Capability for Joint Operations
    - Adequate Land/Littoral/Sea/Air for exercises
    - Initial PMESII support
    - Two-way flow between C2 and Simulation
  - Evolving standards process
    - First balloted C-BML standard
  - Proof of Principle for NATO

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## Summary

### Contributions to C-BML

## What can C-BML get from JBML

- The immediate contribution of the JBML project to C-BML is the service architecture
- The JBML architecture will provide a regular and extensible framework upon which a powerful, flexible and growing family of standards can be created
- Contributions on all identified layers
  - Primitives of the DCS
  - BBS as applicable in the SISO context and
  - CDAS (potentially with transient implementations)
  - Recommended extensions and alternative data models
- JBML Web services are open source

## Web Service Infrastructure

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- The JBML Web services are available as experimental infrastructure to create a reference implementation of C-BML
- While JBML is designed to exchange information with C2 systems and simulations at the top (DCS) layer, we recognize that C-BML needs to offer flexibility of interfacing
  - Comply with standard by interfacing at any layer
- The JBML Web services therefore will be configurable to expose all three layers
  - Can be configured (and, if necessary modified) to create a reference implementation at every layer

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## Questions

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