Representing Geospatially Enabled Command and Control (C2) Information within the JC3IEDM

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Abstract - **The transition to Commander-centric network-enabled Command and Control (C2) is well underway within the US Army and Department of Defense (DOD). The foundation of this approach is an information superiority-enabled concept of operations that describes the way U.S. forces organize and fight in the information age. The idea is to translate this information superiority into combat power by effectively linking friendly forces within the Battlespace, providing a much richer shared awareness of the situation, and enabling more rapid and effective decision making. In order to achieve this type of capability, reliable connectivity must be established among the various types of digitized C2 systems, sensor systems, communications systems, and communications networks. This, however, will only provide half of the required solution. Just as important as connectivity is to this concept is the ability of these systems to discover, consume, understand, and act upon this mission-relevant shared information. This requires that interoperability specifications and standards be established to facilitate shared information understanding among the services, their warfighter domains, and the plethora of disparate digitized systems and networks that constitute the current battlefield.**

One such area of applicable research involves the integration of geospatial analysis with Army planning and decision making. The purpose of this paper is describe work focused on bringing tailored, actionable geospatial information into the hands of the warfighter using the Joint Consultation, Command and Control Information Exchange Data Model (JC3IEDM). The U.S. Army Geospatial Center (AGC) is sponsoring an ongoing effort to develop products and a framework for transforming the volumes of data produced by terrain teams and sensors into information products and tactical decision aids to provide a deeper understanding of the battlefield and including terrain and weather effects. As part of this work a common underlying data representation has been developed and demonstrated as a means of harnessing the analytical power of Geographic Information Systems (GIS) and presenting this information to the Warfighter in terms that he can more easily apply to the battle command process. The paper will provide a description of this underlying geospatially enabled C2 representation.

I. Introduction

The transition to Commander-centric network-enabled Command and Control (C2) is well underway within the US Army and Department of Defense (DOD). The foundation of this approach is an information superiority-enabled concept of operations that describes the way U.S. forces organize and fight in the information age. The idea is to translate this information superiority into combat power by effectively linking friendly forces within the Battlespace, providing a much richer shared awareness of the situation, and enabling more rapid and effective decision making. In order to achieve this type of capability, reliable connectivity must be established among the various types of digitized C2 systems, sensor systems, communications systems, and communications networks. This, however, will only provide half of the required solution. Just as important as connectivity is to this concept is the ability of these systems to discover, consume, understand, and act upon this mission-relevant shared information. This requires that interoperability specifications and standards be established to facilitate shared information understanding among the services, their warfighter domains, and the plethora of disparate digitized systems and networks that constitute the current battlefield.

The U.S. Army Geospatial Center (AGC) located at Fort Belvoir, VA has been working in this problem area for several years, with a focus on the integration of geo-spatial analysis with Army planning. This paper describes work that involves bringing tailored, actionable geospatial information into the hands of the warfighter using the Joint Consultation, Command and Control Information Exchange Data Model (JC3IEDM). Section two provides background on the AGC work and the origins of the geo-spatial information products known as Tactical Spatial Objects (TSOs). Section three defines a TSO including a three tiered classification scheme. Section four identifies how TSO products are made available to the warfighter via the JC3IEDM. Section five describes the details of how a TSO is represented within the JC3IEDM. Section six presents summary and conclusions, and section seven identifies references.

II. Background

An AGC sponsored effort, the Battlespace Terrain Reasoning and Awareness – Battle Command (BTRA-BC) Advanced Technology Objective (ATO) program involves providing products and a framework for transforming the volumes of base data produced by terrain teams and sensors into information products and tactical decision aids to provide a deeper understanding of the battlefield including terrain and weather effects. This is accomplished by harnessing the geo-processing algorithms and libraries that reside within the

Commercial Joint Mapping Toolkit (CJMTK). A common underlying data representation developed as part of the prototype demonstration environment for the BTRA-BC ATO is the Geospatial Battle Management Language (GeoBML). The concept was formulated as a means of harnessing the analytical power of Geographic Information Systems (GIS) and presenting this information to the Warfighter in terms that he can more easily apply to the battle command process.

GeoBML is an extension of the more operationally focused Battle Management Language (BML) into the domain of actionable geospatial information. BML is defined as the unambiguous language used to command and control forces and equipment conducting military operations and to provide for situational awareness and a shared, common operational picture. The goal of BML is to enhance and enable Army Battle Command Systems (ABCS) capabilities to align with emerging concepts of the Unified Battle Command (UBC) strategy as follows: create a clear, unambiguous language that supports communications between humans, automated systems and future robotic forces; improve commander and battle staff training on ABCS by reducing the training "overhead;" and facilitate planning and decision support using automated C2 tools.

GeoBML extends BML into the geospatial domain to fulfill the need of moving from raw terrain data to information through recognition of potentially useful geospatial data products and invoking corresponding BTRA-BC developed applications or engines to generate them. These actionable geospatial products are known as TSOs and provide a means of encapsulating engineered knowledge in a way that is understandable and usable by the decision maker. TSOs are linked to military operational tasks and take into account the effects of terrain and weather by turning raw data into knowledge about the battlefield. These TSOs are defined by subject matter and operational experts grounded in military doctrine and can serve as the basis for further terrain analysis by other specialized BTRA-BC tools and as the final result to be linked back into the operational and tactical domain.

III. Tactical Spatial Object

As mentioned above, the term TSO was established as part of the GeoBML work. TSOs are actionable geospatial products that provide a means of encapsulating operational engineered knowledge in a way that is understandable and usable by the decision maker. A TSO is formally defined as an analytical geospatial object extracted from terrain feature data described in tactical terms of military aspects of terrain that directly supports the planning and execution of tactical military operations. TSOs are meant to be linked to military operational tasks taking into account the effects of terrain and weather thus turning raw data into knowledge about the battlefield. They are defined by subject matter experts (SMEs) in the operational domain and are grounded in military doctrine. They serve as the basis for detailed terrain analysis that is part of the overall military planning process. Currently there are three classifications or tiers of TSOs defined:

Tier 1 – Represents the general military value of the terrain and weather based on doctrinal principles of obstacles, avenues of approach, key terrain, observation and fields of fire, and cover and concealment (OAKOC). They are based mainly on terrain and can be pre-computed without mission-specific input, independent of other factors of Mission; Enemy; Terrain and Weather; Troops; Time and Civil considerations (METT-TC). Examples of Tier 1 TSOs include Maneuver Networks, Cover and Concealment and Choke Points.

Tier 2 – Are derived from the foundational data and/or from analysis of Tier 1 TSOs. They represent a set of candidate products and are associated with specific missions and tasks, by unit type and echelon and require METT-TC context. They are more tightly integrated with the tasks that are required to support the unit's mission or operations and are generated when that information becomes available or is further refined. Examples of Tier 2 TSOs are Attack by Fire Positions, Battle Positions, Engagement Areas, etc.

Tier 3 - Are increasingly mission and task focused while also accounting for specific friendly and enemy situations and are generally associated with a specific unit accomplishing a specific task. In many cases, they have been chosen from Tier 2 candidate TSOs and further refined based upon METT-TC. They contain operational attributes, such as a specific unit and time to execute, as well as supporting geospatial analysis and information, and they represent a command decision. It may also include an associated graphic control measure.

IV. TSO Reference

As the initial design for representing TSO products was developed back the 2006 – 2007 timeframe and the initial prototype implemented it became clear that the Tier 1 and Tier 2 TSO products were potentially very large and would be most efficiently stored within a geospatial database rather than an operational database. As a result it was determined to store a reference to the actual TSO product in the operational database, initially the Command and Control Information Exchange Data Model (C2IEDM) and most recently, the JC3IEDM. This reference would provide information about the TSO including a pointer to the actual TSO product itself. In developing the TSO reference concept, the characteristics of Tier 1, Tier 2, and Tier 3 TSO products were examined and a core set of attributes were defined applicable to all three tiers. These core attributes have been defined from a user's perspective and not necessarily from a database representation perspective. Table I provides a listing of the core set of attributes that define a TSO reference. The table includes attribute name, description, and a data type.

TABLE I TSO CORE ATTRIBUTES

Attribute Name	Description	Data Type
TSOUniqueID	Unique identifier for TSO ref	string
RefNumber	TSO type identifier (e.g., 10xx for Tier 1; 20xx for Tier2, etc.)	int
GeographicArea	lat/lon coordinates of polygon covering the TSO product	list of floats
Version	TSO engine version for product	string
CreationTimpStamp	Date/time the TSO was created	string
ExpirationTimeStamp	Date/time the TSO expires	string
Description	Text string describing the TSO	string
StoredLocation	Path to SDE container/workspace	string
DataSetName	SDE tablename(s)/featureclass(s)	string
DataSetDisplayName	Datasetname text description(s)	string
POCOrganization	Organization generating TSO	string
POCName	Individual generating TSO	string
POCAddress	Address of Organization	string
POCPhone	Contact phone number	string
ConfidenceFactor	Measure of the goodness for TSO (methodology TBD)	string
SecurityClassification	TOS security classification	string
Keywords	0 or more TSO keywords	list of strings

The majority of the core attributes listed in table I represent data or sets of data that can be mapped into existing JC3IEDM structures and concepts or can be easily added. The keywords attributes however, presents a bit more of a challenge. The idea is to be able to associate zero or more descriptive words with a given TSO product. It is likely that these keywords will vary not only from TSO type to TSO type, but also among individual TSOs. As such it is not possible at this time to generate a predetermined list of keywords that could be represented as a set of enumerated values. The details of the proposed implementation for representing the keywords attribute are found in section five.

In addition to the core set of attributes listed in table 1, there was also a requirement to associate certain TSO specific metadata with these products based on their type. This metadata serves to more uniquely specify and/or classify the TSO product being referenced. The list of possible metadata attributes will be based on the TSO engine type and identified by the engine developers. The metadata will take the form of a zero or more attribute and value pairs. Representing the metadata presents a similar problem to that of the keywords attribute in that it is likely that these metadata attributes will be unknown a priori as many of the TSO engines are currently in development or planned for the near future. As of the writing of this document, no metadata attributes have been identified for the existing or under development TSO engines. The details for the proposed implementation for representing TSO unique metadata are similar to that of the keywords core attribute and are found in section five.

V. JC3IEDM IMPLEMENTATION

As mentioned earlier, the very first implementation of a TSO was done using the C2IEDM in 2006 – 2007 as the JC3IEDM was still new on the scene and still evolving. At that time it was determined that a TSO should be stored as a CONTROL-FEATURE object as this seemed to be the entity type that most closely reflected a TSO. During the prototyping process as the definition and potential uses of TSOs began to crystallize it became apparent that representing a TSO as a control feature was going to be too limiting. Through analysis it was determined that Tier 1 TSOs were very large and complex objects requiring storage in a geo-spatial database in order to achieve any kind of reasonable performance. In a similar manner, it was determined that Tier 2 TSOs were less complex but still quite large in size. These observations led to the conclusion that the Tier1 and Tier2 TSO products were too large and complex for the operational database (i.e., C2IEDM/JC3IEDM), but rather a reference to TSO that included descriptive information and a pointer to TSO product be stored within the operational database as metadata.

Upon detailed analysis of the JC3IEDM v3.x data model it became clear that a number of modifications had been made to better facilitate the BML representation as well as in the area of storing reference type information. In the JC3IEDM versus the C2IEDM, the concept of a Reference has been greatly expanded and has the following definition:

Identification of a record of information [1]

The JC3IEDM documentation provides examples that seem to indicate that a Reference is an appropriate way to store any external source of information. In addition the REFERENCE table does actually contain many of the TSO reference core attributes identified above which are also included within the Department of Defense (DOD) Metadata Specification (DDMS) [2]. The implementation design for the TSO reference was therefore updated to use the REFERENCE table as the primary location for storing a TSO reference.

Table II lists all the attributes included in the JC3IEDM REFERENCE table including data type and data format as obtained from the JC3IEDM v3.1b documentation [1]. The first three columns identify the attribute name, data type and basic format. The fourth column shows the mapping from JC3IEDM attribute to TSO Reference core attribute.

Unfortunately, the REFERENCE table alone does not account for representing all of the TSO Reference core attributes. The proposed implementation involves the creation of a new JC3IEDM table, the TSO-REF table as a subclass of REFERENCE. This table would contain attributes only applicable to a TSO reference. In this case the TSO-REF table will be used to store TSOUniqueID, the RefNumber of the TSO, and the ConfidenceFactor attribute value. Table III lists all the attributes included in the new TSO table plus data type and corresponding TSO Reference core attribute.

TABLE II JC3IEDM REFERENCE TABLE

JC3IEDM Table Attribute	Data Type	Format	TSO Ref Attribute
reference-id	Long	Numeric	
reference-approval-datetime	string (len 18)	Datetimefield	
reference-content-category-code	string (len 6)	Enumeration	
reference-creation-datetime	string (len 18)	Datetimefield	CreationTimeStamp
reference-description-text	string (len 255)	Alphanumeric	Description
reference-electronic-source-text	string (len 50)	Alphanumeric	
reference-file-size-quantity	Int	Numeric	
reference-format-text	string (len 50)	Alphanumeric	
reference-language-code	string (len 6)	Enumeration	
reference-lifecycle-code	string (len 6)	Enumeration	
reference-medium-type-code	string (len 6)	Enumeration	
reference-originator-text	string (len 50)	Alphanumeric	
reference-physical-size-text	string (len 50)	Alphanumeric	
reference-primary-location-text	string (len 50)	Alphanumeric	StoredLocation
reference-publication-datetime	string (maxlen 18)	Datetimefield	
reference-releasability-text	string (len 50)	Alphanumeric	
reference-short-title-text	string (len 50)	Alphanumeric	DataSetDisplayName
reference-title-text	string (len 50)	Alphanumeric	DataSetName
reference-transmittal-type-code	string (len 6)	Enumeration	
reference-validity-period-begin-datetime	string (len 18)	Datetimefield	CreationTimeStamp
reference-validity-period-end-datetime	string (len 18)	Datetimefield	ExpirationTimeStamp
reference-verification-code	string (len 6)	Enumeration	
reference-version-text	string (len 50)	Alphanumeric	Version
security-classification-id	Long	Numeric	

TABLE III TSO-REF TABLE

JC3IEDM Table Attribute	Data Type	TSO Ref Attribute
tso-ref-id	Long	
tso-ref-unique-id	string (len 50)	TSOUniqueID
tso-ref-reference-number	string (len 4)	RefNumber
tso-ref-confidence-factor	string (len36)	ConfidenceFactor

As mentioned in section four, there will be TSO type specific metadata that must be stored with the TSO reference. For the reasons mentioned earlier the TSO specific metadata attributes will not be known a priori and the implementation must be able to account for this. Therefore the approach involves creation of an additional JC3IEDM table associated with the TSO-REF table. The new table, TSO-REF-METADATA, will store each of the metadata attribute value pairs and associate each entry with the corresponding TSO reference object found in the TSO-REF table. Table IV lists the attributes for this table including the data type and corresponding TSO reference attribute.

TABLE IV TSO-REF-METADATA TABLE

JC3IEDM Table Attribute	Data Type	TSO Ref Attribute
tso-ref-id	Long	
tso-ref-metadata-ix	Long	
tso-ref-metadata-attribute-name	string (len 50)	metadata/keyword name
tso-ref-metadata-attribute-value	string (len 50)	metadata/keyword value

The tso-ref-id will provide the association to the TSO-ref table. The tso-ref-metadata-ix identifies the index of each attribute-value pair for a given TSO reference object. The metadata attribute and value will be stored in the tso-ref-metadata-attribute-name and tso-ref-metadata-attribute-value attributes respectively.

Fig. 1 illustrates the relationship between the existing JC3IEDM REFERENCE table, and the proposed new JC3IEDM TSO and TSO-SPECIFIC-ATTRBUTE tables.

A. *GeographicArea Attribute*

The geographic area core attribute provides a list of latitude & longitude coordinates defining a polygon where the TSO product falls within (i.e., bounding box). For the JC3IEDM implementation a CONTROL-FEATURE object will be used to represent the polygon. The OBJECT-ITEM-REFERENCE-ASSOCIATION table will then be used to associate the CONTROL-FEATURE object with the REFERENCE object representing the TSO reference. The actual latitude & longitude coordinate pairs will be stored in the GEOGRAPHIC-POINT table.

B. *DataSetName Attribute*

The DataSetName core attribute is used to store a list of one or more SDE Table Names or Feature Classes associated with the TSO Product. In the case where there are multiple Feature Classes within a TSO product, these individual feature classes will also be stored as REFERENCE objects in addition to the TSO reference object itself. Each feature class REFERENCE object will then be associated with the primary REFERENCE object representing the TSO reference via the REFERENCE-ASSOCIATION table.

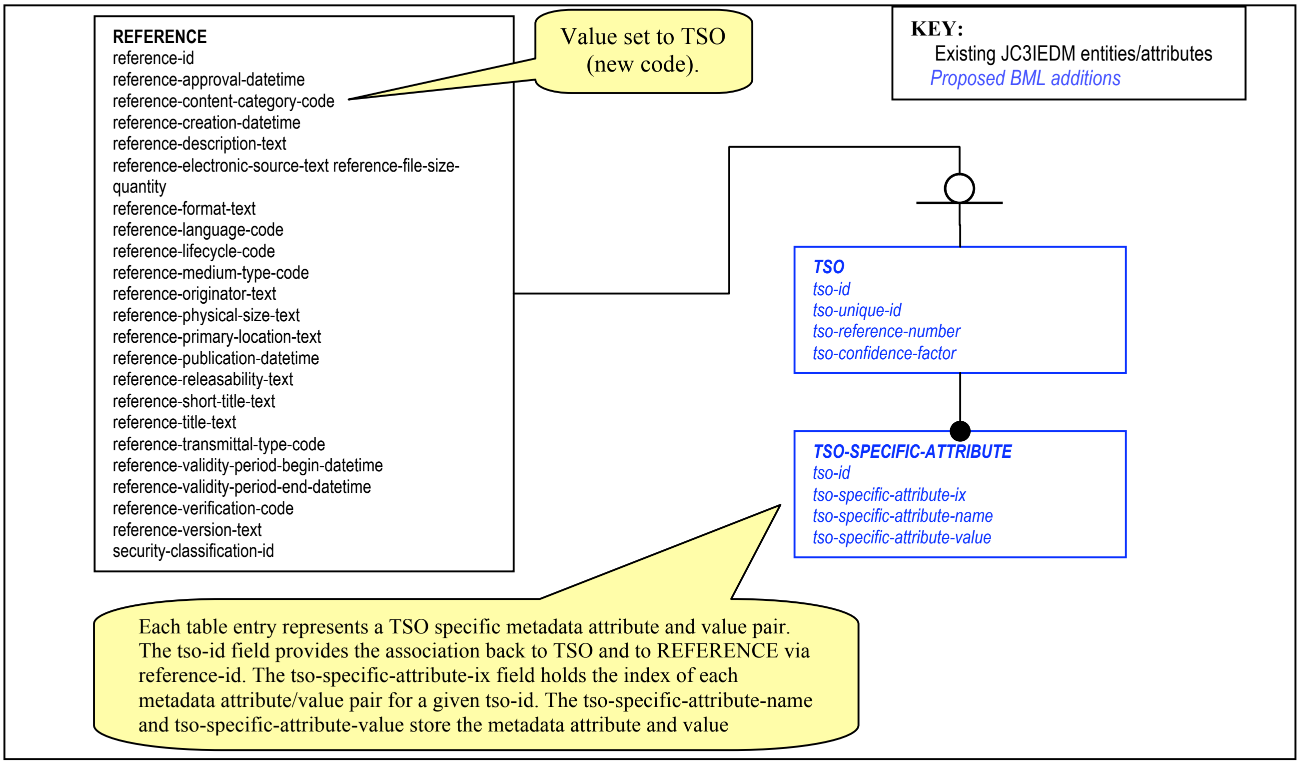

Fig. 1. Representing TSO Reference in JC3IEDM

C. Point-of-Contact Information

There are a number of TSO core attributes that provide the ability to store point-of-contact (POC) information about the originator or creator of TSO Reference. This information includes the originators name, the associated organization, address, and contact telephone number. Table V provides the mapping from the four TSO core POC associated attributes to their corresponding representation in the JC3IEDM.

TABLE V POC ATTRIBUTE MAPPING

TSO Core Attribute	JC3IEDM Representation	
	Table	Attribute
POCOrganization	OBJECT-ITEM	object-item-name-text
POCName	OBJECT-ITEM	object-item-name-text
POCAddress	PHYSICAL-ADDRESS	physical-address-street-text
	PHYSICAL-ADDRESS	physical-address-postal-box-text
	PHYSICAL-ADDRESS	physical-address-city-text
	PHYSICAL-ADDRESS	physical-address-postal-code-text
POCPhone	ELECTRONIC-ADDRESS	electronic-address-name-text

It should be noted that even though POCOrganization and POCName are both shown as being represented by the object-item-name-text attribute in the OBJECT-ITEM table, they are stored in separate OBJECT-ITEM objects with associations back to the TSO Reference object. For the POCName value, the OBJECT-ITEM object is associated directly with the REFERENCE object via the OBJECT-ITEM-REFERENCE-ASSOCIATION table. The POCOrganization value is stored within a separate OBJECT-ITEM object that is associated with the POCName value object via the OBECT-ITEM-ASSOCIATION table.

D. Security Classification Attribute

The security classification core attribute will be stored in the SECURITY-CLASSIFICATION table in the security-classification-level-code field. The REFERENCE table does provide a security-classification-id field however; the actual security classification value cannot be stored here as this provides the association to the SECURITY-CLASSIFICATION table where the details about the classification would be stored.

E. Association of a TSO with Plan/Order

Another aspect involving the GeoBML concept and TSO reference involves associating a TSO product reference with a Plan or Order. This type of capability would be used for instance in the case where an event on the battlefield affected the situation and/or terrain in such a way as to require a TSO product to be regenerated. The idea is then to provide notification to all users of any plans or orders associated with that TSO.

While this is not explicitly represented as part of the TSO core attributes, a methodology has been developed to provide the capability. The PLAN-ORDER-COMPONENT-CONTENT-REFERENCE table will be used to provide the association between PLAN-ORDER and REFERENCE. Fig. 2 illustrates how this association will be represented within the JC3IEDM.

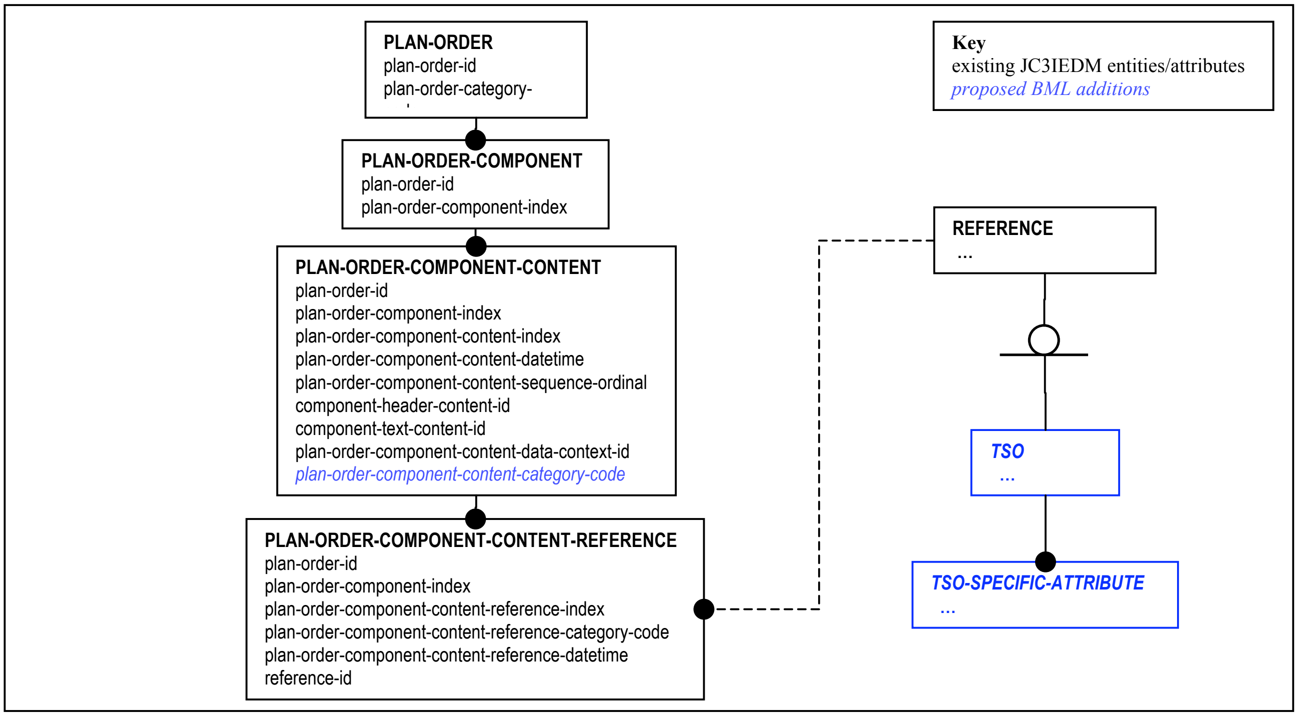

Fig. 2. TSO to Plan/Order Association Representation in JC3IEDM

IV. Demonstration Environment

The use of the TSO representation was demonstrated in an operational context as part of a GeoBML demonstration environment under the BTRA-BC program. The demonstration environment consists of a test bed with three primary components: BML, C2, and BTRA prototype. The BML portion is composed of the BML Web Service providing the business logic for accessing the various BML and GeoBML objects (i.e., order and TSO references) that are stored within an underlying operational database, the JC3IEDM. The BML component also includes a notification service providing for asynchronous messaging and a simulation interface for execution and monitoring of the stored plans and orders. The C2 component consists of a surrogate C2 system providing the means to graphically and textually construct operational plans and orders, monitor execution, and request and display TSOs. The BTRA prototype component serves as the environment for the invoking the TSO engines which are designed to run asynchronously based on TSO product requests from the C2 surrogate. The TSO products themselves are stored within the spatial database engine (SDE) geo-database and reference information associated with TSOs is stored within the JC3IEDM and is accessible through a discovery within the environment via the BML Web Service. Fig. 3 shows the GeoBML Demonstration Environment.

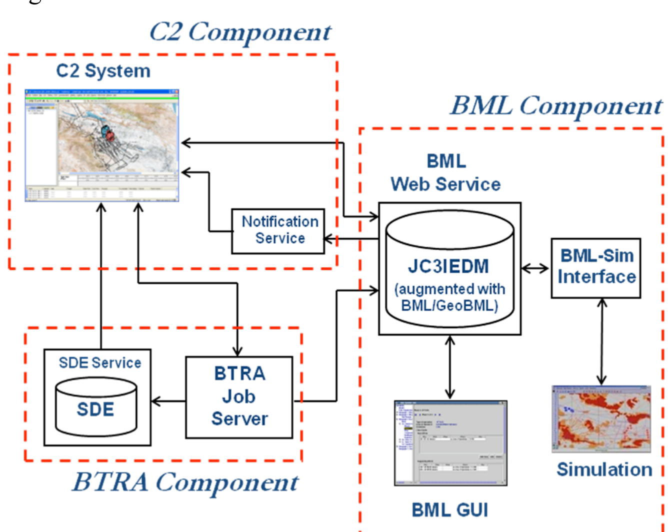

Fig. 3. GeoBML Demonstration Environment

The GeoBML concept has been demonstrated on a number of occasions using the environment shown in fig. 3. The demonstrations have been operationally focused to highlight the use and utility of TSOs within the Army planning process at the echelons of brigade and battalion. The demonstration thread begins with the brigade headquarters receiving notification that a division warning order (WARNO) has been issued. The brigade element retrieves the WARNO from the JC3IEDM via the BML Web Service. The WARNO includes information about the task organization and the area of interest or 'playbox' where the unit will be operating. Given this information the brigade level planner would query for any Tier 1 products available for this area and display them as overlays on top of map display provided by the CSE. These Tier 1 products serve to assist the planning staff with the Initial Preparation of the Battlefield (IPB). Once the division Operations Order (OPORD) has been issued the brigade staff follows the same procedure to retrieve the actual order from the JC3IEDM and begins Course of Action (COA) development and analysis using the CSE. It is during this process that the planners adjust the task organization, create control graphics and assign tasks to subordinate units in order to accomplish their mission.

To facilitate this process the planning staff can request Tier 2 TSOs be developed. For example, the planner may decide he needs to determine possible attack by fire (ABF) or support by fire (SBF) positions for a particular COA. Through the CSE, he can make a request to the BTRA component to invoke the appropriate BTRA engine and create the TSO. As the TSOs are generated they can be displayed on the CSE as potential candidate areas or locations for the COA with an evaluation of their goodness in relation to each other based on their characteristics (e.g., location with respect to objective, fields of fire, cover and concealment, access, etc.). The planner then selects the candidate that he feels best suits his needs, taking into account all aspects of METT-TC. This candidate is then associated with the particular COA as a Tier 3 TSO. Upon completion of the planning process and the COA selected, the brigade order is generated and exported to the JC3IEDM via the BML Web Service including the appropriate links to the TSO references used to create the order. This process is then repeated at the battalion level resulting in the corresponding battalion orders.

V. Summary And Conclusions

Based on initial prototyping and experimentation in this area, it appears there is great value in trying to integrate geospatial analysis with the military planning process to better equip the warfighter for the twenty-first century battlefield. As the network centric concept matures and these capabilities continue to make their way into emerging C2 systems, the potential to overwhelm the users and decision makers with large volumes of data and increased analytic power and bandwidth becomes much greater. Therefore a challenge now facing the military is to determine how to pre-process and transform this low level raw data into more abstract information products that will assist the commander and his staff to better understand the situation.

BTRA-BC is one such program that is focused on determining how to use the power of GIS analytics to take the sheer volume of geospatial data and upgrade its quality and understandability while decreasing its size. AGC has leveraged the intent of BML, an unambiguous language for communicating plans and orders among decision makers and automated C2 based systems, to develop a complimentary capability to integrate geospatial with planning via GeoBML. What the original BML did not have was a clear way to handle geospatial data and the TSO has emerged as a mechanism for bringing geospatially enabled C2 to the warfighter.

The initial implementation of this capability used the C2IEDM as the underlying data store and focused on representing a TSO as a CONTROL-FEATURE. Through a series of prototyping iterations that served to evolve the TSO concept and the realization of the size and complexity of the Tier 1 and Tier 2 TSOs, it was determined that a reference to the TSO and not the product itself should be stored within the operational database. A re-evaluation of the implementation design based on the JC3IEDM data model coupled with the specification of a core set of common TSO reference attributes resulted in a new design centered upon representation of the TSO within the REFERENCE table. The new design included the addition of several new tables in order to accommodate the concept of associating keywords and TSO specific metadata with the reference.

As this effort continues to move forward, the TSO concept will continue to evolve. It is anticipated that further definition and refinement of the Tier 3 TSO will be among the items to be addressed in the near term. A Tier 3 TSO is intended to represent a military decision based on a set of candidates within a Tier 2 TSO. It is therefore envisioned that a Tier 3 TSO would consist of appending or associating certain geospatial information used in making the decision to the corresponding graphical control measure (GCM) or feature stored within the JC3IEDM as part of the plan or order. For example, the GCM for an ABF position could include geospatial information linking it to an associated objective area (OBJ) or engagement area (EA). Exactly how this is to be done will have to be determined. A new cooperative research and development effort between AGC and ESRI known as the Geospatially Aware Battlefield Object (GABO) has shown some promise in this area. The effort involves allowing objects (e.g., GCMs) to have various sets of data or information associated with them and carry this information as they are distributed as part of a plan, order or other communications.

During FY08, project personnel initiated contact with the US JC3IEDM CIG to describe the BML/GeoBML concept and begin coordination for possible inclusion of this work as part of the standard JC3IEDM. Several BML specific extensions were proposed and accepted for inclusion within the current US JC3IEDM standard. A portion of the on-going GeoBML work will be to continue to work with the CIG to incorporate the GeoBML extensions for representing TSO references as part of the US JC3IEDM standard.

During analysis phase of the transition to the JC3IEDM, it was discovered that there were no provisions for representing the idea of metadata. As military digitized C2 system capabilities continue to mature, it would seem appropriate for the US and Coalition countries to consider how to incorporate metadata into the current and future JC3IEDM data model.

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