C2IEDM DOCUMENTATION

The entire documentation for GH6 (officially known as C2IEDM Edition 6.1) is available from the public part of


Specifically:
http://www.mip-site.org/MIP_Specifications/Baseline_2.0/C2IEDM-C2_Information_Exchange_Data_Model/
Preliminary Remarks

- **ER Data models**
  - Provide semantics and syntax (foundation for data interoperability)
  - Can not prevent meaningless data entry by humans – this is role for applications

- **C2IEDM (a.k.a. Generic Hub--GH)**
  - Information exchange focus
  - Balance between 'meta-model' and specific data domain model
  - Fixed 'grammar', extensible vocabulary (enumerations)
  - Battlefield Objects (FACILITY, FEATURE, MATERIEL, ORGANIZATION, PERSON)

Abstraction

```
EQUIPMENT-TYPE
- equipment-type-id
- equipment-type-category-code
- equipment-type-loaded-weight-quantity
- equipment-type-unloaded-weight-quantity
  - equipment-type-category-code

LAND-WEAPON-TYPE
- land-weapon-type-id (FK)
- land-weapon-type-category-code
- land-weapon-type-subcategory-code
- land-weapon-type-calibre-text
- land-weapon-type-fire-guidance-indicator-code
```
Extending Vocabulary

```xml
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    ...
</xs:element>

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            <xs:enumeration value="MATING"/>
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            <xs:enumeration value="HASIHL"/>
            <xs:enumeration value="HANDEL"/>
            <xs:enumeration value="MAGZNE"/>
            <xs:enumeration value="MSCLNE"/>
            <xs:enumeration value="XYZ"/>
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    </xs:simpleType>
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Extending the Core

Diagram showing relationships between equipment, land weapon, and armoured vehicle types.
As part of operation Bravo-11, it is my intent to capture all the paramilitary facilities within a half-a-mile radius of downtown Fallujah. Operations will start at 0500 on 20FEB04. The mission will be a joint one with participation of USMC MEUs, US Army Rangers, and a small contingent of SOF units. The total duration of the mission is estimated to be 3 hours.

It is the goal to minimize all casualties, particularly civilian ones and to maximize the capture of both intelligence materials as well as Al-Qaida operatives.

The element of surprise is essential. However, large caliber weapons will be positioned at strategic locations to suppress armed resistance that cannot be handled by the units directly involved in the capture of the facilities.

A back-up CAS mission is also foreseen, as well as the availability of medical units and helicopters for evacuation of wounded combatants. Intelligence reports indicate that the enemy does not have weapons larger than RPG's and machine guns (AK-47's)—i.e., no mortars, or armor vehicles.
Bravo-11

- Preposition heavy artillery
- Insert SOF Units at Point A
  - Move to Building D9
  - Secure Building D9
  - Provide Enemy Unit Location
- Move Army Ranger Units to western city limit
  - Move MEU 1 to southern city limit
  - Secure city sector 1
  - Capture enemy
  - Collect Intel materials
  - Secure city sector 2
  - Capture enemy
  - Collect Intel materials
- CAS

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</tr>
<tr>
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<td>ACTTA</td>
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<td>3500003</td>
<td>ACTTA</td>
<td>Insert SOF Units at Point A</td>
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<tr>
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<td>ACTTA</td>
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<td>ACTTA</td>
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<td>ACTTA</td>
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<td>ACTTA</td>
<td>Move Army Ranger Units to western city limit</td>
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<td>ACTTA</td>
<td>Secure city sector 1</td>
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<td>ACTTA</td>
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As part of operation Alpha01 consisting on creating a minefield the following actions have been specified:

The principal action is “Create minefield” (Action 7), which includes several sub-actions: “Carry out reconnaissance” (Action 8—Do recce, for short), “Move stores” (Action 9), “Lay minefield” (Action 10), and “Mark minefield” (Action 11). Action 9 cannot start until Action 8 is completed, Action 10 cannot start until Action 9 is at least partially completed, and so on. Although specific times are shown in the figure for purposes of illustration, there is also a need to specify temporal relationships in a relative way without recourse to a clock. Even tough shown, the reader should assume that the time scale is no longer marked. One may wish to begin the sub-ACTION “Move stores” (Action 9) 60 minutes after the start of action “Create minefield” (Action 7). “Lay minefield” (Action 10) is to start 60 minutes after “Move stores” (Action 9). The final illustrated action “Mark minefield” (Action 11) is referenced for its start to Action 10 and its conclusion to Action 7.
ACTION ASSOCIATIONS (2)

**ACTION**
- action-id
- action-category-code
- action-name

**ACTION-TEMPORAL-ASSOCIATION**
- action-temporal-association-subject-action-id (FK)
- action-temporal-association-object-action-id (FK)
- action-temporal-association-index
- action-temporal-association-category-code
- action-temporal-association-reference-duration

**ACTION ASSOCIATIONS (3)**

**ACTION**
- action-id
- action-category-code
- action-name

**ACTION-TEMPORAL-ASSOCIATION**
- action-temporal-association-subject-action-id (FK)
- action-temporal-association-object-action-id (FK)
- action-temporal-association-index
- action-temporal-association-category-code
- action-temporal-association-reference-duration
Alternative representation of the temporal relations among sub-actions for operation Alpha01:

The simplest method of establishing temporal ACTION dependency is through the use of absolute time when such specification is appropriate. In this method, the absolute start and end times are specified in ACTION-TASK so that the subtasks are carried out in the correct sequence. Action 7 is to start at the same time as Action 8 [(011200 Jan 93)]; 9 is to start when 8 finishes [(011300 Jan 93)]; 10 is to start 1 hour after 9 starts and finish 2 hours and 30 minutes after 9 ends; and finally, 11 is to start 3 hours after 10 starts and is to end at the same time as Action 7.

<table>
<thead>
<tr>
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</tr>
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<td>At</td>
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<td>150000</td>
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<td>At</td>
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</tr>
</tbody>
</table>

Note: "*" stands for "action-task."
Two military units, code named 2RTR and 1 R IRISH respectively are performing reconnaissance in their assigned area of operations. 2RTR estimates that (1) the enemy unit began breaching the minefield (Activity 20) at 0700, and (2) that it will complete the breaching at 1100 on 01 Jan 93. 1 R IRISH estimates that (3) at 1000 on 1 Jan 93, the enemy unit had 70 percent completed the ACTION-TASK of breaching the minefield.
An ACTION-EVENT is an ACTION that is an incident, phenomenon, or occasion of military significance which has occurred or is occurring but for which planning is not known. This entity is intended to capture actions that simply occur and need to be noted because they are of military interest.

During the period beginning in 1994 until end of October 2003 there have been reports that include religious violence, disruption of communications, one earthquake, an incident pertaining to arms trade among two of the local warlords, a drought in the northern part of the country, one border incursion by paramilitary forces in the region close to the sea, a successful coup d’etat by the local strongman, and an amphibious operation by forces loyal to the deposed leader.
OBJECTIVES and RESOURCES
During operation Sandblast one of the participating British units, code name 1 RHA, has been classified as being of type *UK Fd Arty Rgt*. In addition, one enemy unit, the 6 Guards Tank Division, was originally classified as an *OR Armd Rgt*. At a later time it has been reported as being of type *OR Armd Div*. Lastly, an enemy vehicle has been tracked by friendly Unit A. Due to inclement weather conditions the first report could only assess it as a vehicle without further characterization. Further analysis indicated that it was some type of armored vehicle. A later detection confirmed it to be a tank. This classification was refined to make it a main battle tank. The last report from Unit A now shows it to be a T72.
1. As part of operation Bronze Shield six actions have been defined, OP GOLD 1 (Action 1), OP GOLD 2 (Action 2), OP GOLD 3 (Action 5), OP GOLD 4 (Action 5), OP LEAD 1 (Action 3), and OP ZINC 1 (Action 4). The 52 Inf Div is allocated as an ACTION-RESOURCE to execute Action 1 (defend Control feature 'Steel') between 011200 Aug 94 and 071400 Aug 94. The 1 (US) Corps is allocated as an ACTION-RESOURCE to execute Action 2 (destroy 6 Guards Tank Division) between 020500 Aug 94 and 061200 Aug 94. The 1 R Irish is allocated as an ACTION-RESOURCE to execute Action 3 (defend Hill 126) between 020200 Aug 94 and 071400 Aug 94. The 2 RTR is allocated as an ACTION-RESOURCE to execute Action 4 (constitute a reserve for 52 Inf Div) between 020230 Aug 94 and 071400 Aug 94. The 1 RHA is allocated as an ACTION-RESOURCE to execute Action 5 (move to Hameln) between 011000 Aug 94 and 011800 Aug 94 using Route Valkyrie. The 3 GE Recce Bn is allocated as an ACTION-RESOURCE to execute Action 6 (secure Route Club) between 010300 Aug 94 and 011800 Aug 94.
As part of the same Bronze Shield operation, the following objectives have been specified:

**Action 1** (52 Inf Div (M) defend) has as its objective the defense of River Weser (which coincides with Control Feature “Steel”). The ACTION is to ensure no enemy penetration and is to be completed by 1400 hours on 7 Aug 94. **Action 2** (1(US) Corps destroy) is focused against 6 Guards Tank Division. The ACTION is to achieve destruction of the enemy. **Action 3** (1 R IRISH defend) has as its objective the defense of Hill 126. The ACTION is to be completed at the same time as Action 1. **Action 4** (2 RTR constitute a reserve) involves placing 2 RTR in reserve to 52 Inf Div (M). **Action 5** (1 RHA move to) is to move to Hameln. The ACTION is to be completed by 1800 hours on 1 Aug 94. **Action 6** (3 GE Recce Bn secure) is to secure Route Club. The ACTION is to be completed at the same time as Action 5.
It should be noted that in C2IEDM the structure ACTION-EFFECT permits the capture of information about effects of ACTIONS on objects that are not necessarily the objectives of the ACTION. It also permits the effects of an ACTION to be reported in terms of OBJECT-ITEMs or OBJECT-TYPES other than those designated as ACTION-OBJECTIVEs. For example, the task may have been specified as that of destroying enemy main battle tanks (OBJECT-TYPE) in a certain area (CONTROL-FEATURE). The reporting under ACTION-EFFECT could cite the number of main battle tanks destroyed; however, it could also say (if such information is known) that the effectiveness of a particular enemy armoured battalion (an OBJECT-ITEM that had not been specified as an objective) has been reduced to some fraction of its former capability.

In the present example we are going to consider the situation of two friendly ORGANISATIONs making an estimate on the effect of a fire mission (Action 21). 2 RTR estimates that an enemy unit (6 Guards Tank Division) has been 70 percent destroyed. The fact that 2 RTR is the reporting organisation is not explicit in the table but would be determined through an instance of REPORTING-DATA identified as rd571. 1 R IRISH estimates the destruction in terms of T64 tanks (object-type-id = 13) and BMPs (object-type-id = 15) destroyed. The identity of the reporting organisation would be determined by reference to instances of REPORTING-DATA via identifiers rd1230 and rd35.
ACTION-EFFECT

ACTION
- action-id
- action-category-code
- action-name
  - is-measured-by
  - method/protocol

ACTION-EFFECT
- action-effect-id
- action-effect-category-code
- action-effect-description-code
- action-effect-severity-code
- reporting-data-id (FK)

ACTION-EFFECT-ITEM
- action-effect-item-id
- action-effect-item-fract
- object-item-id (FK)

ACTION-EFFECT-TYPE
- action-id (FK)
- action-effect-type-quantity
- object-type-id (FK)

REPORTING-DATA
- reporting-data-id
- reporting-data-accuracy-code
- reporting-data-category-code
- reporting-data-counting-indicator-code
- reporting-data-credibility-code
- reporting-data-reliability-code
- reporting-data-comment
- reporting-data-comment-date
- reporting-data-comment-time
- reporting-data-source-type-code
- reporting-data-timing-category-code
- reference-id (FK)
- reporting-data-reporting-organisation-id (FK)

OBJECT-ITEM
- object-item-id
- object-item-category-code
- object-item-name
- object-item-identification-text

OBJECT-TYPE
- object-type-id
- object-type-category-code
- object-type-dummy-identification-code
- object-type-name

ACTION-EFFECT (2)

(a) ACTION-EFFECT

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(c) ACTION-EFFECT-TYPE

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<tr>
<td></td>
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<td>[EQUIPMENT TYPE=BMP]</td>
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</table>
ACTION RESOURCE-EMPLOYMENT is defined as the procedure for using a specific ACTION-RESOURCE with or without dependence upon a specific ACTION-OBJECTIVE. ACTION-RESOURCE-EMPLOYMENT is a dependent entity, derived from the relationship "is used according to/describes use of" from ACTIONRESOURCE. In addition, there is a non-identifying relationship "is the subject of/is relevant for" from ACTION-OBJECTIVE to ACTION-RESOURCE-EMPLOYMENT.

Let's consider a close air support flight that has been assigned as one of the resources to be used during an attack on an enemy battalion. Its instruction are to attack "on orders," at a time to be specified by a coordinating authority. In addition the mission being described includes a rescue helicopter that has been dispatched to recover the crew of a downed attack helicopter. In Action 105 the aircraft is directed to attack the target in direction of 280 degrees; it is allowed to manoeuvre on the right side of the approach direction, and it must pull off target in the direction of 35 degrees from the target. In Action 108, the rescue helicopter is to pick up the downed aviators using a winch. It is expected to report the results of the mission while in flight.
ACTION-RESOURCE-EMPLOYMENT

ACTION-RESOURCE-
EMPLOYMENT(2)

ACTION-RESOURCE-
EMPLOYMENT

ACTION-RESOURCE-
EMPLOYMENT

ACTION-AIRCRAFT-EMPLOYMENT

ACTION-AIRCRAFT-
EMPLOYMENT

Note: ** denotes ‘action-aircraft-employment’.

Note: *** denotes ‘action-resource-employment’.
The BRADYLAND OKIE Front, consisting of two Armies, attacked GENERICLAND on D-Day, 1 November 1995. OKIE Front employed one operational echelon as follows, from North to South: 4th and 5th (OKIE) Armies, which reached current line-of-contact on D+3 Days. The OKIE Front then halted in place, presumably to effect resupply operations. It now appears that BRADYLAND intentions will be clarified if and when the 7th OKIE Armoured Division is committed to battle. The most likely zone of action for 7th (OKIE) AR Division is to participate in an attack on AUSTIN, the capital of GENERICLAND.

Due to treaty commitments, ACE is directed to defend Genericland. The in–place Multi–National Division (MND) has been activated by SACEUR. The MND is tasked with the immediate mission of protecting AUSTIN until relieved. SACEUR has activated the NATO Corps in accordance with guidance contained in NATO Contingency Plans. Seven Nations have identified and allocated formations to participate in a coordinated counterattack against the aggressor forces. Upon deployment, NATO Corps is to prevent 5 (OKIE) Army from seizing AUSTIN. At 0700 Hours on D plus 6 Days, NATO Corps is to launch a coordinated counterattack on OKIE Front formations that have invaded GENERICLAND in order to restore the International Border.
As part of an on-going operation the following actions have been specified: Action 112 has three separate objectives (i.e., instances of ACTION-OBJECTIVE-ITEM). The first is to be marked by red smoke for Unit 1; the second it to be marked by blue flare for Unit 2. The marking is to occur simultaneously for both objectives. The second objective is to be marked by a yellow flare. The third objective is to be designated by a laser for Unit 3.

Action 4073 is a drop of supplies by Unit 52. The position is indicated by an orange T-shaped marker panel. Action 385 involves a lift of troops by transport helicopters that are operated by Unit 76. Their destination is marked by a radio beacon.

The entity TARGET is defined C2IEDM as an ACTION-OBJECTIVE-ITEM that is subject to capture or destruction by military forces or against which military intelligence operations are directed.
During operation Eagle-1 three nuclear-biological-chemical events have been reported by Unit A.

Event 12 is now confirmed via coalition forces detectors, as well as tests to have been a nuclear attack by enemy forces. It involved a single release of gamma radiation with a peak value of 200 cGy. There is no data on the size of the area affected. The estimated yield of the burst is 100 KT to less than 300 KT.

Event 147 was a biological attack conducted as an air burst over a large area in the form of a continuous release. It is also now confirmed via coalition forces detectors as well as tests. There is no information as to whether it was military in nature.

Event 148 involved a liquid sampling of nuclear materials. There is no information on the peak value. The rate dose is estimated at 50 cGy. The event has been confirmed via tests.
The Multi National Division is planning an activity that involves two subordinate units—the 11th (NL) Battalion and the 9th (UK) Battalion. The two units are to move from their current positions, capture Hill 251, and then occupy two different positions on Hill 251, the 11th at location X and the 9th at location Y. The situation is illustrated in figure below. The first panel shows the current positions of the units in relation to Hill 251; the second panel shows the planned movement during the attack; and the third panel shows the desired positions of the two units at the completion of the ACTION. Both the actual initial conditions for the activity as well as the desired final conditions need to be set up.
The initial data that is assumed to be in the database when the planning begins is shown below. The objects that have a role in this example are listed in Sub-table (a). The current locations for the two battalions are provided through Sub-tables (b), (c), and (d). Sub-tables (b) and (c) provide the specification of coordinates (here given as notional), while Sub-table (d) (OBJECT-ITEM-LOCATION) specifies the units (organisations) for which the coordinates are valid. Sub-table (e) contains the reporting data for the position report.
The next step is to create records that specify the initial conditions for the planned operation. In this case, the conditions specified are actual rather than desired. The data are shown below. Sub-tables (a) and (b) specify that this instance of CONTEXT consists of two instances of REPORTING-DATA (0099001 and 0099002 from the previous slide). The table states that the CONTEXT is in effect the fact that the two battalions are in position as specified in the initial table for this example. It should be noted that the CONTEXT structure uses indirect reference to the relevant data by pointing to the specific instances of REPORTING-DATA that are related to the actual data.
The desired end conditions for the operation are set up by the Multi-National Division. This is done by first specifying for the two battalions the final positions on Hill 251 as being (X'-latitude, X'-longitude) and (Y'-latitude, Y'-longitude). The data are shown below, Sub-tables (a), (b), and (c). Since the metadata is identical for the two records in Sub-table (c), only a single instance of REPORTING-DATA is needed. The value for effective date and time (d4, t4) should correspond to a future time after the expected completion of the operation.

### Sub-table (a) POINT

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### Sub-table (b) ABSOLUTE-POINT

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### Sub-table (c) OBJECT-ITEM-LOCATION

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Note: Several attributes from this entity have been omitted as irrelevant to the example.

### Sub-table (d) REPORTING-DATA

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<td>0003001</td>
</tr>
</tbody>
</table>

### Sub-table (e) ABSOLUTE-TIMING

<table>
<thead>
<tr>
<th>absolute-timing-effectiveness-start-date</th>
<th>absolute-timing-effectiveness-start-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>d4</td>
<td>t4</td>
</tr>
</tbody>
</table>

The CONTEXT in this case consists of a single instance of REPORTING-DATA that references the reporting-data-id of the previous table. The construct is shown in Sub-tables (a) and (b) below. This instance of CONTEXT is linked to ACTION as shown in Sub-table (c) where the meaning given to the relationship by the value “Final state, planning” for the action-context-category-code.
During operation Eagle-1 the task commander has identified the requirement for a lay-down of one square kilometer anti-tank minefield in 3 hours.

Sub-tables (a) and (b) set up the specification of the type of capability that is of concern; in this particular case it involves a reference to ENGINEERING-CAPABILITY as well as the specification of the type of facility for which a capability is relevant. Sub-table (c) specifies the required capability for Action 27 (create minefield) as being 3 hours. Sub-table (d) shows the actual ability of two ORGANISATIONs (Units 70 and 96) to lay the specified type of minefield. A comparison of the data in tables OBJECT-ITEM-CAPABILITY and ACTION-REQUIRED-CAPABILITY indicates that the choice of Unit 70 to carry out the ACTION is likely to be the best option based on the capability criteria described.
During operation Harrier-2 the following two units are involved. The first is the 18th ABN Corps (that has organisation-id = 201-1) and the second is the 51st ABN Division (with organisation-id = 201-2). The Corps commands the Division. The Division has been given a task (action-task-id = 201-99) to begin an attack against an enemy target 15 March 2001 at 0700 hours. The Corps has three standing rules of engagement, all of which have been imposed on Action 201-99. The Division requests the cancellation of two of the three rules of engagement. The Corps accedes for one rule and denies the lifting of the second rule.
ACTION-RULE-OF-ENGAGEMENT

ACTION
- action-id
- action-category-code
- action-name

RULE-OF-ENGAGEMENT
- rule-of-engagement-id
- role-of-engagement-name
- role-of-engagement-description-text
- owning-organisation-id (FK)

OBJECT-ITEM
- object-item-id
- object-item-category-code
- object-item-name
- object-item-alternate-identification-text

ORGANISATION
- organisation-id (FK)
- organisation-category-code
- organisation-nickname-name

OBJECT-ITEM
- object-item-id
- object-item-category-code
- object-item-name
- object-item-alternate-identification-text

ACTION-TASK
- action-task-id (FK)
- action-task-category-code
- action-task-activity-code
- action-task-minimum-duration
- action-task-estimated-duration
- action-task-planned-start-date
- action-task-planned-start-time
- action-task-start-qualifier-code
- action-task-planned-end-date
- action-task-planned-end-time
- action-task-end-qualifier-code
- action-task-priority-code
- action-task-detail-text
- candidate-target-list-id (FK)
- organisation-structure-root-organisation-id (FK)
- organisation-structure-index (FK)

RULE-OF-ENGAGEMENT
- rule-of-engagement-id
- role-of-engagement-name
- role-of-engagement-description-text
- owning-organisation-id (FK)

ACTION-TASK-RULE-OF-ENGAGEMENT
- action-task-id (FK)
- role-of-engagement-id (FK)

ORGANISATION-ACTION-TASK-RULE-OF-ENGAGEMENT-STATUS
- action-task-id (FK)
- role-of-engagement-id (FK)
- organisation-action-task-rule-of-engagement-status-organisation-id (FK)
- organisation-action-task-rule-of-engagement-status-index
- organisation-action-task-rule-of-engagement-status-organisation-category-code
- organisation-action-task-rule-of-engagement-status-effective-start-date
- organisation-action-task-rule-of-engagement-status-effective-start-time
- organisation-action-task-rule-of-engagement-status-effective-end-date
- organisation-action-task-rule-of-engagement-status-effective-end-time

ACTION-RULE-OF-ENGAGEMENT(2)

(a) RULE-OF-ENGAGEMENT

<table>
<thead>
<tr>
<th>role-id</th>
<th>role-name</th>
<th>role-description-text</th>
<th>owning-organisation-id</th>
</tr>
</thead>
<tbody>
<tr>
<td>10177-001</td>
<td>RCE 100</td>
<td>Detention or secure of vessels, aircraft, vehicle (is personnel, goods, cargo(s) or equipment is prohibited)</td>
<td>201-1</td>
</tr>
<tr>
<td>10177-002</td>
<td>RCE 17</td>
<td>Do not fire until you see the whites of their eyes</td>
<td>201-1</td>
</tr>
<tr>
<td>10177-003</td>
<td>RCE 259</td>
<td>Soldiers are not allowed to socialise with civilians or captured enemy territory</td>
<td>201-1</td>
</tr>
</tbody>
</table>

(b) ACTION-TASK-RULE-OF-ENGAGEMENT

<table>
<thead>
<tr>
<th>action-task-id</th>
<th>role-of-engagement-id</th>
</tr>
</thead>
<tbody>
<tr>
<td>201-99</td>
<td>10177-001</td>
</tr>
<tr>
<td>201-99</td>
<td>10177-002</td>
</tr>
<tr>
<td>201-99</td>
<td>10177-003</td>
</tr>
</tbody>
</table>

(c) ORGANISATION-ACTION-TASK-RULE-OF-ENGAGEMENT-STATUS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>201-99</td>
<td>10177-001</td>
<td>201-1</td>
<td>Authorise</td>
<td>20030315</td>
<td>070000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-002</td>
<td>201-1</td>
<td>Authorise</td>
<td>20030315</td>
<td>070000</td>
<td>02030303</td>
<td>120000</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-003</td>
<td>201-1</td>
<td>Authorise</td>
<td>20030315</td>
<td>070000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-001</td>
<td>201-2</td>
<td>Request cancellation</td>
<td>20030301</td>
<td>031000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-002</td>
<td>201-2</td>
<td>Request cancellation</td>
<td>20030301</td>
<td>031000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-003</td>
<td>201-1</td>
<td>Cancel</td>
<td>20030301</td>
<td>063000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>201-99</td>
<td>10177-001</td>
<td>201-1</td>
<td>Deny</td>
<td>20030301</td>
<td>063000</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

Note: organisation denotes organisation-action-task-rule-of-engagement-status
A US division and a Spanish brigade under the operational control of a NATO corps are engaged in operations against PURPLE enemy forces. The US division has two armoured brigades and a Military Intelligence Battalion (MI Bn) nominating targets. The Spanish brigade has two battalions that are nominating targets. The NATO Corps itself nominates a target. In all, seven different units are contributing lists.

The two US brigades, the US MI Bn, and the US division submit candidate targets:
- **three** from 1 US Bde,
- **two** from 2 US Bde,
- **three** from 4 US MI Bn, and
- **two** from 1 US AR Div.

Both of the division nominations have been submitted by subordinate units, but the division attaches its own target list numbers.

The two SP battalions submit candidate targets:
- **three** from 7 SP Bn and
- **two** from 8 SP Bn.

The staff of the NATO Corps submits a single target nomination: to attack 78P Div headquarters.
CANDIDATE-TARGET-LIST(2)

<table>
<thead>
<tr>
<th>Candidate-target list id</th>
<th>Candidate-target list name</th>
<th>Reporting data</th>
<th>Reporting organisation id</th>
</tr>
</thead>
<tbody>
<tr>
<td>241001</td>
<td>1 USl Bde for C-3</td>
<td>241911</td>
<td>1 USl Bde</td>
</tr>
<tr>
<td>241002</td>
<td>2 USl Bde for C-3</td>
<td>241912</td>
<td>2 USl Bde</td>
</tr>
<tr>
<td>241003</td>
<td>4 USl MI Bde for C-3</td>
<td>241913</td>
<td>4 USl MI Bde</td>
</tr>
<tr>
<td>241004</td>
<td>1 USl MI Bde for D-3</td>
<td>241914</td>
<td>1 USl MI Bde</td>
</tr>
<tr>
<td>272001</td>
<td>7 (SP) Bn for D-3</td>
<td>272002</td>
<td>7 (SP) Bn</td>
</tr>
<tr>
<td>272002</td>
<td>8 (SP) Bn for C-3</td>
<td>272003</td>
<td>8 (SP) Bn</td>
</tr>
<tr>
<td>435001</td>
<td>NATO Corps for D-3</td>
<td>435001</td>
<td>NATO Corps</td>
</tr>
</tbody>
</table>

C2 VIGNETTE 019

The US division operations officer authorises 4 of the 10 targets for which it has responsibility, including both of its own nominations. The division explicitly does not authorise one target (21P SAM Bty) nominated by a subordinate brigade.

The Spanish brigade acts upon two target lists submitted by its two subordinate battalions without adding any of its own or changing any target numbers. The Spanish brigade authorises two targets, and does not authorise another (8P Communications Site) that is nominated by both battalions—one requesting attack and the other preferring jamming.

The NATO Corps enters two authorisations: one for its own nomination and the second reaffirming the US division attack against 22P Armoured Brigade.

The NATO Corps denies authorisation to two targets: the first (8P Communications Site) is a reaffirmation of a lower echelon decision and the second (1P Target Acquisition Radar) involves a reversal of the US division authorisation to attack.
CANDIDATE-TARGET-LIST(3)

- CANDIDATE-TARGET-LIST
  - candidate-target-list-id
  - candidate-target-list-name
  - reporting-data-id

- CANDIDATE-TARGET-Detail
  - category-code
  - focus-type-code
  - label-text
  - priority-quantity
  - scheme-code

- CANDIDATE-TARGET-LIST-ASSOCIATION
  - candidate-target-list-association-subject-candidate-target-list-id
  - candidate-target-list-association-object-candidate-target-list-id
  - category-code

- CANDIDATE-TARGET-Detail-ASSOCIATION
  - candidate-target-detail-association-subject-candidate-target-list-id
  - candidate-target-detail-association-object-candidate-target-list-id
  - category-code

- CANDIDATE-TARGET-Detail-TYPE
  - object-type-id

- CANDIDATE-TARGET-Detail-ITEM
  - object-item-id

CANDIDATE-TARGET-LIST(4)

(a) CANDIDATE-TARGET-DETAIL-AUTHORISATION
- candidate-target-list-id
- candidate-target-detail-index
- auth-priority-code
- auth-priority-quantity
- reporting-data-id
- candidate-target-detail-category-code
- candidate-target-detail-detail-type-code
- candidate-target-detail-detail-status-code
- candidate-target-detail-detail-priority-quantity
- candidate-target-detail-detail-scheme-code

(b) ITEM
- object-item-id
- candidate-target-list-id
- candidate-target-detail-index
- object-type-id

Note: ** denotes "candidate-target-detail"
The 37th Surveillance Squadron (i.e., of one of its aircraft) detects an emission. Two instances of OBJECT-ITEM play a role: the observer and the unknown object that is emitting.

Sub-table (a) define the object instances. Sub-table (b) define the geometry for the two objects: point geometry for the observer and fan-area geometry for the observed object. FAN-AREA 4 has a vertex at Point 612 (observer point) and covers a 3-degree sector centered at 45 degrees (Northeast). The nominal line of bearing is directed at 45 degree orientation with respect to true North with uncertainty of 1-1/2 degrees to either side. Sub-table (c) assigns the appropriate geometry to the correct object.
In C2 environments is useful to be able to cite sources of information that are external to the data structures. The sources may be USMTF messages, printouts of electronic mail, memoranda of telephone conversations, and other physical storage means that may be consulted as necessary. In C2IEDM the means for this functionality is an independent entity called REFERENCE. It is defined as an allusion to a source of information that may have military significance. The structure of REFERENCE and its relationship to REPORTING-DATA in the next slide. The information that instances of REFERENCE point to can be associated with one or more instances of REPORTINGDATA in order to amplify the data that is referenced by REPORTING-DATA.
PROPOSED EXTENSIONS WITHIN FCS

C2 VIGNETTE 021

During operation Albatross-2 the following report (time t1) is filed by the 101 Mech Bde concerning the number of personnel, and equipment available: 44 total/41 operational M113; 102 total/94 operational BFV; 24 total/22 operational Howitzers; 58 total/ 55 operational M1A1; 3943 total/3607 operational military personnel.

A second report (time t2) indicates that the number of operational BFV is now 88; the number of operational M1A1 is 49 and the number of operational military personnel is 3511.
HOLDING(1)

OBJECT-ITEM
- object-item-id
- object-item-category-code
- object-item-name
- object-item-alternate-identification-text

OBJECT-TYPE
- object-type-id
- object-type-category-code
- object-type-name

REPORTING-DATA
- reporting-data-id
- reporting-data-accuracy-code
- reporting-data-category-code
- reporting-data-counting-indicator-code
- reporting-data-credibility-code
- reporting-data-reliability-code
- reporting-data-reporting-date
- reporting-data-reporting-time
- reporting-data-source-type-code
- reporting-data-timing-category-code
- reference-id
- reporting-data-reporting-organisation-id

HOLDING
- object-item-id (FK)
- object-type-id (FK)
- holding-index
- holding-operational-quantity
- holding-total-quantity
- reporting-data-id (FK)

HOLDING(2)

<table>
<thead>
<tr>
<th>object-item-id</th>
<th>object-type-id</th>
<th>holding-index</th>
<th>holding-operational-quantity</th>
<th>holding-total-quantity</th>
<th>reporting-data-id</th>
</tr>
</thead>
<tbody>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>214012 [Armoured Personnel Carrier, M113]</td>
<td>41000001</td>
<td>1043</td>
<td>44</td>
<td>p1</td>
</tr>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>214015 [Bradley Fighting Vehicle (BFV)], M-2</td>
<td>41000001</td>
<td>94</td>
<td>102</td>
<td>p1</td>
</tr>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>2230012 [Howitzer SP, 155mm, M-109]</td>
<td>41000001</td>
<td>22</td>
<td>24</td>
<td>p1</td>
</tr>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>2296005 [Tank, Main Battle, M1A1]</td>
<td>41000001</td>
<td>55</td>
<td>58</td>
<td>p1</td>
</tr>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>2296005 [Tank, Main Battle, M1A1]</td>
<td>41000002</td>
<td>49</td>
<td>58</td>
<td>p20</td>
</tr>
<tr>
<td>41122010 [101 Mech Bde]</td>
<td>41600 [Military person-type]</td>
<td>41000001</td>
<td>3607</td>
<td>3943</td>
<td>p1</td>
</tr>
</tbody>
</table>
REQUEST-ANSWER

Requests for intelligence need to be linked to the products of surveillance and reconnaissance. A REQUEST is a special instance of ACTION-TASK that can use all the functionality of the ACTION structure to specify a requirement to collect information. The execution planning in response to the request would be done within the same structure as any other ACTION. Once the collection is complete, one or more REQUEST-ANSWERS can be created.

Affirmative REQUEST-ANSWER indicates that additional information may be recorded elsewhere in the model. The pointer to such information is implemented through the entity REQUEST-ANSWER-ELEMENT. For example, a hostile unit may have been located at a given coordinate as a result of a search for enemy units in a prescribed region. This information would be recorded in OBJECT-ITEM-LOCATION that is linked to REPORTING-DATA (subject to be described in a subsequent section). An instance of REQUEST-ANSWER-ELEMENT would then be able to indicate the correct instance of REPORTING-DATA that is part of the REQUEST-ANSWER.

Negative entry in REQUEST-ANSWER is actually a genuine piece of information that cannot be recorded elsewhere. If the search for hostile units results in none being found, then that finding is recorded in REQUEST-ANSWER.
DATA INTEROPERABILITY COMPONENTS

REQUIREMENTS FOR DATABASE TO DATABASE EXCHANGE

DATA INTEROPERABILITY: THE ABILITY TO REUSE DATA FROM ANOTHER INFORMATION SYSTEM WITHOUT ANY INTERMEDIATE TRANSFORMATION AND HUMAN INTERVENTION

SEMANTICS -- MEANING (Information Exchange Standards Specifications (IESS))
DEFINITION OF OBJECTS OF INTEREST
TANK: An armored, self-propelled combat vehicle, armed with cannon and machine guns, and moving on a caterpillar tread.

BUSINESS RULES (RELATIONSHIPS)
a TANK has one or many RADIOS
a TANK has one or many NICKNAMES

METADATA -- SYNTAX (Authoritative Data Sources (ADS))
TANK TREAD TYPE CODE
SQL DATA TYPE: VARCHAR(2)
DOMAIN VALUES: 01 = ALL TERRAIN, 02 = DESERT, 03 = SNOW, 98 = NOS

KEY-MANAGEMENT -- RECORD IDENTIFICATION (Enterprise Identifiers (EID))
TANK (TABLE IN DB 1)
TREAD TYPE CODE
EID TREAD TYPE CODE NICKNAME
FFACD12211 01 CHARLIE 18
CF1AF35929 03 BRAVO 22
BB5CA80102 98 LIMA 007

TANK (TABLE IN DB 2)
TREAD TYPE CODE
EID TREAD TYPE CODE NICKNAME
FFACD12211 01 CHARLIE 18
CF1AF35929 03 BRAVO 22
BB5CA80102 98 LIMA 007

DATA EXCHANGE – COMMON FORMAT (Extensible Markup Language (XML))

ALL RECORDS TAGGED USING EID’S

Minimum Set of Essential Components for Infostructure

Common Semantics and Syntax
Agreed upon Reference Data
Enterprise-Wide Key Management
Common Transfer Mechanism for Web-based Exchanges

Comprehensive Data Interoperability Strategy Army Approach
Solution Component #1: IESS

• Common Structure and Meaning Essential for Automated Exchanges

• Communities of Interest [*] Should Develop IESSs Based on their Exchange Needs (e.g., Architecture Community and CADM; Coalition C2 and LC2IEDM)

• IESS Data Structures should be the basis for developing XML standards (done for Architecture Data)

Requires enforcement of IESS Policy

* Communities of Interest ought to be created on the basis of real data exchange needs, not on functional stovepipes

Solution Component #2: ADS

• Lists of Personnel Types, Materiel Types, Facility Types, etc., must be managed as an Army Resource, i.e., ADSs

• Developers must use them

• Assignment of Responsibility for Army ADSs is Imperative

Requires enforcement of ADS Policy
Solution Component #3: EIDs

Ideally one-to-one correlation between SSN and a US citizen.

EIDs are SSN’s for everything we want to track in our AISS.

Solution Component #4: XML

- Needed to Support Network Centric Warfare
- *Lingua Franca* of the Internet and Web-Based Solutions
- Basis for All Web-Services (Publish-and-Subscribe)
- Self-descriptive (encapsulates metadata)
- Robust
- Simple
- Adaptable
- Low Cost

Requires enforcement of XML Policy.
Implementation of MEC for Infostructure

New Areas

Established Areas

TOP-DOWN

BOTTOM-UP

Army Knowledge Enterprise IM Architecture Reference Model

One Network, One Database

Army Knowledge Office Portal

External (e.g., Joint and Coalition) Interfaces

Network Centric Applications

Army Infostructure Migration Policy

Army XML Policy

Army Reference Data Management Policy

IESS  ADS  EIDs  XML

Data Interoperability

Sustaining Base

Tactical

Joint

Other Gov’t Agencies

Data Information Knowledge Wisdom
Who, What, Where, When

USMC MEUs, US Army Rangers, and a small contingent of SOF units Medical units
Bravo-11 capture all paramilitary facilities within a half-mile radius of downtown Fallujah
Start: 20040401050000
End: 20040401080000

Commander's Intent
minimize all casualties, particularly civilian ones and to maximize the capture of both intelligence materials as well as Al-Qaida operatives.

Resources
large caliber weapons helicopters for evacuation of wounded combatants

Enemy Holdings
RPG’s and machine guns (AK-47’s)

With

Commander's Intent

Resources

Enemy Holdings

Preposition heavy artillery
Move SOF Units
Move Army Ranger Units to western city limit
Move MEU 1 to southern city limit
Secure Building D9
Secure Building D9
Provide Enemy Unit Location
CAS
Capture Enemy
Collect Intel Materials
Collect Intel Materials
0500 0530 0600 0630 0700 0730 0800 0830