Towards a Maritime Domain Extension to Coalition Battle Management Language: Initial Findings and Way Forward

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Research Objectives

- **The research has been performed by NATO MSG-085 «Standardization for C2 to Simulation Interoperation»**

- **MSG-085 Technical Activity (TA) Programme of Work (POW):**

  - **Investigation of multi-national and multi-service use of C-BML,**

  - **Identification of operational/technical requirements to ensure that C-BML supports multi-national and multi-service use.**

- **The focus of this research is to investigate the use of C-BML in the Maritime domain.**

This research effort aims at developing and testing a preliminary Maritime extension to C-BML for expressing and exchanging plans, orders and reports specific to the Maritime domain.

Research Methodology

We have used a scenario-based modeling approach:

1) Preparation of example operational messages in accordance with a naval operational scenario.

2) Development of an initial set of prioritized IERs based on message templates in APP-11(C).

3) Mapping of the prioritized IERs to C-BML expressions/ elements using a scenario-based modeling approach.

4) Development of maritime tasking grammar based on Command and Control Lexical Grammar (C2LG).

Operational Context

- **Naval operations involve the conduct of all or some types of naval warfare such as:**

    - **Anti-Surface Warfare (ASUW),**

    - **Anti-Air Warfare (AAW),**

    - **Anti-Submarine Warfare (ASW) …**

- **The operational scenario focuses primarily on ASUW-related operations: OPGEN and OPTASK ASUW messages.**

- **Scenario developed by MSG-086 based on the VIKING 2011 exercise scenario.**
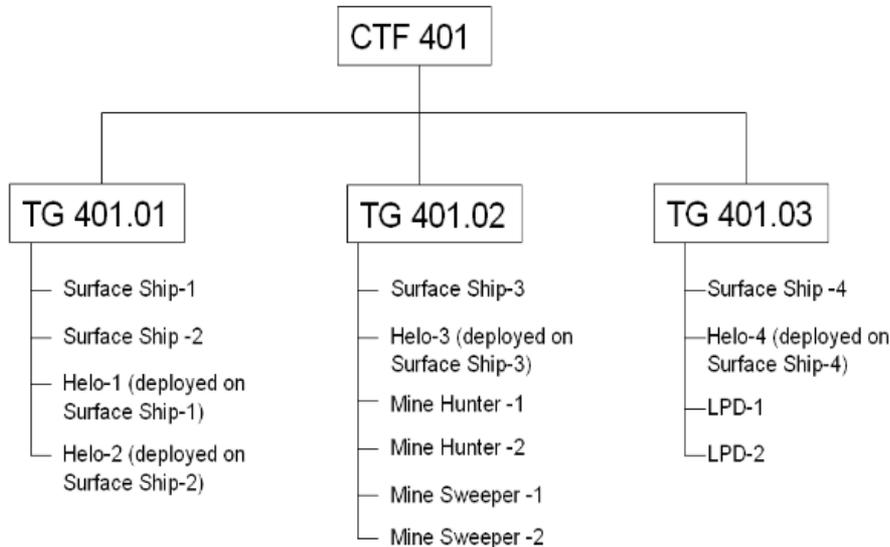
Tasking and Task Organization
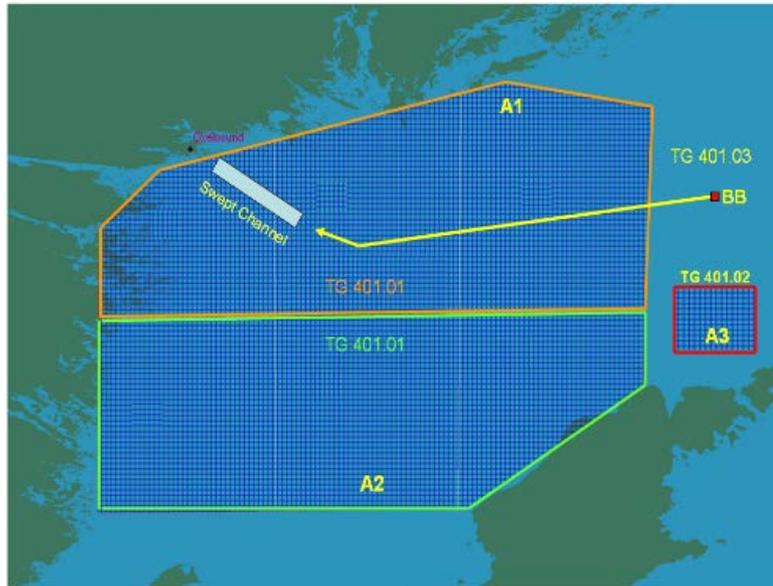
Naval Tasking:

TG 401.01 :
Maritime Interdict Operations in A1 and A2.

TG 401.02 :
Setting a swept channel ashore of Öxelosund.

TG 401.03 :
Movement of a Convoy and ASUW Ops.

Modeling Results

- **The goal of the modeling is two-fold:**

    - **Create examples and guidelines on how to represent maritime tasks in C-BML; and**

    - **Identify potential maritime extensions to C-BML where no apparent mappings exist.**

- **The proposed C-BML Phase 1 Full Schema is used as the target BML schema.**

- **Information Exchange Requirements (IERs) captured in UML to serve as basis for developing a requirements-based Schema.**

Highlights of work accomplished

C-BML Expressions/Improvements:

- **Naval task organization**
- **Initial location of units**
- **Control features**
- **Force dispositions / formation**
- **A set of ASUW tasks**

- **Maritime reports will be covered in future work**

Naval Task Organization

● **Naval Task Organization successfully mapped to C-BML.**

● **Hierarchy mapped to organization «size codes» : Task Force (TF), Task Group (TG), Task Unit (TU), Task Element (TE)**

● **Flag ship, the naval commander and his post are captured in C-BML, however codes/values are missing (OTC/flag ship).**

● **Can be extended to other principal Warfare Commanders (ASUWC, AAWC …).**
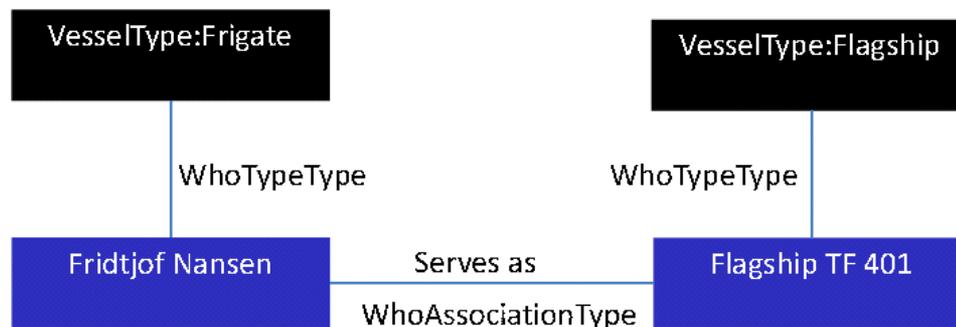
Naval Task Organization, cont.

- **The JC3IEDM models organizations (units) separately from equipment.**

- **In the maritime domain it is not common to look at the crew and the vessel as two separate entities.**

- **Decided that the task organization is represented as units, where leaf nodes point to vessels/equipment.**

- **Organic helicopters modeled as TU/TE with an additional «is_organic» association.**

Representation of Task Organization
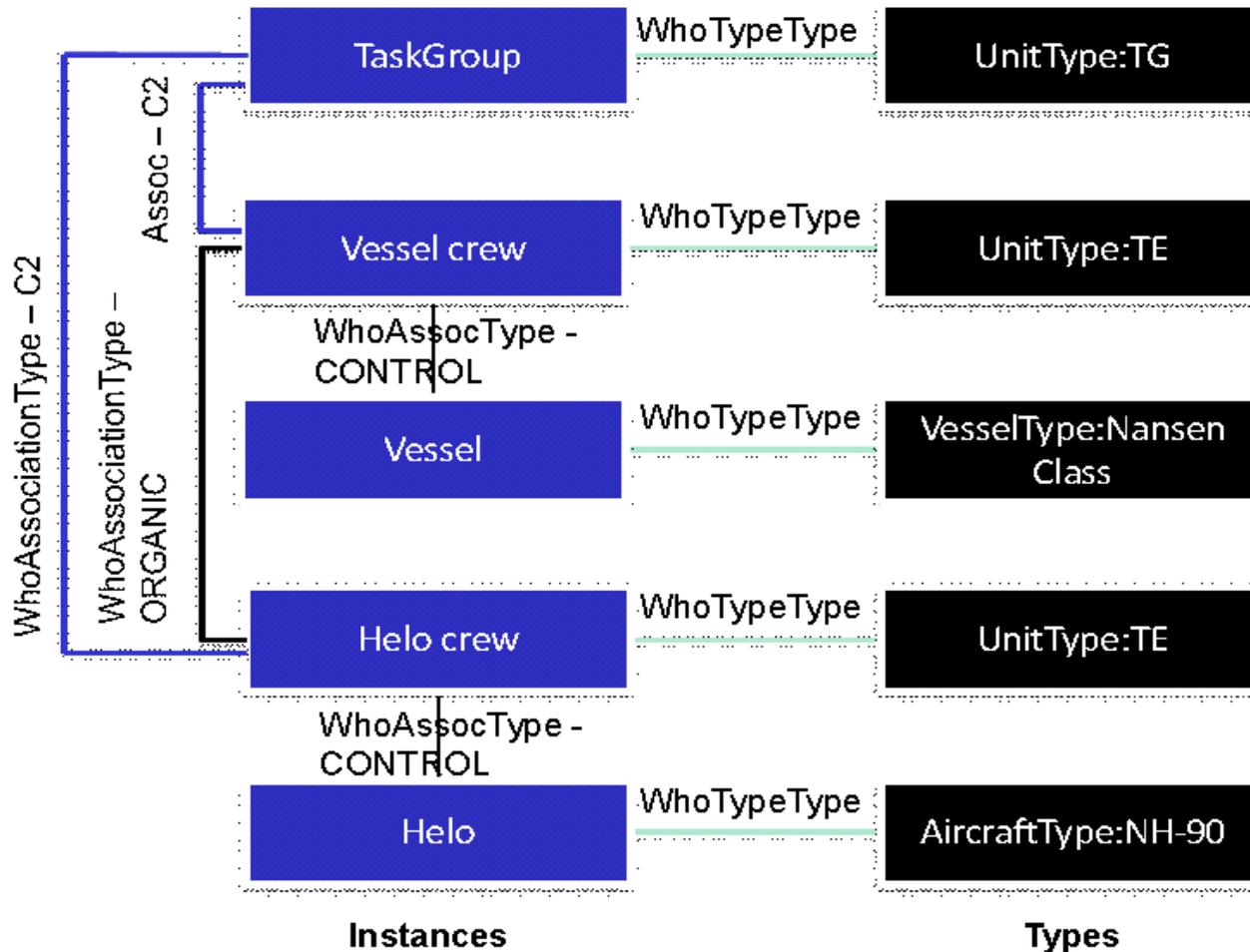
Naval Tasking

- **The task statements in C-BML are based on the principle of 5Ws (Who, What, When, Where, Why).**

- **Employing the 5Ws is not always straightforward when attempting to map a maritime operation plan found in OPGEN and OPTASK ASUW to C-BML statements:**

    - Maritime platforms perform many simultaneous tasks and roles in several warfare areas during an operation.

    - Maritime plans are less specific compared to the land equivalent is found in an Army OPORD.
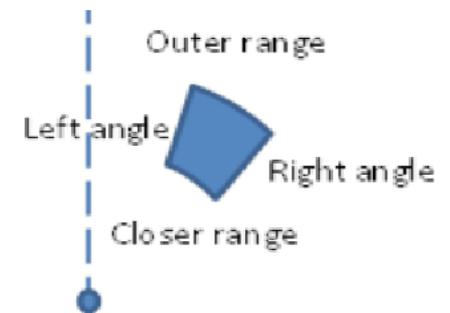
Naval Tasking, cont.

● **There are more than 400 different task values in C-BML, with more than 25 % coming from the maritime domain**

● **Performing detailed mapping of tasks in our example orders to C-BML, the result was equally divided into the following cases:**

> **(1)** **There is a direct mapping for the task in question to an existing value.**
>
> **(2) An existing value is identified, but the definition does not reflect the domain.**
>
> **(3) No mapping suggestion is found.**

● **In cases (2) and (3) task verbs have to be identified and defined based on authoritative sources (e.g. MTP-1)**

Control Features

- The meaning and purpose of control measure is often implied by task.

- Simple approach using general purpose geographic positions:

  - Points, lines, areas, and volumes represent geometry without any semantics.

  - Control measures, with semantic meanings, are assigned geometry (waitingArea, Waypoint).

  - Control measures may have added semantics in their name.

- Need to define additional types of control features.

Example Control Feature - Screen

- **Naval units are often organized in dispositions/formations that serve different purposes.**

- **Definition of screen (AAP-6): An arrangement of ships, aircraft and/or submarines to protect a main body or convoy.**

- **The figure to the right shows a sector screen:**

  - **A control measure represents the sector**

  - **The geometry is modeled as a FanArea**

  - **The Unit to protect is the reference**

- **Several screens can be predefined.**

Outer range

Left angle

Right angle

Closer range

Unit to protect
(screen center)

- **Units forming the screen can be given additic independently, e.g. patroling.**

Command and Control Lexical Grammar (C2LG)

- **The C2LG defines a BML formally, so that the resulting expression are human readable as well as processable by systems.**

- **C2LG task assignments focus on the verb that denotes the task and add 5W-kind constituents to that verb.**

- **5Ws are not used in the maritime domain**

    - **C2LG was both used to guide the modeling (mapping to 5Ws) and for adding semantics to C-BML**

C2LG, Tasking

- **In general, an expression for task assignment is:**

  ```
  TaskAssignment → TaskingVerb TaskerWho
  TaskeeWho (Affected|Action) Where Start-When
  (End-When) (Mod) (Why) Label
  ```

- **A BML-expression to assign an escort task might look like the following:**

  ```
  escort TF401.02  FFGH3  MH1 at escort_area
  start aft 20130401150000 escort-387;
  ```

"TF401.02" orders the frigate "FFGH3" to escort the mine hunter "MH1" through "escort_area" beginning after the 1st of April, 2013, 3 p.m.

Modeling Issues

- In JC3IEDM, there is a restriction, for implementation reasons, that a report ("ReportingData") may only refer to one type of data (table).

- However, several entries in the same table may still use the same "ReportingData".

- In C-BML, the exception also is ruled out, which implies more verbose XML-code, especially during initialization.

- For instance, when assigning types to the instances, 60% of the code in a report is typically repeated from another report.

Experiences, Challenges and Findings

- Current research covers only a limited part of ASUW.

- Each operational message is to be analyzed carefully. Not all messages/message fields are relevant or applicable for C-BML modeling.

- Operational requirements are to be refined in co-operation with technical people in order to identify technical requirements for C-BML modeling.

- An operational scenario and relevant operational message samples based on that scenario are very helpful for the validation of the requirements.

- Current research includes only tasking and orders. Status updates and reports from the units are not included.

Future Work

- Include status updates and reports from the units

- Naval Mine Warfare

- Naval Gunfire Support (Maritime/Land interaction)

- UAV component

- Maritime C2 (Surrogate)

- More sophisticated simulation of maritime entities

- Comprehensive IERs documentation.

- Assess the use of MSDL in the Maritime Domain.

Conclusions

- A preliminary study on use of C-BML in the maritime domain has been performed.

- The modeling is based on a set of IERs established by using an operational scenario.

- IERs have been mapped to the SISO C-BML Phase 1 Full Schema.

- A more comprehensive Maritime C-BML extension based on this research will be tested during the MSG-085 Final Experimentation event.