Command and Control System Requirements Generation: Reuse by Pragmatism – a Case Study

D.F.Dean B.Eng C.Eng MIEE
Defence Evaluation and Research Agency (UK)
DERA Portsdown West
Portsdown Hill Road
Fareham
Hampshire
PO17 6AD
United Kingdom
+44 (0)1705 336520
dfdean@dera.gov.uk

Abstract

This paper[1] details applied research undertaken by DERA to investigate techniques for formulating functional requirements for the procurement of Warship Combat Systems. The project has developed a Domain Model of Royal Naval Command and Control Afloat. The model can be used as a basis for the generation of requirement statements for future Command and Control (C^2) systems and has been validated against current warship procurement requirements.

The work indicated that the model was capable of deriving appropriate re-usable functional requirement statements. Proposed further developments will improve the flexibility and format of these requirements and enable them to assist with the procurement of future warships.

1. Introduction

This paper describes applied research to devise better methods of formulating naval Command, Control, Communications and Intelligence (C^3I) system requirements. This programme is being undertaken by the UK Defence Evaluation and Research Agency (DERA) funded by the Ministry of Defence (UK MOD)

This research has resulted in the derivation of a Domain Model encompassing naval C^3I from which sets of functional requirement statements for specific Command and Control (C^2) systems can be extracted, given clear system operational needs. The Domain Model has been created using an object-oriented notation (initially Object Modelling Technique (OMT [Rumbaugh et al., 1991]) and more recently, the Unified Modelling Language (UML [Booch and Rumbaugh, 1997], [Fowler and Scott, 1997]).

This paper will:

- Highlight the typical problems encountered in the formulation of requirement systems for future naval C^2 systems.

- Outline the impact of UK warship procurement policy on the style and structure of requirements used for defining and procuring future naval C^3I systems.

- Describe the Domain Model resulting from the research programme, and the concept of the Framework, which will be used to extract requirements from it.

- Detail how project-specific sets of requirement statements can be generated using the Domain Model and Framework.

- Outline Case Studies, which have demonstrated the validity and utility of the Domain Model and its application to requirements formulation.

- Conclude with some discussion of the successes and lessons learnt in applying the model, which have been undertaken to date, followed by an indication of the options for future development.

2. Background

The procurement of naval C^2 and C^3I Systems is a complex and expensive business. It has proven to be notoriously difficult for a number of reasons which include:

- C^3I is an 'enabler' facility and, with the exception of communications, only interacts with the physical environment via its sensors and effectors. This 'detachment' from the physical environment makes it more difficult to articulate the requirements that a C^3I system must perform.

- C^3I functionality includes activities traditionally undertaken by service personnel, whose capability is developed by a combination of theoretical and practical training together with experience - the essence of this is difficult to distil. These cognitive tasks are intrinsically difficult to analyse and describe.

- C^3I is also concerned with providing information to enable decision making (Tactics to employ, resource deployment etc.). This includes fusing information from a variety of different sources to gain a more complete (and concise) picture, reducing the quantity of information and simplifying the decision making process.

- C^3I is complex and information intensive, it has many constituent elements, which are highly inter-related, and often concurrent. These are difficult, if not impossible, to consider in isolation.

- C^3I is concerned with tasks with a wide range of temporal constraints.

- C^3I (especially C^2) is, when implemented, generally performed by a combination of men and machines.

These intrinsic C^3I characteristics make requirements formulation difficult. The UK MOD Director of Operational Requirements (Sea) (DOR(Sea)) has investigated and adopted a number of approaches (such as the elicitation of 'user requirements' from service personnel, and the use of generic reusable databases) to facilitate the definition of sets of requirement statements for future naval C^3I systems. These approaches have addressed the need to devise appropriate, operationally justifiable, complete, consistent and unambiguous requirement statements for future systems. These approaches have met with varying, but generally increasing success.

Whilst the ability to 'engineer' requirements for future naval C^3I systems has improved as a result of developing and adopting these approaches, requirements formulation has remained a difficult and deficient aspect of requirements engineering.

Formulation of requirements has previously been addressed within DERA, leading to the development of a prototype computer-based tool to enforce the definition of requirements (in accordance with grammatical rules and using defined terminology). Attention has since shifted to the formulation of complete, and operationally justified requirement statements, which has led to the programme of research into domain modelling. The notion of using domain models for this purpose originated with a report by George Mason University based on the behavioural modelling of C^2 systems [Hatch et al., 1993].

Requirements Engineering is emerging as a discipline of academic interest, views on what constitutes a requirement have also evolved. [Gougen, 1992] defines requirements as "properties that a system should have in order to succeed in the environment in which it will be used". This definition reveals the growing trend to define requirements for a future system in terms of required changes to the system's environment. Such requirements can only be devised through understanding the system environment to a certain level of detail including the causal linkage between both environmental factors and potential system features. A Domain Model can facilitate the definition of such 'black box' style requirements in a manner directly coupled to operational need.

2.1 Requirements engineering within the context of procurement policy

The requirements for future systems are developed to a level of detail which adequately characterises the system need, without unnecessarily over-prescribing (or constraining) the solution. Following the definition of the requirements, design studies are undertaken and a specification is used to define the key characteristics which a solution must adhere to. This specification may be provided in either solution domain terms or in problem domain terms. Increasingly the emphasis has been on the problem domain because the risk of selecting the implementation appropriate for a given problem resides with the supplier (i.e. industry) rather than the customer (i.e. MOD). In practice, the situation is not this simple:

- The development of certain new equipments continues to be funded by the MOD who want this investment to be fruitful in terms of these new equipments being fielded as operational systems.

- Benefits of commonality of user training and supportability can be significant as a result of fitting certain equipments on a fleet wide basis.

- Certain equipments such as cryptos continue to be supplied as Government Furnished Equipment (GFE) and are effectively mandated on the design.

- The functionality performed by the human elements of a naval system is not totally left to the discretion of a contractor since this could lead to major organisational and training issues for the user service (the Royal Navy (RN)).

Some C^3I systems continue to be procured as individual projects, however many are procured as an intrinsic part of the warships on which they are fitted. The specification boundary for warships (and their constituent subsystems) has progressively shifted towards being increasingly high level (more abstract). Procurement policy has shifted from ‘industrial build of MOD design’ to ‘whole warship procurement’.

As MOD’s influence on design (and perceived risk) has reduced, industry’s role (and accepted risk) has increased. Coupled with this transfer of design responsibility and authority, there have been changes in contracting regime, including the need for the customer to place tauter specifications on its supplier (and thus to have better defined requirements in the first place).

3. The Domain Model of Royal Naval Command Control and Communications Afloat

A multi-disciplined team of DERA Scientists, RN Officers, Contractors and Procurement experts began work on what became known as the Domain Model of RN C^3I Afloat in 1995. The model was originally intended to support the provision of a functional re-usable requirement for platform Combat Management Systems (CMSs). The Domain Model of RN C^3I Afloat is an Object Oriented Class description using UML of CMS functionality and includes descriptions of, and interactions between, the resources, tasks, plans, objectives, regions and environments that are relevant to RN operations.

3.1 The Modelling Process

The basic information used to construct the model came from a variety of sources, mainly reference books, tactical publications, and procurement publications, as well as an examination of existing systems and specifications. A structured approach was used to convert this base information into a skeletal model as follows:

- The main Warfare Domains were expanded (AAW, ASW and ASuW) and developed into preliminary models, which identified the key (common) elements.

- These preliminary models were combined to form a core, baseline C^3I model.

- This core model was then expanded to include all other relevant warfare areas.

- A review investigated and checked the Domain Model for consistency. This included a thorough comparison of model elements against the best existing standard available (A generic database of MOD functional user requirement statements).

- Additional information was included to cover areas of particular importance, which required more detailed coverage to represent RN operations (in such areas as the tactical picture, kill assessment and threat identification). It also ensured that the key areas had been covered to a common level of detail to ensure consistency.

- Additional Model elements were developed to represent generic equipment types. This included Sensors, Weapons and Communications Devices.

- A final review of the Model was undertaken using external contractors (not previously involved in the modelling process) to ascertain the validity of the approach and the model contents.

Current work is extending the model to make it more capable of supporting combat system requirement definition and is being done against a background of changing MOD practices for procuring systems.

3.2 What Does the Model contain?

The Domain Model currently contains 191 figures and approximately 10,000 data dictionary items. As well as supporting the standard UML notation, the development tool has also enabled descriptive fields to be added – this has been particularly useful and allowed the model's hierarchies to act as a reference dictionary. It should be noted that the usage of UML notation and further details may be found in the following references: [Rumbaugh et al., 1991]; [Select, 1997]; [Fowler and Scott, 1997].

The Model figure set can be considered in 3 areas:

- The Hierarchy Tree - which contains a specialised expansion of the 9 root (top-level) classes.

- The Core Interaction Model - which contains the figures detailing how different specialisations of the root classes interrelate. The Core model contains the essence of Command and Control Functionality.

- The Compositional Model - which describe the major components that go to make up platforms and systems. The figures start at the level of platforms (i.e. Ships, Aircraft etc.) and decompose to subsystem major component level (i.e. Analysers, Missile Guidance Systems etc, all defined in a generic way).

It is estimated that a very large proportion (90 to 100%) of the core interaction and composition figures will be common to all major warships (based on a study described in section 6). The specialisations from the Hierarchy Tree will also be largely applicable to any platform, with differences arising mainly in the Plan (relating to platform ‘Military Level/Warfare’ roles), and Real World Object (relating to Platform fitted Equipments and specific threats) hierarchies.

Efforts were made to ensure that the details contained in the model were solution independent. This holds true down to the equipment level, and several ship specific figures developed as part of the requirement extraction programme. By choosing any combination of the various classes, it is believed that any past, present, or future planned warship can be functionally represented.

Due to the generic nature of Command and Control concepts, it is believed that a majority of the figures could be equally applicable to other management process. Additional specialisations would need to be added to represent the Land, Air and Space Domains, or a commercial, decision making process. However this view has yet to be tested.

The Domain Model uses the concept of Plans as the driving force behind the command and control process. Plans are used to direct the tasks performed by system resources. The plans are created, monitored, and executed by Command and Control Duties (human or machine ‘managers’). Command and Control Duties get their information from, and base their decisions on, representations (such as the Tactical Picture and Orders). Finally, once they have been allocated to the tasks set out in the plans, the resources perform the tasks (or Directed Activities). The model details these interactions at a high level. It should be noted that the actual low level requirement can be obtained by examining the specialisations of the parent classes, contained in the Hierarchies.

The Hierarchies are tree structures of specialisations of the root classes, which go on to form all of the classes used in the core interaction and composition figures. There are 9 root class hierarchies, which are listed below:

- Real World Object, which goes down to a sufficient level of detail to suggest what generic systems may be fitted to a Platform.

- Task, which defines the various activities that resources can perform.

- Region, which defines the shapes and volumes associated with Naval Combat.

- Representation, which is a ‘Catch all’ for information classes, therefore the content is dependent on the Core model.

- Plan, which is split into a number of sections including Military Level (warfare area i.e. AAW), Policies and Implementation Plans (i.e. Communications Plans and Equipment Configurations).

- Type, which caters for some of the aspects of non-functional requirements (i.e. Standard units on measurement etc).

- Objective, which contains details of all high level objectives for Plans.

- The Resource Tasking Hierarchy refers to largely specific Command and Control (Management) Duties, and Directed Activities (assigned resources).

- The Environment generically covers weather conditions and physical effects.

In conclusion, the Domain Model has been developed to contain information appropriate for the development of high-level requirement statements for use in the early stages of Warship procurement. The following section indicates how this information can be extracted, and how it might be possible to combine the functional and non-functional elements of a specification.

4. The Framework

In order to make the information in the Domain Model practically useful for procurement purposes, it has always been recognised that a structure would have to be added around the Model to provide additional information, and plain text requirements. A process would also need to be established to enable specific platforms to be represented by the model.

The name given to this process was the Framework. At present it consists of sets of tools and databases, which enable single line, ‘Atomised’ requirement statements to be automatically generated based on Domain Model content. This work is still under development, therefore this section indicates what work has been completed. It then describes the way it is intended to drive the work in the future.

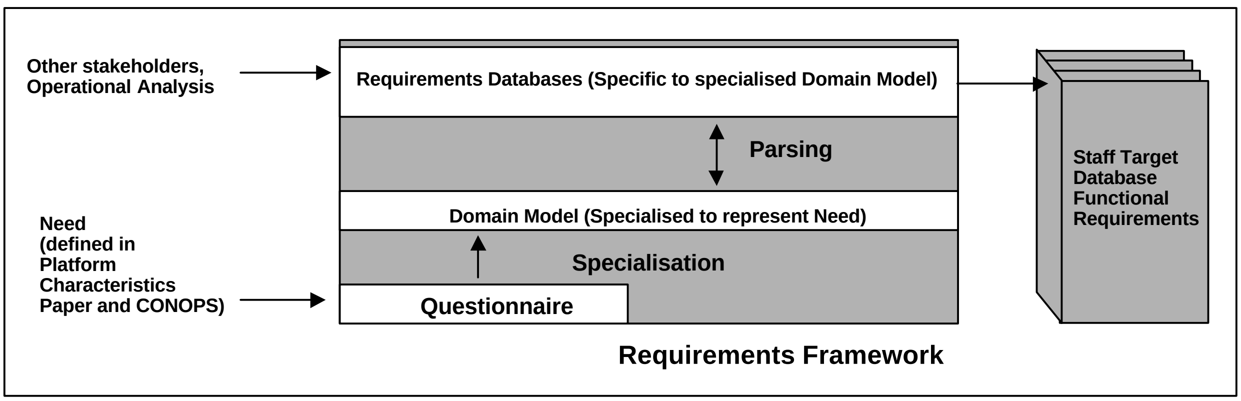

Figure 1. The Framework

4.1 The Framework Concept

Figure 1 shows how the Domain Model is used as a tool for the extraction of requirements. The Domain Model is mapped to a set of functional requirements held on a database (or set of databases). The Model is also mapped to some form of questionnaire, the questionnaire being associated with an algorithm that steers a user through a set of questions and establishes a specific platform capability based on Missions, Roles and Responsibilities. As the questionnaire is mapped to the model, this then also provides a convenient route for modifying the model by exclusion of unwanted specialisations from the hierarchy tree (and any additional relationships from within the core model).

Once the Domain Model has been specialised, it is a straight forward task to specialise the associated functional database and produce a platform specific functional requirement that can be passed on as a first draft to the procurement authorities, who can then incorporate associated non-functional, procurement, and contextual requirements.

Work on the Requirements databases has undergone a number of iterations, as is described in the next section. Development of the framework is currently at an early stage and will be addressed further during the discussion of future work in section 8.

4.2 Requirements Generation and Extraction

The initial approach for the requirement set was to create two hierarchies. The first would directly use the Hierarchy Trees of classes indexed by reference numbers. This set could then be used as reference definitions for terms and notation used elsewhere.

The second set was created directly from the core interaction figures and based on the individual associations (and agglomerations). To set these requirements in context, they were placed in a hierarchy beneath high level statements, based on subject areas and whole figures, which set the lower level context.

These requirements are expressed in terms that are only clear to those with detailed knowledge of the lower level hierarchies or in conjunction with the reference hierarchy. For convenience, this will be called ‘modelspeak’.

The requirements covered all of the required areas, and were reusable. However, their readability could have been improved (see section 6). The concept of requirement clusters has thus been devised. The idea is that for each of the ‘modelspeak’ requirements developed earlier, there will be a cluster of ‘real language’ requirements formed by taking specialisations of each of the classes associated with the ‘modelspeak’ requirements. This will provide real requirements, very tightly linked to a functional concept (for Justification and Traceability). This will also allow a mechanism for linkage to other non-functional requirements. This is further illustrated in section 5.

4.3 The Questionnaire Concept

The idea behind the questionnaire revolves around the idea of the relationships between the Context for a Warship (the Missions, Roles and Responsibilities) the associated capabilities, and the required equipments, which will provide these capabilities.

Figure 2 summarises the relationships between Roles and Responsibilities (the commonly used justification of the need for a requirement), Capabilities and Equipments.

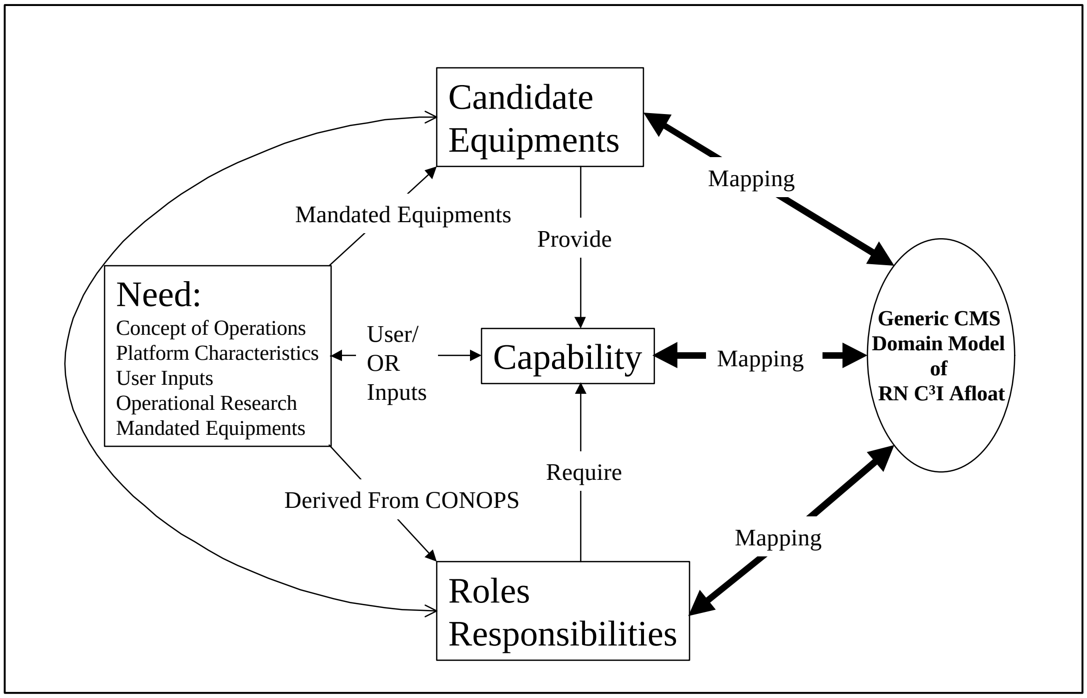

Figure 2. The Questionnaire Concept

Platform Roles and Responsibilities are stated in the UK in a paper known as a CONOPS (Concept of Operations). This paper states the applicable UK Defence Roles, and breaks these down into the traditional Warfare Area roles such as Anti-Air Warfare (AAW) and Anti-Surface Warfare (ASuW). These roles all require a number of Capabilities (such as 'Detect Airborne Real World Objects' or 'Classify Sub-Surface Detections'). Each Role will have a different set of capabilities, and the performance (and cost) requirements for these capabilities will determine the purpose of, and the equipment fit, constituting the Combat System.

Correspondingly, each equipment will provide a set of capabilities and have a likely cost associated with it. Therefore, for a set of capabilities there will be a number of potential equipment based solutions with a range of different associated costs.

Capabilities are already contained within the Model as tasks. Generic equipment/system types are also contained within the Model, along with the notion of the tasks that they perform. Therefore providing a mapping between warfare area roles and capabilities provides a link between roles and potential equipments (or types of system). It should be noted at this point that the term equipments is intended to indicate a level of technology (i.e. Multi Function Radar or Electro-Optical Sensor) rather than a specific 'off the shelf' item.

Developing this link immediately enables a 'generic' combat system fit to be devised for major components and degree of complexity. This enables decisions on major cost drivers to be taken by the procurement authorities before a contractor has gone too far along a particular system design and development route.

The importance of this process is that:

- A generic set of requirements can be specialised to represent a specific need, linked to an operational justification. They can therefore be reused on multiple platforms.

- A realistic idea of the complexity and fit of a Combat System can be reflected by the procurement specification at an early stage.

- The use of generic equipment types still allows a contractor to make actual equipment selections (thereby still allowing most of the integration risk to be transferred to the contractor).

- Although the questionnaire gives an indication of the equipments to be fitted, there will be no notion of specific architectures or computing technologies, which should be adopted.

It should be noted that as part of the maintenance of the model, a register of technological risks and their relationship to the model should be monitored and updated. This will ensure that current knowledge on the latest principles and systems can be accessed.

Most System underlying technologies are relatively stable (for example radar and sonar principles are well founded in physics, and the underlying nature will not change), some (particularly new or immature technologies) are extremely volatile and are almost constantly changing.

Equipments purely related to Defence (such as Weapons and Military specification sensors) can be predicted to a greater or lesser extent. There are a finite number of companies in the world capable of producing high-technology hardware; existing equipments are common knowledge, future equipments are often developed as a result of technology pull through from Government Agencies and private venture research. However the procurement of Commercial Off The Shelf (COTS) products from rapid growth areas (at present these are Communications and Computing) are changing so fast it is difficult to predict future trends. The only way to deal meaningfully with these technologies is by specifying the functionality, and allowing the contractor to select final equipments at a time closer to the in service date.

The areas of greatest technological advancement, and the latest relevant technological developments will need to be added to the Model regularly. This will ensure that all possible solutions are considered (due to the links between environmental effect, weapon/sensor and task (capability)). Technologies that are likely to be revolutionised during the procurement cycle will then be highlighted so that these factors can be considered in time.

5. Non-Functional and Contextual Requirements

Non-functional (performance, ARM, cost, time scales etc.) and contextual (history, background, roles, responsibilities etc.) requirements are not part of the remit for this work. However, non-functional requirements are the key factors which drive the selection of equipments and determine overall platform capabilities; contextual requirements drive the justification for these capabilities. Therefore, they must be considered in any long-term view of the work.

Non-functional and contextual requirements could potentially form their own hierarchies. However, in addition, each functionality statement will tend to be related to a number of these requirements. Therefore one option would be to use the functional hierarchy (i.e. the 'modelspeak' requirements) as a central frame around which clusters of other requirements could be added (by database links), as shown in figure 3.

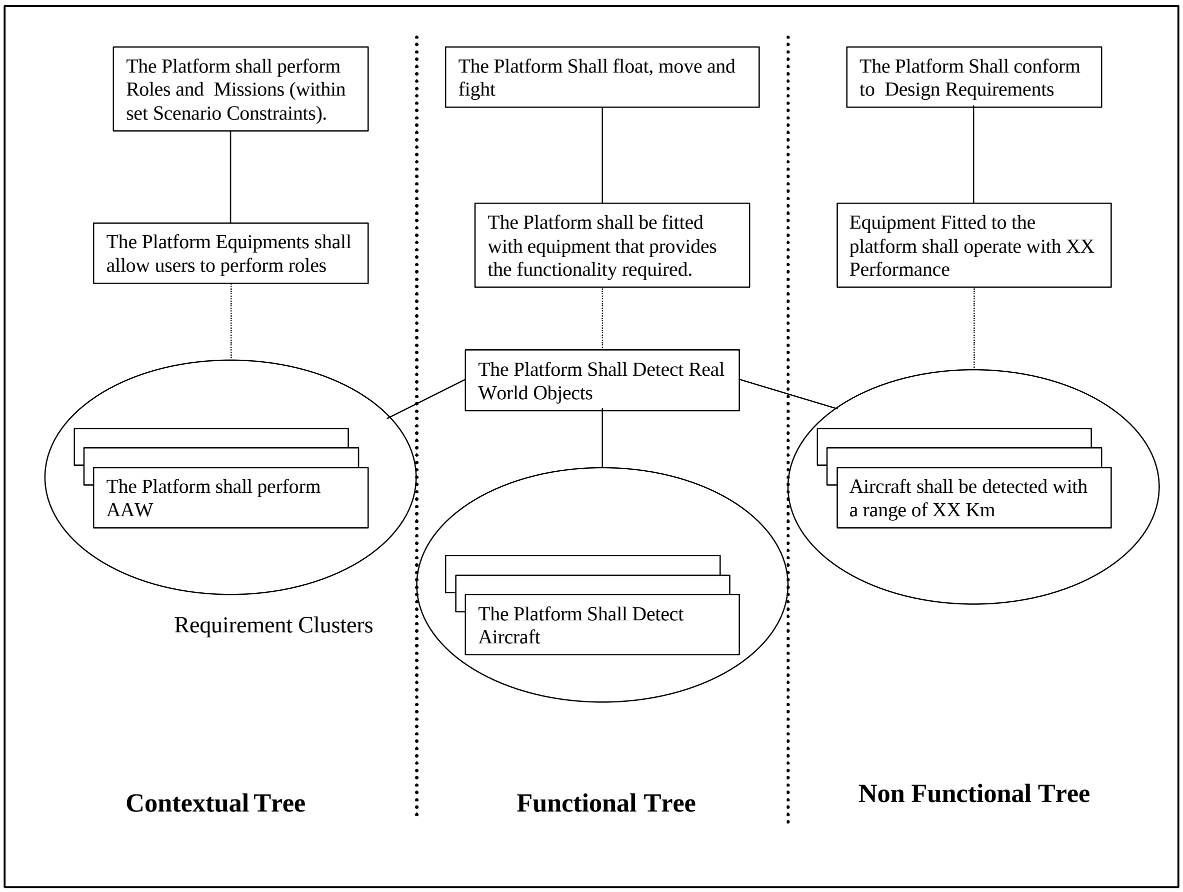

Figure 3 - Requirement Clusters

This would provide visibility to all factors related to a particular requirement and greatly improve traceability throughout the specification. This will not interfere with the relationships within each hierarchy, and may even help the development of the tree by contributing composite values upwards (i.e. ARM figures for each of the subsystems will contribute upwards to the ARM figures for the whole platform).

It would not be possible to instantly extract all of these non-functional and contextual requirements from the Model. However, a number of the attributes and operations currently present within the class descriptions give some of the parameters that need to be specified, or parameters typically associated with that class. It may also be possible in the future to perform some form of additional questionnaire stage based on core functionality and metrics. These options are not currently programmed.

6. The Project Studies

In order to study the potential use of the Model and associated databases in practical situations, three studies were undertaken, based on current procurement projects:

- The Future Surface Combatant (FSC) Case Study investigated the requirement of a warship project. The case study examined the specification and used core elements of the Domain Model and associated 'modelspeak' database to produce a specification of functional requirements for comparison against the available project documentation.

- The Commonality Project Study investigated the requirements for four major future warships, including an aircraft carrier, submarine, and mixed capability surface warships. The main thrust of the study was to compare and contrast the four specifications with each other, and against the Model.

- The Future Attack Submarine (FASM) Case Study, is currently investigating the generation of a submarine-specific functional requirement specification. It will incorporate the latest ideas on requirement clusters and the questionnaire process.

The studies are a way of illustrating the potential of the approach. The most important results obtained to date are as follows:

- Many of functional requirements (80-90%) are applicable to all platforms.

- These functional requirements do not necessarily indicate the equipment fit required unless accompanied by non-functional constraints (i.e. all platforms will have a functional requirement to perform AAW. This will involve detection and engagement of hostile aircraft/missiles, and protection of own ship and friendly assets - obviously for an AAW frigate, this requirement requires a more capable set of systems than the ASW frigate. However, this only becomes apparent when the non-functional requirement for range of engagement is considered).

- The Domain Model covered all requirements for combat system areas, for all of the naval platforms considered (it should be noted that the Domain Model does not currently address requirements associated with the hull or ship systems such as propulsion).

- The format of the requirements is far less important than the content. However it would make sense for the requirements (for future platforms) to be extracted from a common, reusable repository. The requirements produced are suitable for export to the DOORS database (the standard database used by MOD(PE)).

7. Conclusions

7.1 The Domain Model and Modelling Process

Domain Modelling has provided a way of capturing Domain Knowledge in a concise and consistent manner. As a stand-alone entity, it is useful as a reference on Naval Warfare and can be used to look up terms and definitions, as well as providing a pictorial representation of Domain interactions.

Both creation and validation of the model were intensive of manpower and domain expertise. This, however, seemed to be indicative of the complexity of the domain rather than the technique itself. The current model is adequate for research purposes, but continual effort will be required to keep its domain information current, if it is to be used in the longer term.

Much of the information captured would be applicable to any decision making process. If the Naval C^3I specialisations and terminology are replaced with those applicable to most other management processes then the model is likely to contain many of the key relationships at a high level. Modification of the model to represent other domains should be possible.

7.2 The Requirements Databases

Extracting requirements was (and still is) a cumbersome process. Extensions to the modelling tool-sets, possibly allowing the tools themselves to act as contracts, may be a more efficient way of producing requirements. An alternative may be to use application or platform specific Models as the requirement rather than using atomised statements, however this process would require extensive additional work to make it a feasible concept (legally) and enable the non-functional and contextual information to be adequately incorporated.

The final format of the generated requirements was far less important than the information and concepts represented by the model. This implies that there are alternatives to single line ‘atomised’ statements that may be more useful.

7.2.1 The ‘Modelspeak’ Database

The use of Hierarchy Trees of reference requirements has made the database relatively concise, however, flicking between the databases caused some confusion for those not experienced with the tool-set. The database was considered to be useful when the underlying concepts of OMT/UML are known and understood.

7.2.2 The Requirements Cluster Database

This database will be completed (for FASM) by September 1999. It should assist with the readability problems associated with the ‘modelspeak’ requirements. The outputs could then be expressed in a more natural language, whilst still benefiting from the structure and content of the model. The linkage to non-functional requirements seems to be a good idea in theory. However, extensions are not currently planned.

7.3 The Framework

The questionnaire process has begun by establishing interlinkage between roles, responsibilities, capabilities and equipments.

The next stage of the case study will incorporate roles and responsibilities into the Domain Model, and generate the associated contextual requirements.

Comparison of the Framework produced specification with the project specification will provide a confirmation of the questionnaire principals.

Tool-set support for the Domain Model has been relatively easy to achieve by the use of OLE interfaces present within the tools used. These interfaces have greatly increased the ability to perform data manipulation, and to customise aspects of the tool. They will also allow integration with DOORS.

7.4 The Future Procurement Processes

Procurement must be flexible. Every large project has it's own special considerations and a different set of policy needs. Investigation is required to consider some of the implications of the adopted procurement process on the most appropriate style of requirements (and specifications). Issues covered should include:

- A way of judging what sort of system is being procured (what basic functions and technology are likely to be required).

- A recognised way of judging technological developments and deciding which technologies will change and therefore must be specified closer to the end of procurement.

- What constraints must be incorporated into a specification.

- What 'In-service' equipments should be assessed for obsolescence before they are mandated/ considered for GFE provision.

The author believes that procurement should take place knowledgeably and flexibly. Each project will be unique, with its own set of constraints. We must study each project, and identify any rapidly changing technologies, as well as any related stable, in-service items. Pragmatism must be the key to deciding the appropriate level of requirement.

We believe that the tool-set we are developing will solve a lot of the problems associated with producing reusable, consistent, unambiguous requirements. Future development of the framework should facilitate flexible procurement based on sound system engineering principals, and be able to contribute to most levels of specification, within any type of procurement policy.

8. The Way Ahead.

The immediate way ahead, as already stated, is to conduct the FASM Case Study. This will involve the creation of: figures to associate specific Plans and plan content (in line with the questionnaire concept); additional generic requirements to represent modifications to the model and requirement clusters; and additional data manipulation tools.

After this study, the programme is currently scheduled to continue expanding the plan figures and cluster database to represent generic surface warships as well as submarines.

There are a number of options for continuing this work beyond the current programme, these include:

- Database Extensions to represent other cluster trees (non-functional and contextual requirements).

- Development of an automated framework questionnaire (or development of automation to support the process).

- Extension of the model to Whole Warship and possibly Tri-Service environments.

- Development of lower level equipment models to represent specific equipment types, and specific equipments. These models could then be held in a library to act as a repository for future projects.

The work has been structured in such a way that it has the flexibility to cater for conceivable changes to the UK procurement policy and to support changes in research priority.

9. Glossary

AAW	Anti-Air Warfare
ARM	Availability, Reliability and Maintainability
ASuW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
Atomised Requirements	Single Line requirement statements
C^2	Command and Control
C^3I	Command Control Communications and Intelligence
CMS	Combat Management System
CONOPS	Concept of Operations (high level platform requirement)
COTS	Commercial Off The Shelf (commercial products, not generally produced to military standards)
CS	Combat System
DERA	Defence Evaluation and Research Agency, the research agency within UK MOD
DOORS	Dynamic Object Oriented Requirement System
DOR(Sea)	Director Operational Requirements (Sea), The branch responsible for funding Naval research
FASM	Future Attack Submarine
FSC	Future Surface Combatant
Generic 94	A decomposed re-usable functional database based around the Plan, Conduct, Review concept.
GFE	Government Furnished Equipment (Equipment provided to a contractor by the government i.e. Cryptos etc)
MOD(PE)	Ministry of Defence (Procurement Executive), now DPA, the Defence Procurement Agency.
‘Modelspeak’	Requirements generated directly from the Domain Model associations.
NATO	North Atlantic Treaty Organisation
OMT	Object Modelling Technique (Forerunner of UML)
Radar CSA	Radar Cross-Sectional Area
RN	Royal Navy/Royal Naval
ST	Staff Target (High Level UK requirement document)
UK MOD	United Kingdom Ministry of Defence
UML	Unified Modelling Language

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