Adapting to Accelerated Acquisition: WSAF in LAND 19 Phase 7

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ABSTRACT

In a departure from the document-centric approach to capability definition, last year the Whole-of-System Analytical Framework (WSAF) was adopted for the generation of the preliminary Capability Definition Documents for LAND 19 Phase 7, Ground Based Air and Missile Defence (GBAMD). Developed by DSTO, the WSAF is an innovative approach founded upon the Defence Architectural Framework (DAF) and Model Based Systems Engineering (MBSE) principles. The WSAF captures the capability requirements, traced to the user needs and operational context, in a knowledge model that is supported by a well defined process.

Recently, a need arose to develop options for the Counter-Rocket Artillery and Mortar (C-RAM) capability for LAND 19 Phase 7. WSAF was again employed to generate a Description of Requirement (DOR) document to define user needs and functional requirements. The WSAF method and knowledge model allowed the Integrated Project Team (IPT) to produce the DOR in a rigorous, rapid and cost effective manner. Rather than the DOR being a standalone document developed in isolation, it built upon the C-RAM requirements already existing in the LAND 19 Phase 7 GBAMD WSAF knowledge model. The WSAF also aided the auto-generation of the DOR and validation of the C-RAM requirements.

WSAF offers significant benefits over the traditional capability definition approach including improved robustness and traceability to capability needs and client requirements, and their retention in a knowledge model for future reuse and enhancement. In the present instance, the prior existence of the WSAF allowed the LAND 19 Phase 7 IPT to respond quickly and effectively.

This paper describes the WSAF, its application to capability definition and how it enhanced the IPT's ability to adapt to changing priorities. The paper will also describe the benefits derived from the WSAF approach and its planned future growth path.

1. Introduction

Model-Based Systems Engineering (MBSE) is an emerging discipline that uses the development of a model to represent the problem-space to support the capability life cycle. It can be characterised as "...the collection of related processes, methods, and tools used to support the discipline of systems engineering in a 'model-based' or 'model driven' context." [1].

MBSE, in the form of the Whole-of-System Analytical Framework (WSAF), has been applied to Project LAND 19 Phase 7 (LAND19-7) which seeks to develop the Australian Defence Force's (ADF) future Ground-Based Air and Missile Defence (GBAMD) capability [2]. The project is currently in the process of defining the capability requirements which involves the development of the Preliminary Operational Concept Document (POCD), Preliminary Functional and Performance Specification (PFPS) and the Preliminary Test Concept Document (PTCD) for First Pass consideration.

In a departure from the document-centric approach to capability definition currently favoured in Defence, the WSAF was used to model the GBAMD capability system and its external interfaces. The LAND19-7 POCD and PFPS were then generated as artefacts from this model. The recent need to develop the Description of Requirements (DOR) for the Counter-Rocket, Artillery and Mortar (C-RAM) sense and warn component of GBAMD demonstrated the LAND19-7 IPT's enhanced ability to adapt to the need for an accelerated acquisition through the employment of this methodology. The WSAF and its benefits, particularly as they applied to the C-RAM accelerated acquisition, are outlined in this paper.

1.1 The Whole-of-System Analytical Framework

DSTO undertakes analysis supporting the introduction of complex capability into Defence service. The increasing complexity of defence capabilities and the environment in which they operate has driven the need for a holistic and more robust approach to capability analysis. The WSAF was developed to meet this challenge [3] and is based on established Enterprise Architecting (EA) and Systems Engineering (SE) principles and DAF guidance [4].

Initially, the WSAF was applied to develop the analysis requirements for major capital equipment projects. This application showed that, with minor modifications, its use could be extended to developing capability requirements in a more disciplined, rigorous manner. The definition of both capability requirements and analysis requirements benefit from the existence of a knowledge model from which the required project documentation may be auto-generated.

LAND19-7 represents the first application of the WSAF to capability requirements definition. Specifically, the WSAF knowledge model, developed for LAND19-7, was used to auto-generate the Capability Definition Documentation (CDD), the POCD and PFPS. This effort has been reported in some detail [2]. Two significant conclusions from this initial effort were; first, the WSAF aided the IPT to produce a more rigorous set of requirements that were traceable to strategic guidance and the operational needs, and second, the knowledge model is available for reuse later in the capability development process.

The WSAF architecture includes the elements depicted in Figure 1 and described below:

1.1.1 Knowledge Model

A conceptual model that describes the architectural perspectives of behaviour, physical form, purpose, data, performance, and managerial [5]. These perspectives enable the architecture, attributes, relationships, boundary and interfaces of the capability system to be defined. The content of the knowledge model may be viewed from differing perspectives including the DAF views [4]. The CDD, and potentially other related documents, are extracted directly from the knowledge model. Figure 2 depicts a screenshot of the LAND19-7 knowledge model within the CORE® development environment [6].

1.1.2Reference Model

A meta-model that defines the knowledge classes and the inter-relationships between these classes, providing structure to the knowledge model.

1.1.3Process Model

A description of the process whereby the content of the knowledge model is developed. The process model is aligned to the Capability Definition Documents Guide [7] and other related systems engineering best practise such as described in the INCOSE Systems Engineering Handbook [8].

1.1.4Document Scripts

Supporting the access to the knowledge model is a user portal and a series of scripts that are executed to auto-generate documentation (such as the POCD and PFPS) from the contents of the knowledge model.

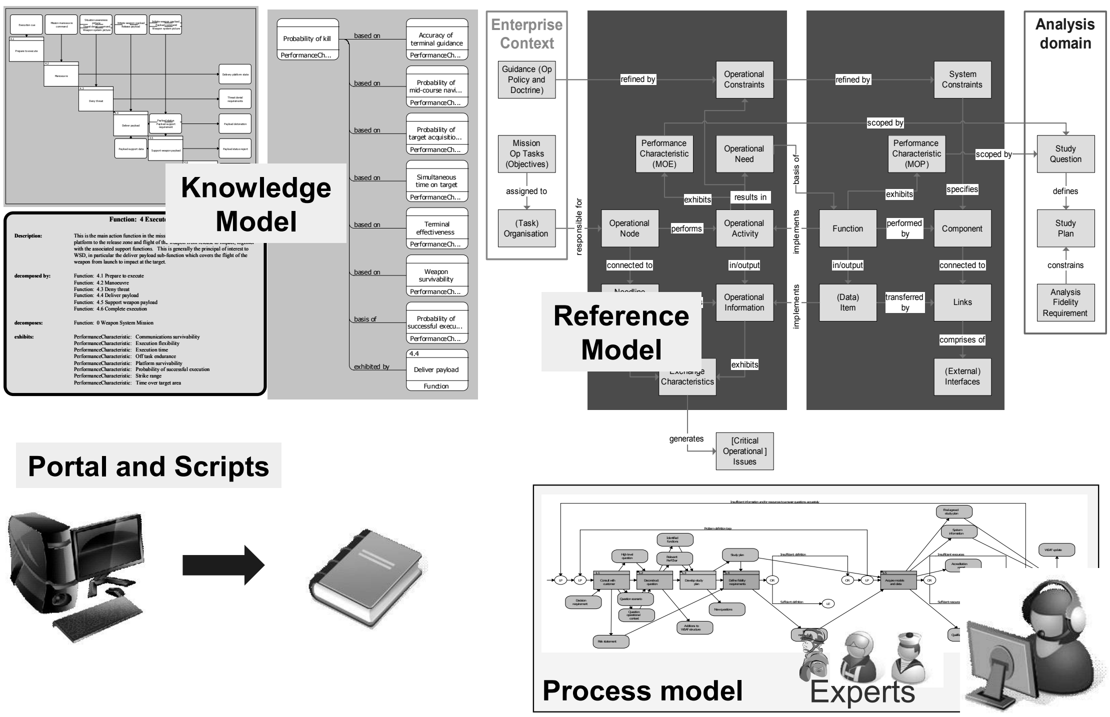

Figure 1: Simplified view of the WSAF

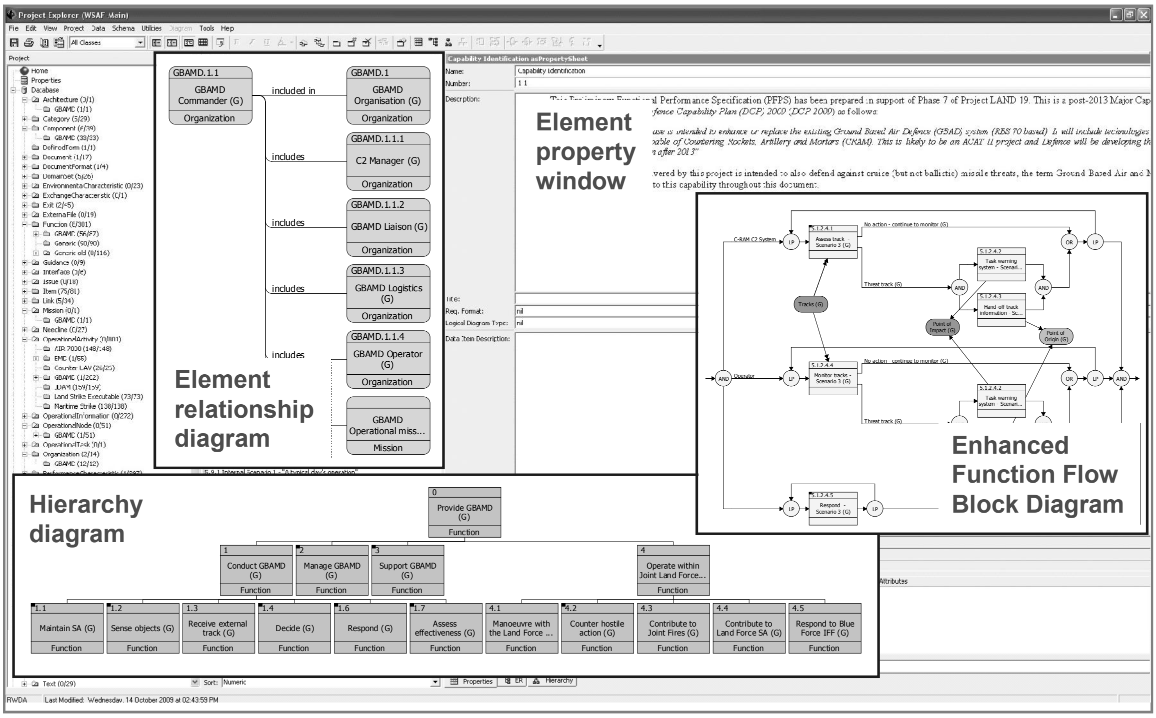

Figure 2: Example Knowledge Model Content

1.2 Experiential Benefits for LAND19-7

Employment of the WSAF for LAND19-7 has demonstrated several benefits [2]. Importantly, this prior use of the WSAF confirmed that the WSAF is compatible with the mandated capability development process producing documents that are compliant with the CDD Guide [7]. The benefits that the WSAF brings to capability definition have been discussed more fully elsewhere [2] and hence only a summary is provided here:

- Enhanced credibility of the knowledge model and therefore the document outputs;
- Enhanced understanding between stakeholders through a greater level of engagement;
- Greater traceability of decisions impacting the final documentation;
- Efficient generation of the knowledge model through reuse;
- Standardisation of language across stakeholders;
- The knowledge model provides the basis for a more efficient method for developing, capturing and iterating knowledge;
- The knowledge captured in the model can be read and explored in a number of formats, thus reduces the learning time for new users;
- Efficient and effective development of the knowledge model that bridges all levels of abstraction; and
- Improved risk management in the production of the documentation.

2. Urgent need for C-RAM DOR

2.1 The Urgent Operational Need

Shortly after becoming Defence Minister in July 2009, Senator Faulkner tasked the Chief of the Defence Force (CDF) to review the force protection provided to Australian Defence Force (ADF) personnel deployed in Oruzgan Province [9]. The need to review these measures arose because Taliban attacks using rockets and improvised explosive devices were then (and continue to be) an ongoing threat for ADF personnel in Afghanistan [7]. The Taliban are also using these attacks for propaganda purposes by posting videos of the attacks on the internet [10], [11], [12]. The operational and propaganda value of the attacks is increased by the mounting casualties suffered by the Coalition and the ADF in particular [13].

Following the force protection review, the Minister for Defence formally announced on 1 June 2010, the implementation of a range of force protection enhancement measures [7]. These included the acquisition of a C-RAM sense and warn system. The C-RAM initial operational capability is required to be in service by the end of 2010 with subsequent progressive delivery of the remaining capability [7].

In early 2010, the LAND19-7 IPT was tasked to urgently prepare a definition of the operational and system requirements for a C-RAM sense and warn system to support the proposed acquisition. Under the normal capability definition process, operational or "user" requirements are contained in the OCD and the system requirements are codified in the FPS. However, because of the tight timeframes, it was determined that both the user and system requirements would be incorporated into a single document termed the Description of Requirement (DOR).

2.2 No Development Procedure or Document Guide for the DOR

In setting out to develop the DOR, the IPT was challenged by the lack of a DOR document guide or template and therefore it was necessary first to create a document structure. The document structure was workshopped and the decision was made to base the DOR structure (and content) on the requirements for a complex acquisition. This enabled the project scheduled to be achieved whilst providing sufficient rigour to evaluate the candidate materiel solutions. The materiel solution would be constrained to commercial and military off-the-shelf equipment, hence the complex procurement document was fit for the C-RAM acquisition.

The second challenge that the IPT faced was that there was no defined procedure for developing the operational and system requirements for an accelerated acquisition. The defined capability development process applies to acquisitions which are subject to deliberate planning and analysis.

2.3 The Task at Hand

As discussed earlier, a significant amount of the analysis for the Ground Based Air and Missile (GBAMD) capability, of which C-RAM is a component, had been performed recently. The employment scenarios, the overall GBAMD architecture and capability definition had been produced using the WSAF. Within the GBAMD knowledge model provision had been made for a C-RAM component, albeit not to the level of detail required for acquisition.

In a recent GBAMD capability study performed by the IPT, the option for a C-RAM sense and warn capability had been considered. Therefore, the IPT was well placed to respond to the urgent request for a DOR as both the operational analysis and

GBAMD knowledge model was at hand. What remained was to further define the C-RAM component and to verify that the GBAMD system architecture and system interfaces that had previously been designed remained current. The specific tasks that the IPT had to accomplish were:

- Refine the operational context for the C-RAM capability;
- Define the system interfaces;
- Establish the operational requirements;
- Translate operational requirements into system requirements; and
- Define the interface requirements.

The operational and physical environment in which the C-RAM capability was to operate in the immediate future was known. However, the IPT also needed to consider broader operational requirements that may arise during the life of the capability, for example, the integration requirements with the future GBAMD capability planned to be introduced under LAND19-7.

2.4 The Process Followed

In order to define the C-RAM operational, system and interface requirements, a detailed understanding of the capability was necessary. By modelling the C-RAM capability within the WSAF environment, the problem space could be more comprehensively analysed resulting in a greater confidence in the derived requirements. Since the high level GBAMD capability had been modelled within the WSAF, the operational context was clearly defined. Therefore, developing a knowledge model of the C-RAM capability in the same environment enabled extensive reuse of the GBAMD knowledge model, exploiting the IPT's familiarity with the existing knowledge model and WSAF processes, while maintaining the validity of the overall GBAMD knowledge model.

To efficiently develop the required model, the C-RAM component of the GBAMD knowledge model needed to be updated and refined to provide sufficient detail for requirements definition. Also, a template and script for structuring and generating the DOR was required to be developed.

Due to the short time frame, an intensive workshop was undertaken to develop the DOR. The IPT members engaged in the workshop exercised the following roles:

- Client (desk officer) – IPT lead, task definition and articulation of user needs;
- Warfighter subject matter expert (SME) – current warfighting doctrine (Tactics, Techniques and Procedures) and user needs;
- Technical expert (S&T advisor with reach back to DSTO SMEs) – population of the knowledge model, guidance, and technical requirements solicitation;
- System modeller – model development and requirements solicitation;
- MBSE SMEs – provided guidance on MBSE methodology; and
- Scripting SME – developed the document generation scripts.

These roles were performed by two contractor and three defence staff, with the contractor effort being focussed on developing the activity models in CORE®, managing the knowledge model (data entry and maintaining model integrity) and generating the document scripts. MBSE expertise was provided to the IPT jointly by DSTO and contractor staff. This left the desk officer free to concentrate on leading the IPT activity, articulating the user and operational needs and providing the warfighter input, rather than on producing the document.

In the period of a week, a model of the C-RAM capability was developed, resulting in the first draft of the DOR. During the following week, the DOR was reviewed by the IPT, and the knowledge model was iteratively updated, resulting in a new version of the DOR being generated.

The resultant DOR for the C-RAM sense and warn capability and importantly an updated GBAMD knowledge model was developed within two calendar weeks, achieved with approximately a total of eight staff-weeks of combined Defence and contractor staff effort. The support contract dollar cost amounted to less than a quarter of what is normally spent on a contractor developed OCD.

2.4.1 Description of Requirements Document

Since there were no existing templates for the documentation required for an accelerated acquisition, a Complex Procurement Data Item Description (DID) was used to develop the DOR structure and content. This document format had previously been successfully employed for a previous Defence rapid acquisition. The DOR contained:

- User needs definition;
- Needs definition boundary, consisting of: user environment, operational scenario summary, consolidated operational needs, operational policies, solution-independent constraints;
- Solution-independent requirements, consisting of: system mission overview, system context, system functionality and performance, design and implementation constraints, system and acquisition boundaries, existing materiel system overview;
- System solution concept, consisting of: mission system solution overview, mission system solution description, system personnel, support system concept, existing support system concept, transition support service needs, support system capability comparison, validation concept;
- Functional requirements; and
- Solution-independent scenarios, including the C-RAM OV-2 (operational node connectivity) and OV-5 (operational activity model).

2.4.2 Requirements Development Process

Although the C-RAM task was for an accelerated acquisition, the capability development process was still required to be followed. The WSAF requirements definition process described in [2] was essentially employed to develop the DOR, albeit with some key differences:

- Instead of developing the full capability model from first principles, the existing GBAMD knowledge model was expanded to add additional detail relating to the C-RAM capability, while ensuring the integrity of the existing GBAMD knowledge model was maintained. Some minor adjustments to the activity flows that had been previously defined became necessary in order to incorporate the unique functions performed by the C-RAM capability.
- During the development of the operational activity flows, the C-RAM specific sections were segmented from the remaining GBAMD model to avoid contamination. In other words, the C-RAM model was decomposed separately, while using the GBAMD model to provide context only, then once the C-RAM model was validated it was reintegrated into the main GBAMD model. The end result was a unified GBAMD model that was defined to a greater level of detail in the C-RAM specific areas.
- During the C-RAM functional decomposition, the GBAMD model was used as a baseline (thereby ensuring

easy reintegration) with some existing functions being slightly modified or updated, and several new functions being created to encompass the unique, C-RAM functions. These included the following functions:

- Provide threat warning;
- Monitor track; and
- Assess the effectiveness of the C-RAM response.

Throughout the entire process, the new and revised data was captured within the GBAMD knowledge model and the relationships were populated. Once each class of information was deemed sufficiently defined/decomposed and the relationships to other classes were populated, the next class of information was then defined or reviewed. Once each class had been initially populated, the entire knowledge model was reviewed holistically to ensure there were no discrepancies between the different classes of information.

The knowledge model was then reviewed by the desk officer, and appropriate SMEs, with the process iterated until the desk officer deemed the problem space adequately defined and the requirements derived to a sufficient fidelity.

Developed in parallel and independently to the C-RAM knowledge model, was the DOR document structure and the scripts required for its generation. Once the scripts had been developed, they could be executed to auto-generate the DOR document from the content of the knowledge model. The generated document would flag the incomplete sections, identifying any gaps in the knowledge model content. This was done progressively during the knowledge model development to identify areas that needed further work. Hence, executing the scripts allowed a knowledge model completeness check to be performed.

Once the knowledge model had been completed, the first full draft of the DOR was exported and submitted to the desk officer and the remainder of the IPT for review. Since the C-RAM capability had been modelled using an MBSE tool, any changes to the system or architecture as a result of the reviews were able to be rapidly implemented within the model and a new version of the document could be exported almost instantaneously. Also, by making any modifications directly to the model, the exported document was ensured to be traceable and coherent, greatly increasing the credibility in the final product.

3. Observations

The lessons and benefits of employing MBSE, and the WSAF in particular, noted previously [2] were reinforced. However, development of the DOR for an accelerated acquisition differed from the previous WSAF experience in several important ways:

- The required completion timeframe was weeks rather than months;
- At the outset, the IPT had a completed GBAMD knowledge model that had undergone some validation and stakeholder review;
- The IPT was well practised in the WSAF and DSTO SME support was available to aid the application of the WSAF methods and tools. Also, contractor SME support in CDD generation and CORE® scripts development was also available.
- There was no DOR development guide or template available to guide the IPT in the task at hand.

Given this context, and the results achieved by the IPT, several observations may be made. The ability to respond to the extremely short time available to the IPT was due to the existence of the GBAMD knowledge model.

This existing GBAMD knowledge model incorporated high level requirements of a C-RAM capability integrated within a broader GBAMD capability. The task of knowledge model development was reduced to one of amplifying a specific area of the knowledge model, with the associated verification checks to ensure that the new information added to the knowledge model did not invalidate that which had been developed earlier. Hence, the prior existence of the GBAMD WSAF Knowledge Model:

- Obviated the need for:
  - A fresh strategy to task analysis – as this already existed within the WSAF knowledge model; and
  - The development of a system architecture to determine how the proposed new C-RAM capability would fit in with the existing and proposed GBAMD capability.
- Enabled the more detailed requirements for the C-RAM capability and the sense and warn functions to be built expeditiously upon the already existing high level requirements; and
- Facilitated the identification of C-RAM requirements for all the GBAMD operational scenarios that had been defined in the knowledge model.

In summary, the WSAF knowledge model supported the articulation of requirements which were at once logical, comprehensive and to an appropriate level of detail. Further, the capability study that had been performed previously:

- Identified the potential for a C-RAM capability based on a sense and warn system; and
- Incorporated a preliminary analysis of available materiel solutions.

This allowed the IPT to readily identify COTS and MOTS materiel solutions that were available to fill the C-RAM capability requirement.

Furthermore, the operational, technical and MBSE expertise resident within the IPT, or available to it, was high. Additionally, SME support in the WSAF methods and tools was available in the form of DSTO and contractor staff. The importance of this aspect can not be overstated. The IPT was able quickly to orient itself to the task, determine a way ahead and work efficiently towards achieving the desired outcome. The quality of the DOR and the timeliness of its completion are directly attributable to the expertise within the IPT and the availability of SME support.

4. Benefits of Employing the WSAF for the DOR

Adopting a structured and consistent MBSE approach, like the WSAF, enabled CDG to rapidly adapt to a change in the acquisition strategy to meet urgent operational needs. This was achieved due to a few key benefits, including the ability to utilise the expertise and knowledge attained by the IPT throughout the LAND19-7 PCDD generation, for the adaptation of the model for the C-RAM DOR. The consistency in development approaches enabled the short time frames to be satisfied, while still maintaining the quality of the document developed.

4.1 Adaptation Benefits

As well as the experiential benefits offered by MBSE (discussed previously in this paper) additional benefits arose during the DOR development due to the structure provided by the WSAF. These benefits were realised throughout the adaptation of the existing knowledge model for the C-RAM problem, and included the following:

- Pre-existing knowledge model: One of the key benefits of following a consistent MBSE approach is the potential for knowledge reuse. Since the LAND19-7 GBAMD knowledge model had already been rigorously developed and reviewed, while encapsulating the C-RAM capability, the high level context of the capability was already defined, allowing the desk officer and model developers to focus on increasing the definition and fidelity of the C-RAM capability within the GBAMD context. This extra definition was added in such a way as to maintain the integrity of the overall GBAMD knowledge model, resulting in a knowledge model that was decomposed to a greater level of detail in the C-RAM problem space.
- Rapid iteration and review: By following the WSAF approach, any changes that resulted from the reviews were easily implemented and a new version of the document could be auto-generated with little effort. This iterative approach enabled a rapid review and model update turnaround time, which in turn enabled a more thorough and comprehensive review process than would have occurred if a document-centric approach was adopted. In the document-centric approach where a change was required to the underlying operational or system definition, the changes would need to me made to the diagrams and the tables, while manually having to ensure that the underlying relationships were still correct, well defined and consistent. Therefore, the WSAF enabled a rapid turn around time, by rigorously enforcing and automatically maintaining the underlying relationships (traceability) and/or identifying when the required relationships had been broken or did not exist.
- By amending and augmenting the existing knowledge model, a significant amount of effort was able to be saved in the DOR. Without the existing, well defined model, such rapid generation of the C-RAM DOR would not have been possible, resulting in either a delay in the acquisition, or a less comprehensive and traceable description of requirements.

4.2 WSAF Benefits Amplified

Along with the adaptation benefits that resulted from the WSAF approach, several of the expected “typical” MBSE benefits were amplified. A key benefit was the abbreviation of the development process due to the existing LAND19-7 knowledge model. Since C-RAM was a subset of the GBAMD capability, the LAND19-7 knowledge model was utilised to provide context and define external interfaces. The LAND19-7 knowledge model also provided decision traceability, a standardised language for all stakeholders, and a transparency in the DOR document generation which led to an improvement in risk management during the production of the C-RAM documentation.

5. Demonstrated Future Use

A less obvious lesson drawn from the LAND19-7 DOR experience is that it demonstrated a proposed future use of the WSAF in developing a knowledge model for a “parent” capability system which establishes the overarching capability architecture, interfaces, information flows and requirements with the potential to subsequently develop detailed requirements for “child” capabilities. This concept is also referred to as “Umbrella OCD’s”.

An Umbrella OCD would be a high level Operational Concept Description of a capability that is developed for the purpose of providing context and defining high level boundaries and interfaces of sub-capabilities. As mentioned, this could also be referred to as "parent-child OCD's", where one high level OCD could be developed to support many children OCD's.

Since the POCD for the overall GBAMD capability for LAND19-7 had already been developed within an MBSE environment, and C-RAM was a sub-capability to be captured within, it acted as a Pseudo Umbrella OCD. The GBAMD operational activity model (OV-5) was originally decomposed to the top level of the C-RAM capability, bounding the problem space and providing the required context. Building on this existing knowledge resulted in only the C-RAM specific activities requiring further decomposition. This enabled the system modellers and the desk officer to be able to focus on the new requirements that were C-RAM specific, enabling the rapid development and turn around time of the C-RAM model and the resulting DOR.

6. Summary

The upfront investment in the WSAF allowed the LAND19-7 IPT to adapt quickly to the need for an accelerated acquisition, which would not have been achievable with the same quality in such a short time frame if a document-centric approach was followed. Therefore, a large amount of the upfront cost of developing the GBAMD knowledge model for the PCDD was recouped as a result of the accelerated DOR development.

7. Future Growth

The employment of an MBSE approach in generating Capability Definition Documents (POCD, PFPS and C-RAM DOR) has been demonstrated for project LAND19-7. This success has encouraged the LAND19-7 IPT to consider extending the use of WSAF to the production of further key documents. Accordingly, in the lead up to first pass it is planned to produce the PTCD and Technical Risk Assessment (TRA) using the MBSE approach and the WSAF as the vehicle.

It is planned to grow TCD development out of the functional breakdown and the following existing WSAF knowledge classes: MOEs, risks, and issues. There is a need to review and improve the existing content of these WSAF elements, and their relationships, and to write a new CORE® script to output the PTCD document. This work can be initiated at the solution-independent stage and will be built upon as the project proceeds through the Capability Life Cycle [14].

TRA development will grow out of the functional breakdown and critical operating issues and existing WSAF elements, including risks relating to particular technologies and issues. TRA development will be initiated at the solution-dependent stage (i.e. post-1st pass). There is a need to write a new CORE® script to generate a document in compliance with the DSTO TRA template. It remains to be determined whether the entire TRA will be contained within the knowledge model, or whether specific elements of the TRA document (e.g. tables and annexes) will be generated by CORE®. The WSAF TRA module will be built upon over time as the project proceeds through the Capability Life Cycle.

An argument can be mounted to extend the WSAF approach to the solicitation stage and beyond. Specifically, the preliminary FPS can readily be developed into the full FPS that is incorporated into a Request For Proposal (RFP) or Request For Tender (RFT). Additionally the TCD can be developed into a Test and Evaluation Master Plan (TEMP) and, if logistics and maintenance requirements are added into the WSAF knowledge model, it would be possible to produce the Statement of Work (SOW) and the Integrated Logistic Support Plan. Further the TRA may be grown into a Risk Management Plan. LAND19-7 offers the opportunity to explore the utility of extending the MBSE approach in at least some of the directions outlined.

8. References

[1] Survey of Model-based Systems Engineering (MBSE) Methodologies, INCOSE-TD-2007-003-01, INCOSE. June 2008.

[2] K. Robinson, D. Tramoundanis, D. Harvey, CAPT. M. Jones, and S. Wilson, Demonstrating Model-Based Systems Engineering for Specifying Complex Capability, presented to SETE 2010, Glenelg, South Australia, May 2010.

[3] K. Robinson, and D. Graham, An Improved Methodology for Analysis of Complex Capability, presented to SETE 2010, Glenelg, South Australia, May 2010.

[4] Defence Architecture Framework online guide, Chief Information Officer Group, Department of Defence, undated. Internal Defence website URL http://intranet.defence.gov.au/ciogweb/sites/DAPM/comweb.asp?page=48651. Accessed on 30 June 2010.

[5] W.M Maier and E. Rechtin, The Art of Systems Architecting, Third Edition, CRC Press, Florida, 2009.

[6] Vitech, Model-Based Systems Engineering, www.vitechcorp.com/solutions/MBSE.html Accessed December 2009.

[7] Capability Definition Documents Guide, V1.4, Defence Materiel Organisation, Department of Defence, February 2009.

[8] Systems Engineering Handbook Version 3, A Guide For System Life Cycle Processes and Activities, INCOSE-TP-2003-002-03, INCOSE, June 2006.

[9] Senator J. Faulkner, Force Protection Measures, Minister for Defence Press Release 057/2010, 1 June 2010. URL http://www.defence.gov.au/minister/Faulknertpl.cfm?CurrentId=10360 Accessed 28 June 2010.

[10] R. Callinan, Taliban 'Filming Attacks for Internet', The Australian, June 12, 2010. URL http://www.theaustralian.com.au/news/nation/taliban- filming- attacks-for-internet/story-e6frg6nf- 1225878648163 Accessed 28 June 2010

[11] Rocket attack on ISAF Patrol Base Qudus in Oruzgan, Liveleak, 4 May 2009. URL http://www.liveleak.com/view?i=63d_1255187107 Accessed 28 June 2010

[12] Afghan Mujahidin Showing a Rocket Attack on NATO/ISAF Base in Oruzgan, Liveleak, undated. URL http://www.liveleak.com/view?i=f99_1260447672. Accessed 28 June 2010.

[13] Casualties – ADF, Nautilus Institute for Security and Sustainable Development, undated. URL http://gc.nautilus.org/Nautilus/australia/afghanistan/casualties-adf Accessed on 30 July 2010.

[14] Defence Capability Manual, Department of Defence, 2006.