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ENGAGEMENT MODELLING BASED ACQUISITION: A CONCEPTUAL TOOL TO HELP STREAMLINE THE RCN PROCUREMENT CYCLE

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AIM

1. This paper will serve to identify challenges in the procurement cycle that make the process lengthy, introduce the concept of Engagement Modelling Based Acquisition (EMBA), and identify how it might improve these challenges.

INTRODUCTION

2. As mentioned in Canada's latest Defence Policy 'Strong Secure Engaged'[1] (SSE), "Effective defence procurement is vital to ensuring the Canadian Armed Forces is equipped and ready…"[2] Yet, according to former Assistant Deputy Minister – Materiel ADM(Mat), Alan Williams, "the acquisition period from the identification of a deficiency to the close-out of a project was 15.8 years."[3] SSE therefore states that "the Defence team will reduce project development and approval time in the Department of National Defence [DND] by at least 50 percent…through improved internal coordination, increased delegation, and strengthened

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[1] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy* (Ottawa: DND Canada, 2017).

[2] *Ibid*, 74.

[3] Alan S. Williams, *Reinventing Canadian Defence Procurement* (Kingston : Breakout Educational Network, 2006), 95.

approval processes."[4] However this is only one portion of a multi-faceted solution as the majority of delays are related to sub-processes that are outside the Public Services and Procurement Canada and Treasury Board control.

3. Although the subsequent concepts suggested are aimed at small-scale major capital acquisitions such as a new radar or weapon system, in theory they could be scaled up or down as necessary, or to different types of procurement. Also, the steps involved are done in terms of Royal Canadian Navy (RCN) processes, but could be modified for Royal Canadian Air Force or the Canadian Army.

DISCUSSION

Sources of inefficiencies

4. In order to better understand *how* to improve the procurement cycle, we must first look at the reasons *why* the cycle is fragmented. The following is a depiction of such source of inefficiencies:

a. Capability Gap Identification: The usual process for beginning the procurement cycle comes from the realization of a capability gap following an exercise by the Canadian Forces Maritime Warfare Centre (CFMWC). This may be realized by accident, or advertently based on a query ('What-If' analysis). In a worst-case scenario, a gap may

[4] DND, *Strong Secure Engaged…*, 112.

be identified as a result of a preventable tragedy. However, before the gap is confirmed, sufficient data is required to be collected, often requiring significant time and cost to set up a trial. For these reasons, it may take years before the procurement process even begins;

b. Requirements Definition: There are two major difficulties with building a satisfactory requirements list: First is the struggle between the necessary time to produce a high-fidelity, 'bit level', set of requirements[5] and the quality of the product that will be delivered; Second is the necessity for justification of the list of requirements. These difficulties can result in either or both the schedule and quality becoming unfavourable;

c. Bidding Process: The process of fairly evaluating a set of bids is time-consuming and is difficult to ensure that the solution proposed will in fact satisfy the requirement. This risks quality, which in turn may risk schedule and cost;

d. Design Review: The evaluation of the contractor's design is difficult to ensure whether it will meet the requirement, function desirably, or whether it will cause second or third order problems. This can trivialize the Detailed Design Review into a simple verification that the contractor has produced *a* solution, not necessarily *the* solution;

e. Installation and Integration: Integration of the newly delivered equipment to the existing system is challenging for two reasons: Firstly, integration requires access to accurate information regarding the existing systems, which can be difficult if those

[5] Steven Whiting, "Streamlining Naval Project Procurements – Utilizing Collaborative Communications Between Stakeholders" (master's thesis, Royal Roads University, 2006), 59.

systems are changed throughout the project.[6] Secondly, access to the equipment itself requires time and force resources to be allocated to the process; this may include the use of a ship to conduct tests and trials in order to progress the integration effort;

f. Product Acceptance: In order to conduct acceptance trials, a heavy dependency is placed on a number of requirements (good weather, environmental conditions, and other external resources). They also require that all integrated systems function properly as described to the contractor. Difficulties in aligning these requirements can lead to an extension of both cost and schedule;

g. Employment: Normally the Operational Test and Evaluation (OT&E), tactical training, or employment of new equipment cannot be started until after the product has been fully accepted. This sometimes causes a new system to sit idle for months or years while support organizations produce tactics, training, and protocols. This can cause disdain amongst operators as the equipment is available yet the gap has not been filled;

h. Corporate Knowledge: As the posting cycle of most positions is two to three years, and a procurement project can last much longer than that, there are usually multiple project managers in key positions of this process.[7] Without a clear understanding of the mindset of the original Project Management Office (PMO), the ability to properly and adequately test and challenge a contractor that may not be delivering the initial intent is challenging;[8] and

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[6] *Ibid*, 57.
[7] Whiting, *Streamlining Naval Project Procurement…*, 49.
[8] *Ibid*, 65.

i. Changes Throughout the Process: As the procurement cycle is quite long, more so if the product is built customarily, changes to the requirements or the integrating systems can frequently occur. This either causes significant costs and delays to the process, or is left to the end of the procurement to hopefully be identified as a necessary change afterwards.

5. There are a number of lengthy processes that make use unsmooth checkpoints, causing these projects to last a considerable amount of time. This can result in a desire to short-circuit the process,[9] which should not need be the case. Also, the fact that a significant portion of this process is done serially makes it difficult to shorten and puts the entire process on the *critical path*.

Engagement Modelling Based Acquisition

6. A model can be considered a representative body of knowledge of an entity of interest. In this sense, the concept of modelling to support procurement can be used to pass that knowledge from one phase of procurement to the next throughout the whole process. Engagement Modelling is a relatively new concept consisting of the use of highly detailed physics based models placed in a suitable, faster than real-time, interactive simulated environment, in order to confidently observe the behaviour of a complex system-of-systems against a set of complex threats or

[9] Williams, *Reinventing…*, 39.

obstacles.[10] Currently this type of modelling is in use by the CFMWC to evaluate system capability and create suitable tactics for the RCN. Similar types of simulation are used by PMO Canadian Surface Combatant for bid evaluation and by the Maritime Theater Missile Defense Forum for much of the same purpose.

7. In order for EMBA to be effective, an engagement modelling organization must be established, with full-time resources for the development, modification, control and distribution and validation of models. This organization must also have access to a large processing, data collection and analysis capability, access to the research and development, intelligence, and training communities (both domestic and international) to ensure the models are up-to-date, accurate, and available at all times.

8. The main concept of EMBA is to embody the focus of the procurement, which is expected to create a solution to a capability gap, throughout the entire process. The concept of EMBA would therefore function as follows:

a. Once a gap is identified, DND/RCN creates the requirement for a capability in the form of a set of engagement modelling scenarios, using the most up-to-date applicable models available;

[10] The two important aspects that enable understanding of a complex environment are the interaction between models and the simulated environment and the ability to conduct statistical analyses to minimize system variability.

b. The scenario set would then be provided to all bidders as an interactive description of the requirement;

c. The bidders would then be required to provide their bid as a functioning, rudimentary model to be placed in the scenario set and tested by the evaluation team (adhering to an agreed upon scoring criteria);

d. The winning bidder would then design their solution and provide that design as a detailed version of the model. This design model could then be tested against both the initial requirement and the ‘bid model’ to quickly ensure compliance is still retained. This model could then be used by DND to conduct Design Test and Evaluation (DT&E) to test and have corrected any aggregate gaps that the new equipment creates. These changes can then be added to the scope of the project well before the work is completed;

e. Throughout the development of the equipment, updated models can be provided as firm decisions are made by the contractor, including training simulations, and user interface models. This will enable further DT&E, progressively detailed tactics development, and training of operators on both the tactical/operational use of the equipment and the actual manipulation of the equipment, long before the equipment is delivered. Feedback, again, can be provided to the process/contractor in order to make ‘course corrections’ before the development is completed;

f. The finished product, the equipment itself, will be delivered alongside a high-definition model, which can then be tested against the design model and even against the original requirements to prove compliance to the contract. This model can then be

virtually integrated with the rest of the system models. These system models can then be replaced one-by-one as the integration is completed and tested;

g. The high-definition model can be run through a high-volume of virtual trials to ensure total compliance, and to identify test scenarios to be completed in the real-world to validate the models and provide the overall acceptance, while being confident that the equipment covers the capability gap for which it was procured; and

h. Lastly, this model can then be added to the overall model suite and maintained as necessary for further testing, tactics creation, training, and future procurement projects (as a 'legacy system').

Improvements to the Procurement Cycle

9. EMBA can therefore be used to provide adherence to the initial need for procurement, to fill a capability gap required of the RCN and DND, providing flexibility and concurrent activity to avoid some of the redundancies and inefficiencies with the current procurement cycle. The concept of EMBA will subsequently be considered against the aforementioned sources of inefficiency to discuss how EMBA can help minimize those inefficiencies:

a. Capability Gap Identification: A sufficiently large model suite, both own-ship systems and threats, with a simplistic user interface will enable anyone (operational planners, tactics developers, training scenario developers, or anyone thinking outside the box) to test 'What-If' concepts against the current capability set, flagging the concern to

subject matter experts (SMEs) to test further. Doing so can help identify such a gap before it happens in real life and without extensive testing using real scenarios;

b. Requirements Definition: Once the gap is identified, the creation of a set of threat scenarios where the capability gap would apply, including variability (differing threat types and positions, weather conditions, land geometry, task force composure, etc) as necessary, can be created in a straightforward manner. This enables DND to state a set of requirements that envelopes the scenario outcomes alone instead of specifying the contributing factors, enabling the bidder/contractor to employ innovation to solve the problem. The ability to produce these scenarios can be additionally useful when justifying the need to fill the gap, providing visual explanations and statistical evidence, shortening the approval process;

c. Bidding Process: Given that the bidders will provide a model of their proposal, the evaluation process can consist of running those models through the requirement scenarios to ensure compliance. The SME evaluation can then occur only where the results are questionable, drastically reducing the effort and time needed to evaluate the bidding process;

d. Design Review: Similarly, the design model can be quickly evaluated and approved. Furthermore, the ability to provide timely and accurate feedback and make changes at this stage will drastically reduce the time and cost required to make the necessary changes before development is finished;

e. Installation and Integration: With the ability to thoroughly and remotely integrate the new equipment with the legacy system will reduce the requirement for resources and

ensure that the physical installation of the equipment is conducted as smoothly as possible;

f. Product Acceptance: Compliance of the delivered product can be rigorously tested in the simulated environment, with the requirement of conducting only a minimum amount of real-world tests to confirm the validity of the delivered high-definition model;

g. Employment: As the DT&E, tactics development, and operational training of the equipment can be accomplished before the equipment is delivered or accepted, operators could be trained and provided doctrine to effectively use it as soon as the project has closed;

h. Corporate Knowledge Challenge: Since the capability gap, concerned scenarios, and requirements of the product are encapsulated in a model or set of scenario simulations, the evaluation of the development of the process at any stage can be linked directly to the intent of the project, to fill the originally identified gap, despite the posting cycle of project managers involved; and

i. Changes Throughout the Process: As already discussed, the ability to receive and analyse the design model as it evolves and in parallel to the development of the equipment gives the project office the ability to identify aggregate gaps or impacts to and from changes to the legacy system-of-systems as soon as possible, fixing them dramatically quicker and for less cost than previously possible.

CONCLUSION

10. This paper identified some sources of delay, cost, and quality related issues caused by the linearity and isolated procedures of the current procurement cycle. It then introduced the concept of EMBA, and highlighted how such a tool could help improve many of these sources to shorten the decision cycle, and to keep DND and the RCN in step with the contractor throughout the process.

11. It is believed that the introduction of EMBA will provide a significant benefit not only to the procurement cycle itself, but to the overall RCNs understanding and employment of its own equipment and capabilities, from the technical and tactical SMEs and Life Cycle Maintenance Managers to the operators themselves.

12. EMBA is not expected to provide a full solution to all challenges in the procurement cycle, but will smooth out the processes that feed into those challenge areas.

13. Furthermore, EMBA will likely not be a *cost-savings tool* as it will require a significant set of resources to establish, maintain, update and improve upon model sets, and more so to process and produce the valuable information to the procurement cycle. However, it will increase the knowledge based momentum of RCN procurement, drastically reducing the ‘gap

identification-to-employment' timeline, enabling a faster and better understanding of equipment integration overall.

14. Nevertheless, despite the above challenges with establishing such a tool, the CFMWC has already overcome many of the technical obstacles involved for the use of tactics development; what is remaining are the processes and procedures to be modified and adapted throughout the procurement cycle to take advantage of this capability.

RECOMMENDATION

15. It is recommended that Director General Maritime Equipment Project Management (DGMEPM) or ADM(Mat) establish an EMBA capability to support a streamlined procurement cycle that generates quality systems, in a compressed timeline, with less associated costs.

16. It is also recommended that further research is conducted to provide a detailed evaluation of scope, cost/benefit, and changes necessary to implement an EMBA capability.

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