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# Procurement of Evolving Innovative Technology

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# Procurement of Evolving Innovative Technology

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# Procurement of Evolving Innovative Technology

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## AIM

1. The Royal Canadian Navy's (RCN) approach to procurement of niche capabilities is sometimes beset with problems. The aim of this paper is to describe why present methods of procuring developing technologies are flawed and suggest a method that addresses those flaws.

## INTRODUCTION

2. Technology moves apace. If militaries are to be successful and capable, they must keep up with evolving technology. The transformation of the use of intelligence gathering drones to munitions dropping drones over a very short time period by Islamic State is an example of technological development that must be matched. Indeed, Reference A states that "Technology is a critical enabler of modern militaries and fundamental to every type of operation the Canadian Armed Forces is expected to conduct."[1] Strong Secure Engaged, in discussing technology as enablers, specifically mentions remotely piloted (or unmanned air) systems as one of the three key capabilities that have "become particularly critical to modern military operations."[2]

[1] Canada. Department of National Defence, "Strong, Secure, Engaged: Canada's Defence Policy," (Ottawa 7 June 2017), 70.
[2] *Ibid*.

3. In October 2016 in the United Kingdom (UK) the Royal Navy conducted a large-scale multinational exercise named Unmanned Warrior.[3] A unique event, the main protagonists were not the military but Industry providers showcasing their unmanned underwater, surface and air systems in a two week long realistic military scenario. During the exercise planning stage, lasting 18 months, many of the civilian companies, unhindered by defence bureaucracy, upgraded the specifications of their vehicles as they were developed in house. The capabilities demonstrated gave a glimpse of unmanned capability in the maritime in the future; what is more telling is the companies' ability to upgrade their capabilities in the lead up to the exercise so that they demonstrated the very latest in this niche area. In a similar vein, militaries must avoid allowing their procurement methods to hinder leveraging the capability on offer. This paper will first show that Canadian and UK military procurement methods are similar and that these methods are not effective in maintaining the military edge when dealing with innovative, evolving technologies. It will then suggest a method that is.

**TECHNOLOGY EVOLVES**

4. Over time, technology becomes more advanced whilst at the same time becoming relatively cheaper. Theodore Wright in 1936 and Gordon Moore in 1965 have argued this successfully. Wright, an aeronautical engineer, hypothesized that "cost decreases as a power law of cumulative production."[4] What this means is, as the amount of a technology produced increases, there is an increased efficiency in doing so, and therefore the technology becomes relatively cheaper to produce. Wright states that the benefits are "greater quantities with cheaper

[3] UK Ministry of Defence, Defence Equipment and Support, "Unmanned Warrior 16 Post Event Report," London (2017).

[4] Forbes, "Moore's Law vs. Wright's Law," last accessed 30 January 2018, https://www.forbes.com/sites/jimhandy/2013/03/25/moores-law-vs-wrights-law/#3a36dbd177d2

prices brought about by virtue of such quantity increase."[5] Moore, the co-founder of Intel, saw that the number of transistors able to be placed on a circuit board doubled every year;[6] he later altered his theory saying that this doubling of transistors would occur every two years.[7] Whatever the time interval, his theory summarizes into the fact that "technologies improve exponentially with time."[8] For the military this means that over time capability based on technology innovation and development can be increased, at similar or even cheaper cost. So tanks, aircraft and ships become more technologically advanced, over time, at approximately the same cost, notwithstanding defence inflation. The military, however, cannot undertake this technology development; they must rely on the military industrial complex to achieve this. Sometimes the development is funded by private capital, sometimes by direct military investment.

**CANADIAN PROCUREMENT**

5. The Canadian Treasury Board is the overall authority for spending government funds, providing project approval and expenditure authority to the Department of National Defence (DND.) This involves significant bureaucracy; however it ensures that projects are in line with government policy, managed properly and provide value for money for the Canadian taxpayer.

6. Military equipment is procured in five stages. In accordance with Reference B, Stage One is where the project is identified as a capability to fill a gap. Stage Two, Options Analysis,

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[5] T. P. Wright. "Factors Affecting the Cost of Airplanes", *Journal of the Aeronautical Sciences*, Vol. 3, No. 4 (1936), 128.

[6] Gordon Moore, "Cramming more components onto integrated circuits," *Electronics*, Volume 38, Number 8, April 19, 1965, pp.114 ff

[7] Forbes, "Moore's Law vs. Wright's Law," last accessed 30 January 2018, https://www.forbes.com/sites/jimhandy/2013/03/25/moores-law-vs-wrights-law/#3a36dbd177d2

[8] *Ibid*.

is where options are analyzed to determine the optimal method to fill the capability requirement. Stage Three, Definition, marks the transition from determining what should be done to mitigate a deficiency, to determining how the preferred option will be implemented. Stage Four, Implementation, enables the DND to have the contract awarded through Public Services and Procurement Canada. The capability will then be procured and introduced into military service. Stage Five, Close-Out, occurs when a project reaches its full operational capability and it becomes a managed capability.[9] It is not hard to imagine the difficulties in changing the project to encompass technology developments

**UK PROCUREMENT**

7. The UK has a similar system, known as the CADMID cycle. The stages are Concept, Assessment, Demonstration, Manufacture, In Service and Disposal. Simply put, project approvals and funding release occurs at two points, prior to both the Assessment and Demonstration phases, known as Initial and Main Gates respectively. Once a capability has been procured, changes to capability are very difficult, as the end product would have a different specification from that cited in the original project approvals.

8. In the UK during the Demonstration, Manufacture and In-Service phases, and in Canada post Phase Five, Implementation, changes to the capability need to be re-contracted, causing additional delays and risk to the entire project. This is normal for large projects, such as warships, heavy armour or combat aircraft as these sorts of projects take time to process and user requirements may change, or capability traded out as cost savings measures. Indeed, in defence

[9] Department of National Defence and the Canadian Armed Forces, "Defence Acquisition Guide 2016," last accessed 30 January 2018, http://www.forces.gc.ca/en/business-defence-acquisition-guide-2016/index.page

procurement this is now the norm vice the exception, and is the reason so many projects are delivered late or over budget. After manufacture there is normally some planned capability enhancement path, normally through a mid-life upgrade (MLU). In this case, if the technology advances before the approvals and funding is obtained for the MLU, there is potential for the newer technology to be obsolete even when it finally enters service. During the life of a capability there will come a time when its successor needs to be decided and the whole cycle starts over. This cycle is summarized in Figure 1.

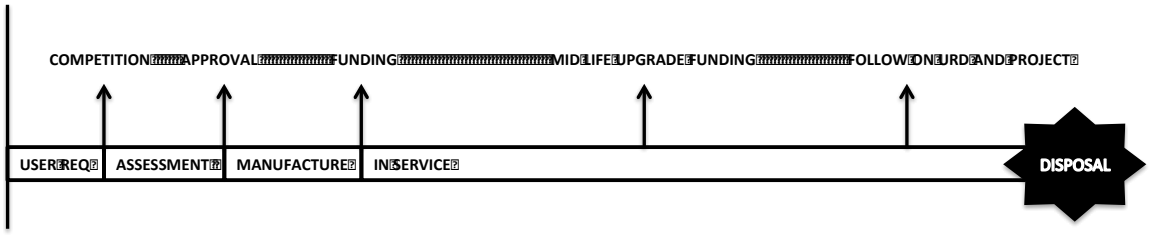


**Figure 1 – Traditional Defence Procurement Model**

## CANADIAN EXPERIENCE

9. The procurement of the CH148 Cyclone maritime helicopter has been beset with problems. In July 2012 Defence Minister Peter MacKay admitted it was "the worst procurement in the history of Canada."[10] Political u-turns adding significant time delays to the project aside, there have been classic elements of "user requirement creep." During the mid-stages of the project the DND asked the manufacturer to add in additional electronics and armaments. This

[10] National Post, "A government blunder teaches us how not to buy helicopters," last modified 11 February 2013, http://nationalpost.com/opinion/michael-byers-and-stewart-webb-a-government-blunder-teaches-us-how-not-to-buy-helicopters

became a real problem as since the project had already been approved, the additional equipment escaped the normal scrutiny.[11]

10. This resulted in a delay to the delivery date, with initial models being received in 2010 and deployed frontline service not starting until the spring of 2018.[12] These delays will inevitably mean that the electronic equipment within these helicopters will become obsolete a lot sooner than originally planned, without a means to quickly upgrade them. In some projects development delay becomes self-sustaining; the project takes too long leading to technical obsolescence, therefore the statement of requirement needs to be revised thus delaying the process, and the cycle continues. There are elements of this visible in the Cyclone project.

11. In the RCN it is not just the procurement of new equipment that suffers from technical obsolescence. This is also the case in existing equipment while awaiting new equipment to be delivered. For example, when replacing broken CRT monitors used for displaying acoustic data, the RCN is contractually obliged to purchase out-dated CRT monochrome monitors at circa $100,000 each. It would make better sense to buy new flat screen colour monitors, however this is not allowed as the RCN haven't officially "purchased" new screens. The result is the replacement of old screens with old screens. This issue has been somewhat addressed in the introduction of the Business Case Analysis process[13] where you can make a case for replacing replace old for new if it is cost effective. Another example is in the RCN waiting for the

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[11] *Ibid*.

[12] CBC, "Military's much-delayed new Cyclone helicopters return to limited service," last modified 14 June 2017, http://www.cbc.ca/news/canada/nova-scotia/cyclone-helicopter-royal-canadian-air-force-1.4159754

[13] Government of Canada, "Government Oversight," last accessed 1 February 2018, https://www.canada.ca/en/government/system/oversight.html

underwater suite upgrade. Legacy items (such as circuit cards for sonars) must be fabricated from the original company since they are no longer in production, resulting in significant cost to the RCN.

**UK EXPERIENCE**

12. In 2005 the UK contracted Thales to develop and deliver Watchkeeper, a tactical battlefield Unmanned Air System. A development of the proven Israeli Hermes 450 system, it was expected to enter service in 2010 with a programme cost of £850M. Due to the issues inherent in the British procurement system, akin to those in Canada, the system's first and only operational service was in Afghanistan in 2015, at a project cost of £1.2Bn.[14] In 2016 it was demonstrated at Unmanned Warrior and proved to be a capable system in the maritime,[15] however its optics, not updated since inception, were out-dated and have been surpassed by more recent technology. This is because of a lack of any upgrade path, contractually, in the vehicle. A staged update path could have been incorporated into the initial contract between the UK MoD and Thales, but was not. Had it been so, the vehicle could have been quickly upgraded and undoubtedly would now be serving operationally supporting the Royal Navy.

13. In 2011 the Royal Navy leased the Boeing Insitu ScanEagle small Unmanned Air System. Fitted to Type 23 Frigates, this system was deployed to the Gulf from 2103 until late 2017. Used for standard Intelligence, Surveillance and Reporting (ISR) tasks, it was extremely successful, with Commanding Officers routinely commentating on how it was a force enabler.

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[14] The Guardian, "UK's £1.2bn bill for drone that's seen 146 hours of active duty," last accessed 27 January 2018, https://www.theguardian.com/world/2015/oct/02/watchkeeper-drone-uk-military-delay-over-budget-investigation

[15] YouTube, "An Interview with Lt Cdr Spillane," last accessed 30 January 2018, https://www.youtube.com/watch?v=B2TNlKcbOnM

In 2015 an Australian company, Sentient Vision Systems, partnered with Insitu to offer the Visual Detection and Ranging (VIDAR) system to ScanEagle. This system, a bolt on to the airframe, scans the horizon and instantly alerts the operator to all surface contacts within visual range, even those not visible to the naked eye. In areas such as the Arabian Gulf, and strategic chokepoints, this ability is critical to timely and correct Command decisions. Demonstrated at Unmanned Warrior, it was the standout technology offered.[16] If this component could have been added to vehicles deploying on RN frigates, the capability jump would have been enormous. However, this upgrade path was unavailable due to the procurement system (leasing) being used. It would have required a whole new contract to be drawn up, which even if financially approved, would have taken significant time to develop. The contractor was ready to supply, and could have done so instantly, however the Service was unable to accept due to the contract restrictions.

14. These two examples show that even if a capability can be procured, under existing purchasing systems it is very difficult to upgrade, denying the frontline the latest technology and thus military advantage.

**ALTERNATIVE SOLUTION - FLEXIBLE SHORT TIME FRAME PURCHASING SYSTEM**

15. A solution to the problem of procuring innovative technological advances onto existing capabilities could be by the use of a flexible short time frame purchasing system. In essence this requires the initial approvals and funding to be granted, as in the traditional system, followed by what could be described as a form of "Mission Command" given to the project team delivering

[16] This is a personal view in my capacity as the Unmanned Aerial Vehicle subject matter expert (SME) at the Royal Navy Maritime Warfare Centre. This view was endorsed by the Canadian UAV SME witnessing the exercise at my invitation.

the capability. If it is known that a new or upgraded element of the project is continuously developed every six months, then the model allows for this. If the technology evolves every 2 years, the model allows for this. The time interval will be different for all technologies, however generally much shorter than the traditional procurement model can work to.

16. At the start of the project the time interval is decided between the project team and Industry, and approvals sought for staged release of funds at those time intervals. At some pre-determined point, potentially at the 33% or 50% of projected In-Service lifespan, the project can be audited to ensure it remains within scope, approvals and is still providing value for money. The technological life cycle with proposed updated investment for projects involving innovative or niche technology projects is summarized at Figure 2.

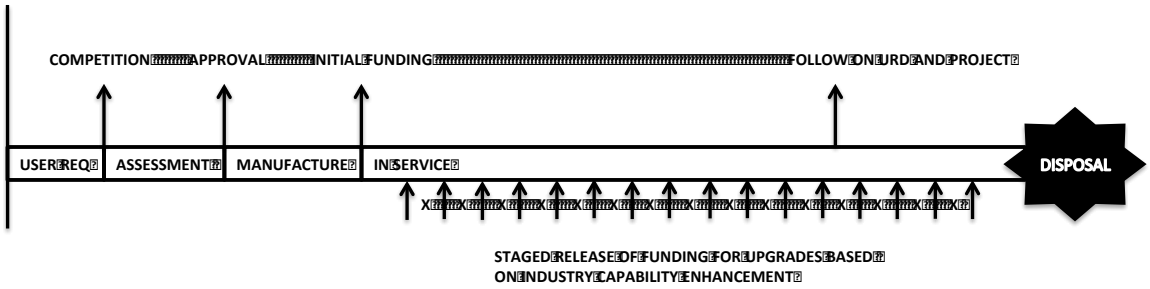


**Figure 2 –Defence Procurement Model – Niche Technologies**

17. If this system is enacted, post competition and approved business case, it is very easy to manage with a single contractor. Potential issues arise if during the project upgrades become available from a different manufacturer. For example, if an Unmanned Aerial Vehicle (UAV)

system has been procured from one company offering frequent upgrade paths and a different company offers a better sensor. In this case the "mission command" actions on the part of the project would play a role. Therefore, this system hinges on obtaining the relaxed authorizations at the start, and the "institution" trusting the project team to deliver. This scenario would be difficult, however not insurmountable, especially if a prime contractor is used. The prime contractor could then sub-contract to the new company under the existing defence arrangement.

**CONCLUSION**

18. In smaller projects involving innovative technology, such as in UAVs or autonomous systems, or those reliant on electronics, obsolescence can occur extremely quickly based on real time technology development. Can a military afford to have niche capabilities delivered late or over budget because the user requirements change as technology progresses? The answer is to procure in line with this development, however this normally involves so short a time that traditional project timelines cannot keep up.

19. A flexible short time frame purchasing system would allow an initial capability to be procured and introduced to service, with the project team cognisant of the specific technological development timelines. With financial release approval based on specific time periods, for example three or six months, technological improvement could be incorporated into existing capability as soon as the manufacturer was ready to release it, not months or years later. Whilst maintaining military capability, this method would also foster closer relations with industry, allowing them to understand emerging military requirements better and thus tailoring their

development appropriately. The outcome of this is a leaner system with better cooperation between the military and industry, which still provides the technological edge required.

20. This paper has shown that despite empirical evidence that technology development is exponential, a change in the way these capabilities are updated could mean having the latest technology available, staying ahead of obsolescence and maintaining a military edge. The use of a flexible short time frame purchasing system, as described above, could be a solution to this issue.

**RECOMMENDATIONS**

21. It is recommended that:

a. The use of a flexible short time frame purchasing system, with pre-approved spending limits be considered for staged procurement of innovative and rapidly evolving technologies that form part of existing programmes. Examples of these could be UAS payloads or computer processing equipment.

b. Commander Force Development is tasked to investigate and validate this thesis.

P W Spillane
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