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WEAPON SYSTEM PROCUREMENT: WHERE LESS IS MORE

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Exercise Solo Flight

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“There are two ways not to suffer from poverty. The first is to acquire more wealth. The second is to limit your requirements. The first is not always within our power, but the second is always in our power.”

- Leo Tolstoy, *Russian Novelist*

INTRODUCTION

Less is more when it comes to the acquisition of major weapon systems. In other words, it is better to own and operate affordable equipment than to dream about the ideal equipment that will not enter your inventory. The Canadian Armed Forces (CAF) operates highly sophisticated equipment that is an integral part of our capability and necessary for the safety and security of Canadians. For this reason, defence planners and managers often push for better and better systems continually pushing the scope of their projects which is known as “scope or requirements creep”. When ‘good ideas’ are added to the project, the schedule increases and/or the costs go up. So it is paramount that scope, schedule and cost are balanced and the warfighter is equipped with suitable and affordable weapon systems.¹

Given the likely budget shortages now and in the future, it is essential that CAF leaders and managers carefully manage their limited resources and smartly follow authorized acquisition processes. The Government of Canada (GoC) has delegated the whole of government purchasing agent to Public Works and Government Services Canada (PWGSC) requiring the Department of National Defence (DND) to follow PWGSC’s Procurement System. In this role, PWGSC balances the military requirements of DND with the industrial and technological benefits (ITBs)

¹ Craig Stone, Breakout Educational Network, *The Public Management of Defence in Canada* (Breakout Educational Network, 2009), 66.

of Industry Canada to facilitate a procurement that provides the best value for Canada. Although there are many critiques with the procurement system alleging it is broken, this may not be completely true. One of the main reasons for the criticism is that CAF may not obtain, in their opinion, the best military equipment since PWGSC's decision involves not only CAFs technical evaluation, but also the bid costs and the ITB evaluation.

Canada is not the only nation facing procurement challenges. The National Audit Office in the United Kingdom (UK) slammed the Ministry of Defence for their overly ambitious and unaffordable equipment plans². Furthermore, the cost of their 11 largest defence procurement projects slipped by 17 months and rose in costs by £708 million in FY 2012/2013.³ Similarly, in 2013, following a review of the 29 largest defence procurement portfolios, the Australian National Audit Office reported an accumulative project slippage of 957 months (an average of 36% schedule slippage) and budgets had increased by 15.5% over the years at a cost of A\$6.5 billion.⁴ A Government Accountability Office (GAO) report for the United States (US) highlighted that as of 2013, 80 major procurement programs had increased in cost by \$448B and were 28 months delayed when compared to their initial full estimates.⁵ Between 2000 and 2010, the US cancelled \$46B in weapon system investments; even the world's superpower has not yet figured out effective and efficient military procurement.⁶

This paper will highlight the rising costs of military weapon systems, provide a general overview of the defence procurement process, identify examples of poor project requirements, name some of the major procurement reforms ongoing in Canada and provide several

² Ministry of Defence, *The Defence Strategy for Acquisition Reform* (UK: TSO,[2010]), 7.

³ Martin Auger, "Defence Procurement Organizations: A Global Comparison," (2014), 9.

⁴ *Ibid.*, 8.

⁵ Michael J. Sullivan, *Defense Acquisitions: Assessments of Selected Weapon Programs* (United States Government Accountability Office, 2014).

⁶ David Barno et al., "The Seven Deadly Sins of Defense Spending," *Foreign Policy* 6 (2013), 25.

recommendations for generating better weapon system requirements. It will be demonstrated that Canada's procurement system is an effective tool to acquire new weapon systems and future reforms need to focus more on the users of the system vice the system itself. The scope of this paper is limited to CAF weapon system requirements and force effectiveness, but may apply to other nations.

DISCUSSION

Part I – Weapon System Costs Are Soaring

Given today's advancements in technology, asymmetric threats found in the air, land, sea, space and cyber, and aversion to collateral damage, procurement costs for state of the art military weapon systems are just about, if not already, out of reach for many nations.⁷ Coincidentally, the Canada First Defence Strategy (CFDS) published in 2008 promises to replace Canada's aging and obsolete equipment; however, the government has not allocated sufficient funds to implement all of the planned acquisitions.⁸

A recent study involving 30 classes of weapon systems indicates that the Unit Production Costs (UPC) have grown by 5-10% per year.⁹ So in reality, following the 20-year life cycle of a particular fleet, the unit cost for a replacement weapon system could cost double what was paid for the in-service model. Unfortunately, the normal growth in GNP in NATO nations has not kept pace with the rapid increases in UPC. The global financial crisis of 2008 has only exacerbated the budget shortfalls and many nations are now struggling to procure the right

⁷ Stephanie G. Neuman, "Power, Influence, and Hierarchy: Defense Industries in a Unipolar World," *Defence and Peace Economics* 21, no. 1 (2010), 110.

⁸ James Craig Stone, "Improving the Acquisition Process in Canada," *SPP Research Paper* 8, no. 16 (2015).

⁹ Philip Pugh, "Performance Based Cost Estimating", (1994).

equipment at the right time for the right price. To purchase this equipment, Canada uses its Defence Procurement System.

Part II - The Defence Procurement System in Canada

The Canadian Defence Procurement System is used to acquire goods and services and includes a Defence Acquisition Guide published in 2014. The guide describes the project approval process for DND and is divided into five stages. Stage 1 is *Project Identification* where DND describes the capability gap and produces a Statement of Operational Requirements (SOR). This stage ends once the Treasury Board Secretariat approves the further examination of this procurement project. Stage 2 is *Options Analysis* where DND examines various options to fill the deficiency. During this phase, industry provides a rough order of magnitude (ROM) on their costs to fulfill the requirement. This ROM does not include the government costs for infrastructure, project management costs, government furnished equipment/services, etc. Stage 3 is *Definition* where Treasury Board gives Preliminary Project Approval and money to DND to establish a project office and further define the project and determine how the preferred option will be implemented. Stage 4 is *Implementation* where DND is given Effective Project Approval and the authority to issue a Request for Proposal (RFP). Before a contract can be awarded, Treasury Board must provide DND with sufficient funding and PWGSC must support the decision to issue the contract. It is during this phase that the equipment is developed, tested and fielded. Stage 5 is the *Closeout* which terminates remaining contracts and reports on the project.¹⁰ Overall, this is a well-documented process complete with various tools that can guide all project managers to successfully field new weapon systems for CAF if used correctly; a system is only as good as those employing it. There are certainly many risks throughout the

¹⁰ Government of Canada, *Defence Acquisition Guide 2014* (Government of Canada, 2014).

procurement process like requirements definition which can easily include creep, cost overruns, schedule delays, lack of stakeholder involvement, bias towards a particular system, changes in the market, unexpected technical issues, etc., but training, experience, communication and leadership can mitigate each of them if the procurement system is not short-circuited, and is used as designed.

Part III – Poor Military Requirements: Examples of What Not To Do

The Avro Arrow

Unfortunately, CAF's generation of good weapon system requirements has stumbled for generations. On 20 February 1959, following an investment of more than \$340M to build a Canadian interceptor aircraft that would outperform all other fighter aircraft globally, Prime Minister Diefenbaker cancelled the Avro Arrow program.¹¹ A Canadian dream, albeit in technicolor, of becoming the nation with the fastest most advanced interceptor, was shattered.

In 1953, CF-100 Mark V Canuck, the incumbent interceptor aircraft, had a unit cost of \$750K, while the original unit price estimate for an Arrow was \$1.5M to \$2.0M.¹² Soon thereafter, the Liberal Government approved an initial appropriation of \$30M to design and develop two prototype aircraft, C.D. Howe the Minister of Defence Production publically stated that the ambitious goals concerned him and he estimated that the cost would be around \$100M vice \$30M. Unfortunately, these warning signs were not taken seriously by the government or industry.¹³

¹¹ Murray Peden, *Fall of an Arrow* (Dundurn, 2003), 10.

¹² *Ibid.*, 25.

¹³ *Ibid.*

The reason for Howe's skepticism can be attributed to the RCAF's initial requirements for the Arrow. The Arrow would be a twin-engine all-weather interceptor capable of supersonic speeds to catch Soviet bombers and it would carry highly sophisticated fire control and weapon systems.¹⁴ Interestingly, the CF-100 had a top speed of 0.77 Mach, while the Arrow's requirements were a minimum of Mach 2. So, Canada sought a fighter to go twice as fast as the speed of sound before they had a fighter that could go the speed of sound. In contrast, the USAF F-106 Delta Dart speed requirements were Mach 1.

Three major changes to the RCAF's requirements occurred in 1954. First, the RCAF engine requirements were extremely ambitious. To put their engine requirements into perspective, the Arrow's engine thrust requirements were not met until the F-22 Raptor was fielded by the USAF in 2005, 51 years later.¹⁵ Second, the RCAF decided not to use the proven Hughes fire control system, but to design a brand new system called ASTRA, a completely new weapon and fire control system with advanced specifications for the Arrow. Ironically, A.V. Roe Ltd, the manufacturer of the Arrow, argued against this decision and recommended for the RCAF to go with the Hughes solution since it was an almost off the shelf solution with 95% of the capability of the unproven and risky ASTRA/Sparrow target. Third, the RCAF switched their missile requirements to pursue the Sparrow II missile, a new and undeveloped missile capability.¹⁶ During development, it was realized that the cost to develop the ASTRA and Sparrow II missile would cost between \$100M and \$200M, an amount that was more than double Howe's prediction for the full aircraft. Consequently, the ASTRA and Sparrow projects were cancelled and the Hughes fire control and Falcon missile system, were adopted.¹⁷

¹⁴ *Ibid.*

¹⁵ Randall Whitcomb, *Avro Aircraft & Cold War Aviation* (St. Catharines, Ont.: Vanwell, 2002), 138.

¹⁶ Randall Whitcomb, *Avro Aircraft & Cold War Aviation* (St. Catharines, Ont.: Vanwell, 2002), 84.

¹⁷ *Ibid.*

By 1955, the Arrow's program cost had ballooned beyond all estimates. The estimate for development was now at \$300M, ten times more costly than the original appropriation of \$30M. Unit cost per aircraft was now at \$2.6M vice the \$1.5-\$2.0M originally estimated, 3.5 times more expensive than each CF-100 Canuck.¹⁸ Four years later the program was cancelled. Although the Avro Arrow case study is somewhat dated, similar issues still surface six decades later. The Avro Arrow highlights the RCAF's lack of understanding in developing reasonable weapon system requirements and the importance of listening to wise counsel from procurement and industry experts. This case study has been very well documented with numerous books written on the subject and it is important to note that the literature does not fault Canada's procurement system for the Avro Arrow's failure.

The Sea King Replacement Project

In 2012, the Minister of Defence, Peter MacKay, publicly stated that the Sea King Replacement Project was the worst procurement in Canadian history.¹⁹ This project which had been mired in politics, came to a head when Prime Minister Chretien cancelled the EH-101 Helicopter Contract soon after he defeated Brian Mulroney in the 1993 election. During his election campaign, Chretien voiced concern that the EH-101 was a Cadillac solution that Canada could not afford and he promised to cancel the project if elected.²⁰ The CAF then restarted the procurement process for a Sea King replacement. In November 2004, 11 years after the EH-101 project was cancelled, Prime Minister Paul Martin announced the Government would procure 28

¹⁸ Peden, *Fall of an Arrow...*, 52.

¹⁹ Macleans, "Peter MacKay Calls Cyclone Helicopter Deal 'Worst Procurement' in Canadian History," *Macleans*, 2012 .

²⁰ Michael Byers and Stewart Webb, "The Worst Procurement in the History of Canada," (2013).

CH-148 Cyclone helicopters from Sikorsky to replace the Sea King²¹. After the contract was signed with Sikorsky, DND modified the SOR to include new electronic and weapon system requirements to *Canadianize* the helicopter. These additional requirements subsequently increased the weight of the Cyclone helicopter forcing a major engineering change to two more powerful engines.²² This occurred in 2008 and the Cyclone is still not ready for nighttime operations over water, a significant limitation for a Maritime Patrol Helicopter. In this example, politics had and still have a major role to play; however, DND also is accountable for altering requirements after contract award which has contributed to the cost overruns and project delays.

The Fixed Wing Search & Rescue (FWSAR) Project

A recapitalization of CAF's FWSAR assets had been on the books since 2003 when the CDS, Gen Henault, announced FWSAR as a priority project. At that time, spare parts and increased maintenance were plaguing the Buffalo and Hercules H Model fleets and SAR services for Canada were at risk.²³ However, this identified project stalled for the next few years due to a changeover in federal politics and Canada's increased commitment to Afghanistan in 2006. Suddenly in 2009, the project was back in sight when the Defence Minister announced plans to purchase up to 17 Alenia C-27J Spartan search and rescue aircraft. The aircraft would be purchased following the posting of an advance contract award notice (ACAN) for 30 days²⁴, meaning that the government believed only Alenia could meet the requirements, but was giving industry one month to prove otherwise. The news of an ACAN was highly criticized accusing the

²¹ Ugurhan Berkok, "Canadian Defence Procurement," *Defence Procurement and Industry Policy: A Small Country Perspective* (2009).

²² Byers and Webb, *The Worst Procurement in the History of Canada*, (2013).

²³ Elinor Sloan, *Something has to Give: Why Delays are the New Reality of Canada's Defence Procurement Strategy* (University of Calgary: CDFAI, 2014), 25.

²⁴ *Ibid.*

government of fixing the requirements towards a particular solution. Consequently, the procurement was again stopped and in 2010 the National Research Council Canada (NRC) was tasked to conduct an independent review of the FWSAR SOR. NRC reported on many issues with the SOR including six major issues with CAF's assumptions, nine major issues with CAF's constraints on industry and 15 major issues with the High Level Mandatory Requirements.²⁵ It is odd that an ACAN was chosen given that one of the former project managers, Colonel (retired) Pat Dowsett, reported that he had flown both the EADS/CASA C295 and the Alenia C27J Spartan in the early 2000s and he was quite satisfied that the project would have a valid competition for FWSAR.²⁶ However, Dowsett had been posted out of the project prior to the ACAN decision. Based on NRC's report, it is clear that CAF did not write a solid SOR that would allow industry the flexibility to offer FWSAR alternatives that CAF may have overlooked. The FWSAR SOR and Request for Proposal (RFP) was subsequently updated and released to industry on 31 March 2015.²⁷ Therefore, Canada is still many years away from replacing the Buffalo and Hercules H Model fleets.

The Advanced Lightweight Anti-Armour Weapon System (ALAWS) Project

In 2006, the Canadian Army's Advanced Lightweight Anti-Armour Weapon System (ALAWS) was supposed to be a simple procurement as both Raytheon and Rafael were offering satisfactory product solutions. Instead of limiting the number of requirements and selecting based on lowest compliant bidder, the SOR included 480 mandatory requirements. Not surprisingly, neither company adequately addressed all of the requirements so both were ruled

²⁵ Malcolm Imray et al., *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft - Final Report* (Ottawa, Ontario: National Research Council Canada, 2010).

²⁶ Pat Dowsett, "FWSAR: Defending the SOR," *Frontline Defence Articles* 10, no. 3 (2013).

²⁷ PWGSC, "Tender Notice - CAPABILITY ACQ & IN SERV SUPP-FWSAR (W847A-150179/A)," <https://buyandsell.gc.ca/procurement-data/tender-notice/PW-FWS-003-25055>, (2015).

non-compliant.²⁸ Not only did this delay the project, it also negatively impacted the credibility of DND's procurement system. Part of this failure was caused by scope creep where the project staff and stakeholders continued to add requirements when clearly less would have been more.

A Pattern of Problems in Generating Military Requirements

A former Associate Deputy Minister of Materiel (ADM(Mat)), Mr Alan Williams, concludes that one of the major factors causing delays in military procurement is the time it takes to finalize the SOR. He recommends that the CAF should limit the number of mandatory requirements in the SOR and frame the requirements in terms of performance and what the equipment or system needs to do, vice how it should do it.²⁹ This recommendation is further echoed by industry where DND has been criticized for developing requirements that were overly prescriptive and included too many mandatory requirements. Unfortunately, even industry world leaders were unable to satisfy all of the mandatory requirements in some of DND's RFPs, or were forced to bid a less capable system to remain compliant with some of DND's outdated requirements.³⁰ This point is evidenced in the ALAWS project failure described above.

The FWSAR project described above highlighted a fundamental flaw in the development of the SOR. DND is supposed to write performance-based requirements requesting industry to produce a solution that meets those requirements.³¹ The SOR should tell industry what needs to be done, but not how to do it. As described in NRC's report, the original FWSAR SOR was

²⁸ Alan S. Williams and Breakout Educational Network, *Reinventing Canadian Defence Procurement: A View from the Inside* (Breakout Educational Network, 2006), 40.

²⁹ *Ibid.*, 39.

³⁰ CADSI, *Industry Engagement on the Opportunities and Challenges Facing the Defence Industry and Military Procurement*, CADSI, 2009), 11.

³¹ Williams and Network, *Reinventing Canadian Defence Procurement: A View from the Inside* (Breakout Educational Network, 2006), 39.

overly prescriptive which handcuffed industry from exploring creative solutions and one of the reasons that contributed to the significant project delays.

Regarding the Sea King Replacement, unfortunately both politics and poor requirements affected this critical project. The Project Office underestimated the development work that needed to be done on the Cyclone for it to meet operational requirements.³² Furthermore, the Project modified major portions of the SOR after contract award, forcing major rework, cost overruns and significant delays. It is no wonder that the Sea King Replacement has been dubbed the worst procurement in Canadian history.

Lastly, what was to be a major breakthrough for the Canadian Aerospace Industry and the RCAF, the Avro Arrow became a broken dream and a major hit to national pride. This example has highlighted that procurements are doomed for failure when overly ambitious and unrealistic requirements are pursued. Additionally, the RCAF did not accept the wise counsel from procurement and industry experts during the process which ultimately led to the demise of a Canadian dream and a lost opportunity for Canada to play a larger role in the aerospace defence industry.

Part IV - Canadian Procurement Reforms

An analysis of 241 military procurement files active in 1998 revealed that the average acquisition period from identification of a deficiency to project close-out was 15.8 years. Senator Colin Kenny, Chair of the Senate Standing Committee on National Security and Defence was very critical of this fact and publicly announced that the military equipment fielded was obsolete

³² Aaron Plamondon, "Amnesia in Acquisition: The Parallels of the F-35 Procurement and the Sea King Replacement Projects," *Canadian Foreign Policy Journal* 17, no. 3 (2011), 271.

when it showed up at the units.³³ Through DND acquisition reforms developed by the VCDS, ADM(Mat) and PWGSC, as outlined in the middle of the figure, delivery times would be reduced to 111 months (9.25 years).³⁴ It is worth noting that the major reductions in time are between deficiency identified and contract award. To achieve these reduced timeline, project directors and managers are expected to produce performance-based SORs and include only the absolute mandatory requirements. To be successful, scope creep will have to be closely managed and avoided. To this end, the Government has recently established a task group headed by Kevin Coulter, a former member of the Fighter Secretariat that will challenge DND requirements ensuring they are valid, reasonable and affordable. This initiative was done as part of the Government's new Defence Procurement Strategy in 2014.³⁵

The New Canadian Defence Procurement Strategy

In Canada, recent procurement reforms include the release of the Defence Procurement Strategy in February 2014. This new strategy aims to increase industry engagement; institute a challenge function and an expert analysis capability; identify key industrial capabilities; and publish an annual Defence Acquisition Guide that will outline the government's procurement plans for the future. Overall, this is viewed as a step in the right direction for Canada.³⁶ However, the focus of this strategy is on industry and economic advantage for Canada. A weakness in the strategy is that it does not include a plan of action to fundamentally change the DND culture of how weapon system requirements are developed, validated and communicated. Many of the failed procurements over the past decades can be linked to poorly written and communicated

³³ Williams and Network, *Reinventing Canadian Defence...*, 95.

³⁴ *Ibid.*, 97.

³⁵ Dave Perry, *Putting the 'Armed' Back into the Canadian Armed Forces - Improving Defence Procurement in Canada* (Ottawa, Ontario: CDA Institute, 2015), 16.

³⁶ Stone, *Improving the Acquisition Process in Canada*, Vol. 8, (2015).

requirements and some of those examples have been described above. It has been said that acquisition reform is only five minutes younger than the first procurement of equipment.³⁷ Since the process has been criticized for so long, perhaps all of the past and current reforms of creating new independent positions, outsourcing, creating major departmental reorganizations, legislative changes and going to a single procurement agency, may not resolve the procurement problems.³⁸ Given *system* reforms have not worked very well up to now, perhaps it is time to focus reform efforts and energy on the *people* that use the system, vice the system itself.

To be balanced, there are many examples where defence procurement has gone well and fielded much needed cost effective weapon systems to the warfighter. A subset of these include the Tactical Armoured Patrol Vehicle (TAPV), the CC-130J Hercules, the C177 Globemaster, plus multiple other urgent operational requirements for Afghanistan such as the Chinooks, tanks, UAVs, trucks and various projects to increase vehicle survivability.³⁹ It appears that the procurement system works well in wartime, but we definitely need to find improvements in peacetime.

Part V – Recommendations on Generating Better Military Requirements

A review of the literature available on acquisition reforms for Canada and many of its allies indicates that many problems still exist following years of reform.⁴⁰ It is illogical to continue with reforms that don't work. They partly don't work because they are too focused on the system vice the users of the procurement system. A system is only as good as its user community and for that reason, significant reform success will come about when the users

³⁷ *Ibid.*

³⁸ Perry, *Putting the 'Armed' Back into...*, 4.

³⁹ *Ibid.*, 4.

⁴⁰ *Ibid.*

(project directors/managers and stakeholders) become smart buyers who fully understand how to acquire the weapon system that offers the best *value* for Canada.⁴¹

CAF must rethink its *true* requirements when looking to recapitalize in-service weapon systems. Top of the line, shiny and elite are not affordable. Traditionally, requirements have been based on the latest and greatest of what is available or will soon be available within industry, which ultimately targets the most complex and costly systems. The game to chase better and better requirements simply leads to scope creep, delays, cost overruns and cancellations. This approach is flawed according to Secretary Gates and he directed DoD to avoid “exquisite” weapon systems.⁴² The article on ‘Trends in Costs of Weapon Systems’ written by Kirkpatrick, explains that nations should be balancing the cost with the effectiveness of the weapon system. For instance, if the requirement is for the most effective weapon system on the market, each one will cost more per unit and only a few will be affordable. Alternatively, if the requirement is for a basic weapon system, each one will cost much less allowing more of them to be purchased. This describes only two choices, but the user can choose any option between these two extreme cases. As he goes on to describe, the most cost effective solution occurs when the force effectiveness is maximized and this occurs when the user has procured many middle of the road weapon systems.⁴³

The move away from writing SORs targeting state of the art military weapon systems is further supported by Michael Handel, a research associate at the Harvard Center for International Affairs. His article published in the Journal of Strategic Studies defines total military power as follows:

⁴¹ Real Property Branch PWGSC, "Procurement Management Manual," Government of Canada, <http://www.tpsgc-pwgsc.gc.ca/biens-property/sngp-npms/bi-rp/conn-know/approv-procure/manuelga-pmmanual-4-eng.html> (2015).

⁴² Barno, *The Seven Deadly Sins of Defense Spending*, Vol. 6, (2013), 24.

⁴³ David LI Kirkpatrick, "Trends in the Costs of Weapon Systems and the Consequences," *Defence and Peace Economics* 15, no. 3 (2004), 6.

$$\text{Total Military Power} = \text{Quantity} \times \text{Material Quality} \times \text{Non-material Quality}$$

where total military power refers to the full military power of a particular state; quantity refers to the weapon system numbers; material quality refers to the quality and performance of the weapon system measurable in terms of speed, firepower, range, durability, reliability, etc., and non-material quality refers to the quality of the: training, soldiers, motivation and morale, leadership, political leadership, resolve, interoperability, ethical behaviour, etc., and these items are not easily measured.⁴⁴

Based on his research, he attests that state of the art equipment has resulted in less reliability and battle worthiness in war and conflict. The higher costs of this equipment has led to smaller numbers of platforms, and of the units procured, fewer of them are mission-ready due to increased risk of technical problems and maintenance snags.⁴⁵ He contends that emphasis must shift away from state of the art expensive systems, to more easily maintained, available and reliable weapon systems that can be bought in larger numbers.⁴⁶ A portion of the cost reductions can then be applied to improving CAF's non-material quality to further increase its total military power. To mitigate early obsolescence in these weapon systems, it is essential that projects include upgradability as an important requirement in the SOR. In this way, fielded platforms will have the ability to remain operationally relevant and effective over the life of the weapon system.⁴⁷

⁴⁴ Michael Handel, "Numbers do Count: The Question of Quality Versus Quantity," *The Journal of Strategic Studies* 4, no. 3 (1981), 231.

⁴⁵ *Ibid.*, 248.

⁴⁶ Michael Handel, "Numbers do Count: The Question of Quality Versus Quantity," *The Journal of Strategic Studies* 4, no. 3 (1981), 225-260.

⁴⁷ Stefan Markowski, Peter Hall and Robert Wylie, *Defence Procurement and Industry Policy: A Small Country Perspective* (Routledge, 2009), 63.

The recommendation to not procure the most elite system available is consistent with recommendations from other authors. Mr Norman Augustine, a prominent American aerospace businessman who served as Under Secretary of the Army from 1975 to 1977, wrote the law of insatiable appetites which states, ‘*the last 10% of the performance sought generates one-third of the cost and two-thirds of the problems.*’⁴⁸ The analysis, research and experience of Kirkpatrick, Handel and Augustine highlight major risks when attempting to procure state of the art, or to be developed, equipment; this approach will not maximize force effectiveness, but will cause most of the procurement problems. If Canada had followed these recommendations and not sought the Cadillac solution, perhaps the Sea Kings would have been replaced two decades ago.

And finally, the delay or demise of many acquisitions is caused by cost overruns. To mitigate this risk, Project Directors and Project Managers require additional training and education on estimating life cycle costs.⁴⁹ Progress in this vital area has already started with ADM(Mat)’s Project Management Competency Development Initiative and a newly created Executive MBA program at the University of Ottawa’s Telfer School of Management which will focus on Program Management and Procurement.⁵⁰ When estimates are low and the budget is exceeded, there is an appearance that the project is off the rails and over budget. More attention must be focused on mitigating low ball estimates early in the project by honestly developing the figures. To remain competent estimators, project staff should have the requisite level of field and project experience for the complexity of the weapon system acquisition. Industry is a great source of information to provide weapon system estimates and the new Defence Procurement Strategy further reinforces this partnership with industry⁵¹, and enables productive dialogue

⁴⁸ Norman R. Augustine, *Augustine's Laws* (AIAA, 1997).

⁴⁹ Perry, *Putting the 'Armed' Back into...*, 8.

⁵⁰ *Ibid.*, 20.

⁵¹ Canada, *Defence Acquisition Guide 2014* (Government of Canada, 2014).

between government and industry.⁵² Although this upfront estimate work will not reduce any project cost per se, it will better inform decisions regarding future acquisitions, ultimately mitigating cost overruns and obtaining the best value for the Canadian warfighter.⁵³

CONCLUSION

Weapon system costs are on the rise while military budgets are dipping. The CFDS outlines a simple plan to replace CAF's aging equipment, but the government does not have the funding for all initiatives. This situation is forcing CAF to be smarter and more frugal when planning and implementing major capital acquisitions. Historically, many CAF acquisitions have failed to properly identify requirements which have led to project cost or schedule overruns. Some of those examples have been highlighted herein and include the Avro Arrow, the Sea King, FWSAR and ALAWS. It is now time for a major shift in how weapon system requirements are determined, communicated and sold to stakeholders. Going forward, the CAF needs to carefully select the minimum set of mandatory, performance-based requirements, and not strive for the shiny, new, state of the art equipment that Canada cannot afford politically or financially.

It has been shown that procurement success starts with requirements that maximize a state's total military force. This total military force is a function of weapon system quality, quantity and the non-material quality of the state. Furthermore, limited quantities of state of the art weapon systems often produce less overall military force when compared with larger quantities of less expensive weapon systems. Less expensive available weapon systems are less susceptible to maintenance and reliability issues that plague newly developed systems that have

⁵² Barno, *The Seven Deadly Sins of Defense Spending*, Vol. 6, (2013), 24.

⁵³ Obaid Younossi, *Is Weapon System Cost Growth Increasing?: A Quantitative Assessment of Completed and Ongoing Programs*, Vol. 588 (Rand Corporation, 2007), 46.

not yet 'cut their teeth' on operations. This is consistent with Augustine's law of insatiable appetites which states, '*the last 10% of the performance sought generates one-third of the cost and two-thirds of the problems*'. Additionally, the non-material quality of a state cannot be underestimated. History has shown that training, readiness, doctrine, resolve, leadership, interoperability and the quality of our people are the true force enablers that consistently trump weapon system performance on its own.

Although Canada has made some progress on acquisition reforms in terms of the new task force to challenge requirements and enabling more frequent engagement with industry, more work remains. Many years of acquisition reform on the system have come and gone, so these new reforms may seem repetitive. It is recommended that future acquisition reforms focus on the *people* vice the *system*. It is the user community that needs additional training, education and experience enabling them to make the procurement system work better. Project Managers and users should not ask what added features they are going to get with their new equipment, but what added features will take away from needed capability. It is time that CAF starts to live within its means and treat government resources just like personal salaries and demand value for money. In closing, when it comes to generating weapon system requirements, good enough is better than perfect and way better than nothing at all.

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