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SURFACE-BASED AIR DEFENCE: WHAT SHOULD CANADA PROTECT?

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JCSP 46

Service Paper

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PCEMI 46

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CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 46 – PCEMI 46

2019 – 2020

SERVICE PAPER - ÉTUDE MILITAIRE

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Word Count: 2,397

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AIM

1. To consider potential air threats to the Canadian Armed Forces (CAF) and what it should aim to protect from air attack, before making recommendations as to how, whilst remaining broadly aligned with Canada's current defence policy and spending plans. This paper will suggest where the CAF is most vulnerable to air threats and recommend what type of Surface-Based Air Defence (SBAD) capabilities, which includes land and sea, it should focus on procuring to protect itself. Noting that the CAF has already secured a significant increase in defence spending over the next 10 years¹ and that public support for yet further investment is unlikely, this paper also suggests innovative procurement solutions that may be worthy of further investigation.

INTRODUCTION

2. Canada has very limited SBAD capability and its limited mass of expensive military equipment is therefore vulnerable to air attack. This capability gap has existed for some time, cannot be filled by one project or system, and will become of increasing concern as the CAF takes receipt of more expensive equipment, such as warships and combat aircraft expected to serve Canada for 30 years or more. The Canadian Government is, however, planning to spend up to \$499 million on a Ground-Based Air Defence (GBAD) project and up to \$1 billion on a (warship) Point Defence Missile

¹ On page 5 of Canada's 'Strong, Secure and Engaged' Defence Policy document released in 2017, the Canadian Government is committed to "Grow defence spending over the next 10 years from \$18.9 billion in 2016-17 to \$32.7 billion in 2026-27".

System upgrade project over the next 10 years.² It is also planning on spending similar amounts on both advanced short-range and medium-range air-to-air missiles for the new CAF Future Fighter Weapon System (FFWS) combat aircraft fleet.

3. SBAD for both land and sea-based assets is ideally provided by a layered defense, which “normally includes land-based or sea-based aircraft, long-range and medium-range Surface-to-Air Missiles (SAMs), Short Range Air Defence (SHORAD), which includes Close In Weapon Systems (CIWSs), as well as disrupting and decoying effects”.³ To sense air threats, this layered defence must also be supported by “necessary space, surface, and airborne early warning, detection, and tracking assets.”⁴ It is worth noting that in general terms, the longer the range of the weapon system, the more it is likely to cost. Further, the CAF does not have sufficient aircraft to provide long-range protection to its surface assets for anything more than brief, planned periods of time.

DISCUSSION

Potential Air Threats

4. As a military fighting force, employed to protect the interests and population of Canada as a nation with the world’s 10th largest Gross Domestic Product⁵, the CAF will always be a target wherever it is operating in the world. However, what is changing is the complexity of the threat, which goes beyond terrorism and is being driven by “the re-

² "Defence Equipment Purchases and Upgrades", accessed Oct 14, 2019, <https://www.canada.ca/en/services/defence/defence-equipment-purchases-upgrades.html>.

³ US Joint Service Command. *Joint Publication 3-01; Countering Air and Missile Threats*. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_01_pa.pdf?ver=2018-05-16-175020-290: US Government, 2018: V-2.

⁴ Ibid.

⁵ "IMF Gross Domestic Product." Accessed Oct 14, 2019. <https://www.imf.org/external/pubs/ft/weo/2018/02>.

emergence of long-term, strategic competition”⁶ between nations. In its Defence Policy the US singles out China and Russia as presenting a particular threat, publicly stating that they are both “undermining international order from within the system by exploiting its benefits while simultaneously undercutting its principles”.⁷ Although both Russia and China can wage irregular warfare against Canada (and most probably are already, for example through cyber), in the context of this paper it is their significant air-to-ground attack capabilities that cause most concern.

5. Russia and China have amongst the world’s most advanced military equipment, are both nuclear powers and are both investing far more on their military capabilities than Canada. Whether directly, or due to Canada’s links with the US (which it shares a long land border with and heavily relies upon for protection via the mainly US resourced North American Aerospace Defence (NORAD) arrangement), these nations could present the most significant air threat to Canada. Although one should not ignore the threat posed by smaller military nations and non-state actors, particularly given the increasing utility and affordability of Unmanned Air Systems (UAS) for the purposes of air attack on a smaller scale, the air threats that could be posed by Russia and China are considered the worst case. The subject of how to best defend against UAS, particularly of the smaller variety that are very difficult to detect, is considered a very worthy area of further study, but beyond the limited scope of this paper. This paper will therefore consider the air

⁶ Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge, U.S. Department of Defense [2018]: 3.

⁷ Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge, U.S. Department of Defense [2018]: 5.

threat posed by Inter-Continental Ballistic Missiles (ICBMs), cruise missiles, aircraft launched missiles, and surface launched missiles and projectiles.

Assets Vulnerable to Air Attack

6. As discussed, all CAF assets, including its people, are vulnerable to air attack. However, just because something is vulnerable, doesn't mean it is valuable, i.e. so what if it is lost? The value of an asset depends on a mixture of how valuable its destruction would be to the enemy, how hard it would be to replace, and how much capability and mass (weight of effort) it offers. As far as the CAF is concerned, it will therefore be argued that 'warships', 'concentrations of aircraft' and 'concentrations of ground troops' are its most prized assets; why and how each should be protected from air attack (by cruise missiles, aircraft launched missiles, and surface launched missiles and projectiles) is discussed by asset type below. As ICBMs would likely be targeted at and inflict huge damage to the general population, this worst-case threat is addressed separately and up-front by considering 'the public' as an asset to be protected.

The Public

7. The tax paying Canadian public is an asset is to be protected by the CAF. Although Canada necessarily collaborates with the US on NORAD, it currently has no will or mandate to develop its own nuclear and/or intercontinental missile capability to directly deter an ICBM attack. Canada may also be given the option to collaborate with the US on its controversial Ground-Based Midcourse Defence (GMD) missile system should it become increasingly concerned of ICBM attack. However, if reports are to be believed, this \$60 billion (US) system is not only currently pretty ineffective, particularly against multiple targets, but is doing little but force "Russia and China to increase the size

and sophistication of their nuclear weapons arsenals.”⁸ Although ICBMs do pose a persistent threat, becoming involved in a controversial missile defence system would make Canada more of a target and could actually increase the threat to the public. Further, such a move would not be good for Canada’s reputation as a force for good in the world.

Warships

8. The replacement of the current Royal Canadian Navy (RCN) Halifax class fleet with 15 Canadian Surface Combatant (CSC) general purpose warships is expected to cost \$55-60 billion, with the first ship being delivered in the mid-2020s.⁹ Warships are not only very expensive and therefore highly prized pieces of equipment, but as big lumps of metal sitting on a flat surface of water, they are highly vulnerable to attack if not well defended. The current warships are fitted with a Medium Range SAM (MRSAM) point defence system, which includes a target acquisition radar and Air Defence (AD) missiles, and the Phalanx CIWS (automated rapid-fire gun), but these now dated systems may not fare well against the latest missiles; hence the \$1 billion point defence (upgrade) project mentioned in the introduction. However, given the limited funds available and the age of the Halifax fleet, one has to question whether this significant amount would be better spent on the next generation of CSC warships or elsewhere by accepting a capability gap.

⁸ Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge, U.S. Department of Defense [2018]: 7.

⁹ "CSC Project Web Page", accessed Oct 14, 2019, <https://www.canada.ca/en/department-national-defence/services/procurement/canadian-surface-combatant.html>.

9. The CSC is expected to be fitted with an AD capability similar to that being installed in the British Type 26 Global Combat Ship from which its design is taken.¹⁰ The British are purchasing a Common Anti-air Module Missile (CAMM) MRSAM solution to arm their Type 26 fleet, which is designed for the land, sea and air environments; this same missile is to be used by the British Army for AD.¹¹ This will be complemented by a CIWS such as Phalanx. If the manufacturers' claims for the CAMM are to be believed, "High rate of fire against multiple simultaneous targets; Soft vertical launch technology for minimum launch signature and high performance; Compact missile allows for multiple weapons fit in limited spaces; Compatible with any surveillance sensor for targeting; Vertical launch enabling 360° coverage in all launch sectors."¹²

the economies of scale and flexibility offered by this multi-domain solution might present an opportunity of interest to Canada. It would seem logical for Canada to take a similar approach should the CAMM system prove effective and economic for the British. Given the strategic value of its limited number of warships, and in particular its next generation of CSC fleet, Canada must either invest in protecting these prized assets, or keep them out of harm's way, i.e. limit the scope of their operations.

Aircraft

¹⁰ Reference to Canadian Government websites relating to the CSC ships project did not confirm that the current contract and funding commitment includes the integration of an Air Defence system to all 15 ships, however this will be assumed for the purposes of this paper.

¹¹ "MBDA CAMM Missiles", accessed Oct 14, 2019, <https://www.mbda-systems.com/solutions-and-services>.

¹² Ibid.

10. Aircraft are amongst the most expensive (to both procure and support) and fragile assets operated by any military. For example, the CAF is currently planning to spend \$15-19 billion on purchasing 88 combat aircraft (the FFWS project) to replace the ageing CF-18 fleet.¹³ This is the CAF's second largest procurement project after the CSC warship. Further, the speed, reach and utility offered by air power make Royal Canadian Air Force (RCAF) aircraft an extremely attractive first response tool to many crises, both at home and abroad. It could also be argued that the RCAF CF-18 force offers Canada's most potent strike capability, and its best AD capability through deterrence and Offensive Counter Air (OCA), i.e. by "destroying enemy aircraft and missiles, both before and after launch".¹⁴ There are however limits to how many and over what distances SBAD can protect aircraft whilst on the ground. Given its limited resources, the CAF would be best focussing on protecting only significant concentrations of aircraft when effective allied AD is not available.

11. Whilst on the ground CAF aircraft are normally parked in obvious locations on mapped airfields and are highly vulnerable to air attack (unless protected by allied AD). Although passive defence measures such as camouflage and dispersing assets should not be ignored, SBAD for aircraft on the ground is ordinarily provided by a layered defence system. Ideally the system would be a modular "networked grid of long and medium range SAMs with identification of friend or foe...facilitating 'plug and play' area air

¹³ "Defence Equipment Purchases and Upgrades, FFWS." Accessed Oct 18, 2019. <https://www.canada.ca/en/department-national-defence/services/procurement/fighter-jets/future-fighter-capability-project.html>.

¹⁴ US Joint Service Command. *Joint Publication 3-01; Countering Air and Missile Threats*. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_01_pa.pdf?ver=2018-05-16-175020-290: US Government, 2018: ix.

defence cover for all assets”.¹⁵ Given Canada’s limited budget, it should probably first consider whether the cheaper medium and short-range systems could provide sufficient AD protection for the investment. This was the approach recently taken by the Swedish, who in 2013 ordered 4 mobile Patriot batteries with 200 missiles for MRSAM, complemented by 4 IRIS-T Surface Launched Standard (SLS) SAM systems for SHORAD. The Patriot equipment reportedly cost around \$3.2 billion (US) and the IRIS-T is the same missile used by the Swedish Saab Gripen as its short-range air-to-air capability, again highlighting the opportunity for using the same missile and/or system in multiple domains (land, sea and air). Noting that the Canadian Government is planning on spending up to \$1 billion on a short-range air-to-air missile capability and up to \$499 million on a medium-range air-to-air missile capability for its new FFWS combat aircraft fleet. The Patriot system is also a popular and highly evolved export product, with proven form in recent conflict.¹⁶ However the IRIS-T SLS, or the previously mentioned CAMM system, which also offers an Extended Range (ER) missile, may offer more innovative and cost-effective solutions across the domains.

Ground Troop Concentrations

12. As for aircraft, the CAF would be best focussing on protecting only significant concentrations of ground troops when effective allied AD is not available. The Canadian Strong, Secure and Engaged (SSE) defence policy commits the CAF to 2 major sustained deployments (of 500-1500 personnel, including one as lead nation) and one major time-

¹⁵ Ibid.

¹⁶ Patriot batteries are currently being widely used in the Kingdom of Saudi Arabia to protect not just military assets, but also its people and its international airport in Riyadh. The system regularly and reliably defeats mainly long-range missiles from Yemen and potentially elsewhere.

limited deployment (of 500-1500 personnel for 6-9 months).¹⁷ Given this ambition to lead one to 2 major deployments, the CAF should have sufficient SBAD equipment to protect at least one, but ideally 2 major deployments at any one time. Using the Swedish Patriot MRSAM procurement costs as a guide, the CAF would probably need to find around another \$1 billion to add to its current GBAD budget of up to \$499 million (which would probably limit the CAF to less effective CIWS options) to procure a MRSAM capability. As previously suggested, this could, for example, be taken from the RCN point defence system upgrade project by accepting a capability gap until the new CSC fleet enters service. To meet its SSE policy, the CAF should invest in a credible and quickly relocatable layered GBAD system, which includes a MRSAM capability, to organically protect up to 2 major concentrations of ground troops at any one time, wherever they may be in the world.

CONCLUSION

13. This paper first acknowledged the very limited SBAD capabilities of the CAF (to protect land, sea and air assets) and the Canadian Governments current spending plans to help resolve this key weakness across the 3 domains. The primary air threats were then identified as being ICBMs, cruise missiles, aircraft launched missiles, surface launched missiles and projectiles, and UAS (which were considered beyond the limited scope of this paper due to the complexity of the threat they pose). It was then argued that ‘the Canadian public’ would likely be the asset at threat of ICBM attack, but as Canada has no

¹⁷ Canadian Minister of National Defence, *Strong Secure Engaged, Canada's Defence Policy*. Canadian National Defence, 2017: 11-12.

will or mandate to grow its own nuclear deterrent, it should avoid becoming involved in any ICBM defence system that could make it a target. From CAF's current and planned assets, 'warships', 'concentrations of aircraft' and 'concentrations of ground troops' were identified as not only amongst the most vulnerable assets, but more importantly the most valuable. Options and examples of how these assets could be protected, whilst remaining broadly aligned with the CAF's current spending plans, were discussed by asset type and resulted in the recommendations below. However, it was also considered illogical for any Government to spend upwards of \$70 billion on the latest warships and combat aircraft without investing in the latest SBAD capabilities to protect it. The Canadian Government may therefore wish to consider if it could accept one less warship, and a few less 5th generation fighters to better ensure the availability of the rest of its precious assets.

RECOMMENDATIONS

14. This paper makes 3 recommendations to the CAF 1* most responsible for AD capability and procurement projects across all 3 domains (land, sea and air):

- a. Before committing to any AD procurement project, further investigate the potential economies of scale and flexibility of multi-domain missiles.
- b. If not already included in the CSC contract, focus AD spending (planned or otherwise) on ensuring this new fleet of warships has the best possible medium and short-range AD systems.
- c. Procure 2 proven and value for money MRSAM systems that could be quickly deployed to protect 2 air bases (concentrations of aircraft) and/or 2 major deployments (concentrations of ground troops).

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