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Reorganising the RCAC For Tomorrow's Fight

Major Daniel G. Carruthers

JCSP 49 DL

Exercise Solo Flight

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INTRODUCTION

After two decades focused on a COIN environment, coupled with a period of marked reductions in defense spending the RCAC needs to be reoriented, trained, and equipped for Large-Scale Conventional Operations (LSCO). In Ukraine, both sides are operating across all domains at a scale unseen in recent decades; the war has thrown certain assumptions about LSCO into question. The CA like many of our allies has been scrambling under the competing priorities of ensuring forces readiness, while simultaneously attempting to support an embattled Ukraine. Chief among the deficiencies that the Ukraine war has highlighted is the importance of major weapons systems - Tanks, fighting vehicles, artillery, engineers etc. From an RCAC perspective this has shone a bright light on the paucity of CA/RCAC capabilities.

The default for many in the RCAC would be simply "do it the way we did before"; this is incorrect. This would see the RCAC push for a larger MBT fleet then the current 74. It doesn't consider the contemporary operating environment and how it has been shaped by new technologies and tactics. It is folly to think that the Armoured regiment organization of the 1960s, through a series of iterative updates is the best solution for this century. The original armoured regiment in battle was published in the mid 1950's, some 70 years ago. Considering that 70 years before the publication of the Armoured Regiment in Battle, Canada had just stood up its first regular army units and cavalry was still very much a horse borne affair, and sabre drill was a fundamental skill set for soldiers in battle vice a tradition relegated to the drill square. This paper is not a vision for RCAC 2025, rather it is a potential roadmap for the RCAC in 2035-40.

This paper will begin with an examination of the strategic environment to better understand what role the RCAC will play in the CA. It will then discuss in detail what the battlespace will look like based on historical trends and recent operations. Next, within the context of the contemporary/future battlespace it will discuss the role of the RCAC in the CA. Understanding the role of the RCAC; it will then look at capability requirements, extant sub-unit elements in terms of organisation, equipping, employment etc. The intent is to evaluate the Echelons and suggest improvements that can be made to how they are organised and operate. It will then briefly consider what an armoured unit could entail. The conclusion will make recommendations for the way ahead for the RCAC to ensure that it maintains relevancy and success on battlefield.

THE STRATEGIC ENVIRONMENT

The strategic environment the RCAC is faced with presents stark realities. First, the RCAC plays a pivotal role in supporting Canadian remits for alliance obligations for NATO (HQ Supreme Allied Commander Transformation, 2021). While reemphasizing the extant Main Battle Tank (MBT) requirements, it clearly articulates the need for a CMBG complete with heavy/medium recce elements (Supreme Allied Commander Europe, 2020) (HQ Supreme Allied Commander Transformation, 2021). To fulfill these remits will mean bold adaptations, and a willingness to revisit how to achieve success using the extant resources of the RCAC as it is – not as it wants it to be.

THE EVOLVING BATLLESPACE

It is important to understand the evolving environment in which the RCAC will fight. The RCAC has been tied to interpretations shaped by experiences in WW2 and Korea and coalesced during the cold war. This model is now outmoded; while this has likely been the case for some time, the early 2000's shift to a COIN environment allowed it to remain entrenched. With the return of great power competition and LSCO the RCAC is at risk of becoming outmoded. While this has been exacerbated for the RCAC/CA by a procurement system that is glacial, a culture that is reticent to change has not helped. The first step in understanding what the RCAC must become is understanding changes to the battlespace.

ANTIQUITY.

In antiquity the phalanx was used to great effect as a concentration of force in an extremely small space. It was the Spartan mastery/complacency of the phalanx in close battle that led to their downfall as an elite fighting force (Strauss, 2013). The Spartan dominance forced their adversaries to adapt (Tim Kirby, 2002) and develop new tactics and technologies to overcome the Spartans[1]. Unfortunately, the Spartans became dogmatic in how wars were fought, seeing the employment of Archers as cowardly (Tim Kirby, 2002). While the Spartans continued to focus on and one form of warfare, their enemies to adapted. These adaptations to the Spartan 'way of war" led them to suffer defeats as their enemies outpaced them[2]. Ultimately the Spartan Phalanx became outmoded[3].

WW1 & WW2

The last century saw the introduction of industrialized war, first seen in WW1 and continuing through today. Perhaps most pivotal were those lessons first learned through WW1; solidified during WW2 that fully realized the battlespace as being fought not only on a frontage, but also depth with progressively increasing dimensions. These trends were summarized by B.H. Liddell Hart's 1960 'The Ratio of Troops to Space' (Hart, 1960). His observation was that with changes driven by tactics, but more importantly technology; that there was a reduction in the number of personnel required to fight a given Km of frontage (Figure 1). The Battle of Amiens (1918) saw a concentration of armour in an effective manner for the first time with allied forces effectively throwing the Germans in disarray under concentrations not previously possible in the war (Fuller, 1954)[4].

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[1] Prior to and at the outbreak of the Peloponnesian War the Spartan Phalanx was used to incredible effect, the unified, well-trained, organized and motivated Greek (Spartan in particular) Phalanx dealt defeat to the Persian invasion (Tim Kirby, 2002), unfortunately the Spartans in turn suffered from the 'victors disease' and ways of fighting: with Hoplite phalanx, against phalanx, in daylight in smaller open ground was the accepted norm (Kagan, 2004; Tim Kirby, 2002).

[2] During the Peloponnesian War and the battle of Sphacteria, where after defeating the Spartan navy the Athenians were able to land on the Island of Sphacteria employ a force of light armed forces (Light Infantry) and archers to defeat the Spartan Phalanxes (Lendering, 2024). Using tactics that refused to engage the more heavily armed and armoured Spartan phalanxes, but instead used agility and standoff range of the archers to engage them on favourable terms until ultimately forcing the surrender of the spartan forces (Tim Kirby, 2002).

[3] At the battle of Leuktra where the novel organization and groupings of the Theban forces proved decisive in their victory over the Spartan led Peloponnesian forces marking the end of the Spartan dominance and the end of their favoured warfare – events had overtaken them, and their way of war had become obsolete (Majoor, 2003).

[4] During this battle Divisions averaged a frontage some 200m, and in the case of the tanks being employed saw armour concentrated 4th Brigade to the Canadian Corps on its frontage, and likewise 5th Brigade with the Australian Corps, and 3rd Bde of tanks to the Cavalry Corps. The employment of this armour, and the effects of them with Infantry artillery and aviation was to prove decisive in handing the Germans their most significant defeat in the war up to that time (Chappelle, 1993). If the opportunities had been realized during the attack greater effects could have been achieved had the allies been better prepared more may have been achieved, as it were the General Ludendorff acclaimed it 'the black day of the German Army in the History of this war" (Fuller, 1954)

Ser	Conflict	Fighting Troops per Km Defence (est)	Fighting troops per Km Offence (est)	Comments
1	Napoleonic wars	12500	25000 (2:1)	Using set-piece Battles, massed formations in extremely small areas maneuver to gain an advantage to secure victory
2	US Civil War Beginning	7500		Muskets, smoothbore artillery are being used at the outset, very similar to Napoleonic wars. Arms race starts as both sides seek to gain advantage
3	US Civil War End	3125		Rifles and rifles artillery allow improved range and accuracy of engagement, reducing the need to concentrate forces from what was required at the outset
4	WW1 outbreak	2250		Armies are going to war with what is on hand and in production
5	WW1 1917	1900		German Defending forces began to employ a system with each division reinforced by another with only one formation forward. Viewed in depth this meant the ratio had climbed back up to approaching Napoleonic densities
6	WW2	1250	3750 (3/5:1)	1/3 is seen as the minimum, depending on the nature of the battlespace, significant more troops required in the offence – technology is driving much of this.
7	Cold War 1960	1 Division	2 Division	**B.H. Liddell Heart** assessment based on trends in technology but tempered by their expectation of conscript army performance (on both sides) in NATO at that time along with additional assumptions based on both mobilization criteria and thresholds for the employment of nuclear weapons.

Figure 1. Summary of Troop Ratios (Hart, 1960)

US ARMY DIVISION – CHANGING BATTLESPACE, THEN AND NOW

The US Army has continued to keep apace of the expanding battlespace. Their current doctrine indicates a significant change to the relative depth of the battlespace from its 1984 evaluation (Army Futures Command, 2020)

Figure 2.Summary of Battlefield Geometry changes (Army Futures Command, 2020)

Ser	Period	Div Frontage	Div affect/BHOL	Note
1	1984	18-28	5-15 Km	2 or 3 brigades up
2	2028	18-28 km	14-70 Km	2 or 3 brigades up

There are challenges that the dispersed AO presents that need to be addressed such as sustainment, C2, sense etc. For the US Army it is the Cavalry Sqn (Bn in CA terms) in each SBCT is resourced with 3 sub-unit of 2 Platoons and an anti-armour sub-Unit that is responsible for the covering force battle [5]. The US Armies FM 3-94, Armies, Corps, Divisions is informative as it frames the potential employment of a CMBG. From the anticipated frontage of 18-28 Km for a division, depending on brigades abreast, 2 or 3; the CMBG frontage must be considered 10 km+.

The depth of the battlespace has changed more. For the RCAC the critical areas are the "Close, Deep and support areas for divisions (US Army, 2021). In the context of the CMBG the Deep fight for the Division is from (forward of the line of Contact) 15-24 Km, while the Close area is from the LC to 15 km (Figure 3). The support area for the division can extend from 29-36 Km to the rear of the LC. While all three are relevant, the critical pieces for the RCAC are the Close and Support Areas which combined recognise the

[5] The US army with the introduction of SBCTS has organized them to address the covering force battle. SBCT Cavalry Bn is equipped with 3 x sub-unit and a 4th optimized for the anti-armour role. These Cavalry Battalions have 3 companies of 2 troops (CA troop/Platoon) while the 4th Coy consists of 3 anti- armour Platoons (Auld, 2023). This suffices for the US army, but it will not for the CA. If the CA is to bring credible formations to our allies it will need to be able to operate in a US division, the difference is that a CMBG must retain the ability to operate in a US division but do so independently if it is to add value.

need for units to be able to operate over a depth of 50+ Km. The structure of both CMBGs and RCAC units are not suited to operating an AO of 10 x 50 km.

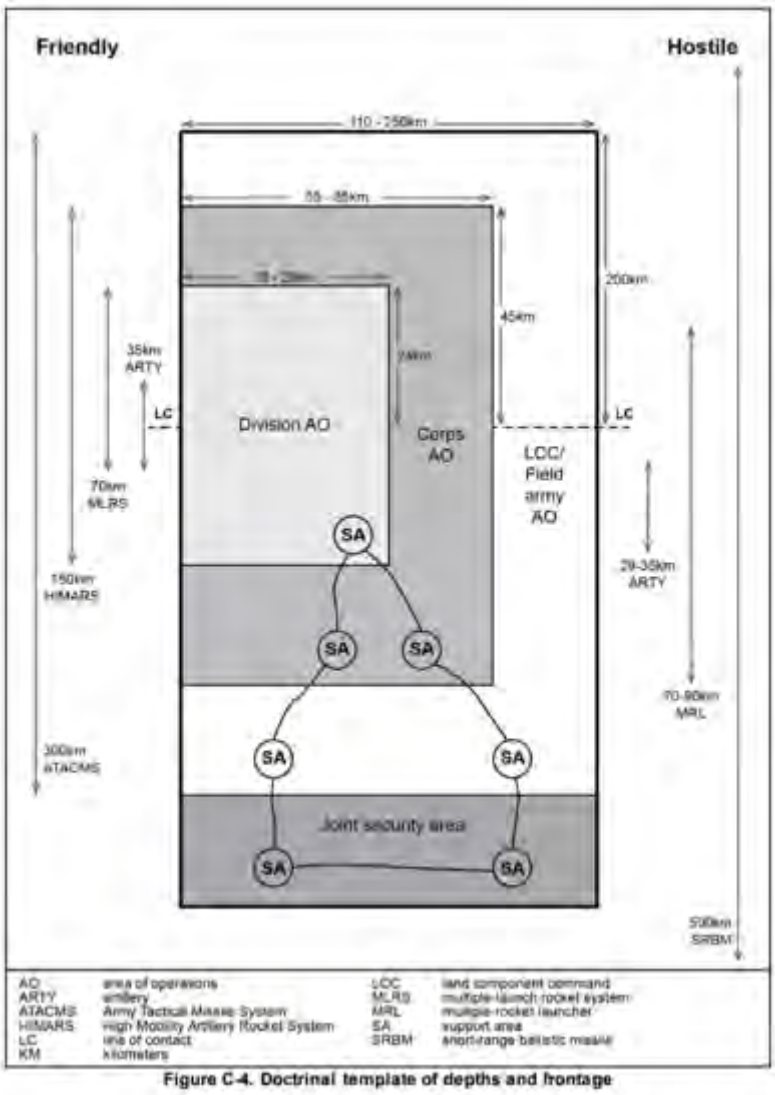

Figure 3. Frontages and Depths (US Army, 2021)

This increase is driven by the need for forces to move from disaggregate to aggregate to avoid being targeted by enemy effectors (artillery CAS etc). While this helps forces survive, it also makes massing for decisive battles difficult. Increasing geometry has facilitated a second technology race beyond kinetic lethality; that of C2, targeting necessary to support the coordination of increasingly dispersed forces. (Auld, 2023).

UKRAINE

In Ukraine the battlespace has continued to not only experience this enlargement; but keeping apace, if not outstripping this is the advent of new capabilities in the form of uncrewed platforms and the

emergence of AI. Ongoing experiences in Ukraine may require a revisit of the marked changes outlined by the US Army (Army Futures Command, 2020).

While Russian performance in the war has been noted in detail, the advanced thought behind Russian operations has received less attention. In many respects the war in Ukraine has seen the maturation of deep strike capabilities that has been in development since the 1980's; part of this trend (at least theoretically) has been to move away from larger force engagements.[6] Dispersion of forces is key to their survival in Ukraine, in some instances Ukrainian rifle companies in the defence have 3 Km frontages, and battalion frontages are closer to those of Brigades (Mykhaylo Zabrodskyi, 2022) (Noorman, 2023). An important take away from the war is that both sides will commit significant fires once an enemy concentration larger than a sub-unit is identified by their kill chain (Noorman, 2023).

The most important quality in the conflict appears to be the mobility of forces. We can imply from this that if forces need to 'aggregate' and come together for decisive operations that they need to be able to do so rapidly, from a distance, then move on to a given task, followed by rapidly 'disaggregating' to avoid counter fires.

RCAC units need subunit/unit structures that can fight/operate across a brigade frontage of 10+km through a 50km+ in depth in a meaningful manner.

THE ROLE OF THE RCAC IN THE FUTURE BATTLESPACE

Despite the aspirations embodied in 1 Div HQ the CA is incapable of deploying, fighting, and sustaining itself at the Division level. As outlined by Director Armour, the only feasible scenario where the CA will fight a peer adversary is in the context of a collation either under the aegis of the UN, NATO or some other multinational force (Auld, 2023). Likely this would mean an environment where the lead allied land component is the US Army[7]. While the RCAC has sought to re-invent itself under the heavy/medium/light construct; preliminary Lessons in Conventional Warfighting from Russia's Invasion of Ukraine: February–July 2022 (rusi.org) a more succinct conversation is: How will the RCAC structure/equip itself so that it can perform the close and covering force battles?

The role of the RCAC to fight the close mounted battle is understood; historically this has been accomplished by MBTs (Auld, 2023). Beyond the immediate challenges of a paucity of MBTs and an inability to maintain them; the CA/RCAC have other concerns. The RCAC lacks the ability to conduct the covering force battle in a meaningful manner; historically the Recce Squadron has been given this task, lacking integral Anti-armour capability it is ill-suited to do so.

Any force structure for the RCAC must include sub-units capable of fighting both the close and covering force battles, based upon the recent experiences in Ukraine and the trend of increasingly dispersed operations one assumption made is that the preponderance of battles will be dispersed and covering force

[6] 'Conducting sequential and concentrated operations" instead, there is a move to dispersed, mobile, combined arms, linked in a single intelligence-information space, placing greater demands on command and control'(Gerasimov) (Noorman, 2023).

[7] In the context of a CMBG operating as part of a US Army division there (Army Futures Command, 14 Aug 2020). As discussed by director Armour in their position paper (Auld, 2023), this makes eminent sense, and in the context of the current environment, working with the US Army is for the RCAC an eminently sound assumption at this point given both Canadian capabilities, alliances and indeed stated American expectations (Supreme Allied Commander Europe, 2020) (HQ Supreme Allied Commander Transformation, 2021).

in nature, vice those previously found in set piece battles; however, there still exists an extant requirement to maintain the close combat capabilities of MBTs. .

An assumption is that the RCAC will operate 4 ‘sabre’ squadrons per regiment as the armoured component in CMBGs. The close fight and covering force tasks are significant, and arguably merit two dedicated units. This draws us to the conclusion that Armoured sub-units must be able to operate and fight across not less than half the CMBG frontage (5+Km). This will require both new capabilities and structures at the sub-unit level.

CAPABILITIES NEEDED TO MEET FUTURE THREATS

There are several considerations for the RCAC defining itself. An effective starting point would be to adopt a different framework from the classic armour firepower mobility triangle and instead adopt a framework based upon the Armour Firepower, Mobility, Deploy-ability, Adaptability and Sustainability.

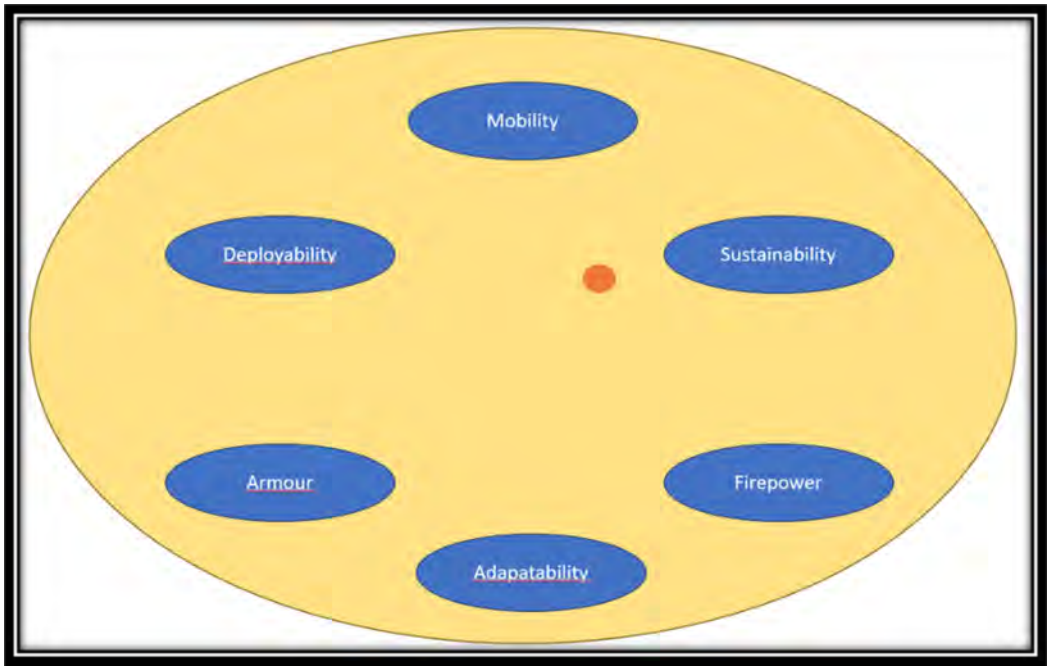

Figure 4. The balance of design: Source Author

As outlined in the previous section there are remits any force organization must meet. Allied armies have done a similar analysis and come to similar conclusions – a consistent theme is that a single platform that can ‘do it all’ will be cost prohibitive. The German and French Armies have been collaborating on the MGCS program and have come up with a 3-4 variant solution (Felstead, 2024)[8].

[8] While both countries are collaborating on the project and appear to agree to the multi-variant solution there is still some overarching areas where differences remain. In particular it would appear that the German army is leaning towards a heavier, 50 000 Kg +/- platform well suited to the terrain of Western Europe type solution.

Figure 5. Bundeswehr concept art for MGCS.Source: (Felstead, 2024)

While taking part in the MGCS as an equal partner, initial information indicates that the French Army is considering 3(+) variants as being the necessary number with the possibility of a 4th version being discussed. (EDR Magazine, 2022)

Figure 6. French Army MGCS Concept. Source: (EDR Magazine, 2022)

Though allied developments do not need to be 'copied' or followed implicitly, they should inform RCAC plans.

There is also a very important discussion to be had between the RCAC and RCA about range bands. Like the other arms, the expanding battle space and more specifically the increased depth, means that the artillery must now fight the 'deep' fight at ranges longer than ever. While the ranges of the Close fight have also continued to extend with MBT now capable of direct fire engagements out to 6+km (Below the Turret Ring, 2021). It is assumed that the CA will continue to resource the RCA in line with other NATO countries using self-propelled guns with 155mm calibre and these will remain the cornerstone of CMBG indirect fires[9]. As the ongoing development of 155mm capabilities is pushing these systems out to 70 km, it represents a doubling of ranges. (Gourley, 2024). The discussion is, not that the artillery stops

[9] The current M777 initially procured for Afghanistan is acknowledged as a less than ideal weapon for the RCA as an artillery system for the CMBG

supporting the manoeuvre elements but at what ranges do we expect the artillery to fight in support of maneuver forces?

Though not recognized now, there will be an 'intermediate fight' fought by maneuver forces. For discussion, the intermediate fight is defined as beyond the line of sight, out to 13km as it is the maximum range at which many 120 mm mortars and loitering munitions operate (Armees, 2021)

New technologies need to be used so that what is unique today (Drones loitering munitions will be common While the UAS/UGV will continue to be a pivotal part of this, the capability concept needs to be revisited. Much of our current thinking related to UAS can be summarized as 'the few, the complex, the expensive' this worked for the COIN environment; to be relevant in LSCO where 90% of UAS will be destroyed within their first 3-6 flights does not survive LSCO (Mykhaylo Zabrodskyi, 2022), the approach should be "the plenty, the easy to produce, repair operate, and above all the cheap'. Moving beyond loitering munitions and UAS, there will be a need to develop and invest in Uncrewed Ground vehicles that are armed and capable of carrying the fight to both enemy forces and that all autonomous systems are employed with view to achieving dominance in the autonomous realm as well.

Understanding the changing technical needs of the battlespace, both France and Germany are well along this process with the MGCS project (EDR Magazine, 2022). As discussed previously there are 3- 4 variants to consider, the author has in considering both allied commentary, Canadian considerations, and the discussed 'intermediate zones' developed rough descriptors of what a Canadian family of vehicles technical capabilities could entail (see Figure 7).

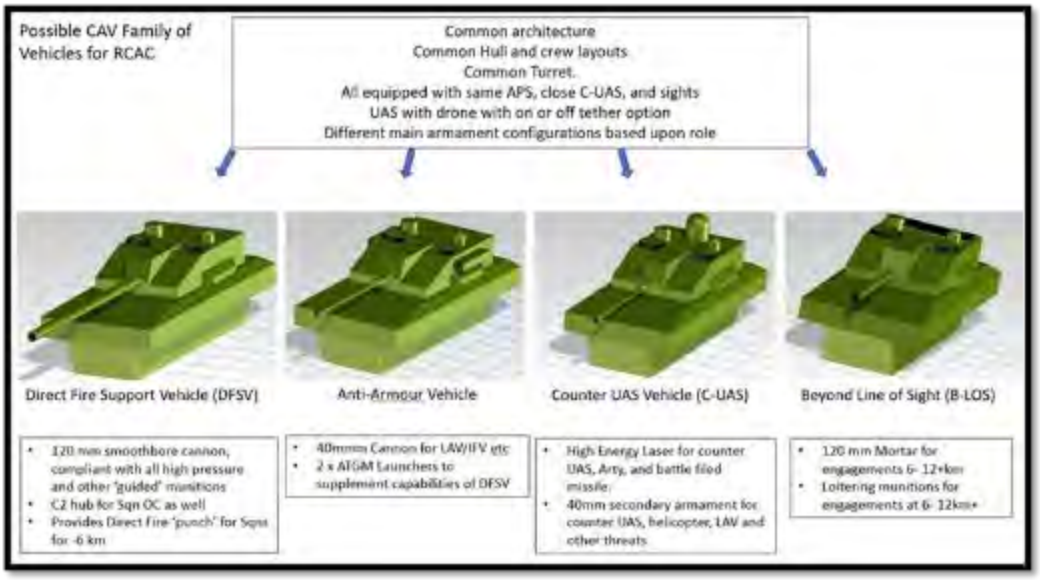

Figure 7.Conceptual build of future AFV variants. Source: Author

For any sub-unit grouping to fully realize the efficacy of these variants both in terms of the battlespace, training and sustainment, a modular approach should be taken. This is often taken to mean the chassis, recent work by Cockerill on a universal turret suggest this can be taken further (Cockerill(R) 3000 Series Turret, 2024).

Figure 8. Cockerill 3000 Series Turret. (Cockerill(R) 3000 Series Turret, 2024)

MAINTENANCE.

The next generation of AFV must do a complete about face in terms of maintenance practices. The TAPV is an excellent example of what the RCAC does not need for AFV maintenance. While the initial support contracts for the vehicles were put in place with the intent of improving readiness and serviceability of the fleet, they have done the opposite [10].

The CA and the RCAC need a maintenance revolution in their next generation of fighting vehicles, and B fleets as well. The RCAC needs to ensure that crews can maintain their equipment without being crippled by a need for expertise, complexity, and contractors. The intent is to enable a vehicle that less, the most complex and heavy of repairs can be maintained by the crew.

[10] The fleet has been plagued by an unresponsive contractor, absence of parts, extraordinarily high Vehicle Off Road (VOR) rates. Much of this has been exacerbated by contractual caveats that preclude the crews from maintaining the vehicle themselves, and indeed greatly limit the ability of the CA maintainers to do much as well, anecdotally many feel as though they are more aptly described as 'tag technicians' vice 'vehicle technicians' being unable to do little more than label parts that are unserviceable and await the contractual support that must and can only be used.

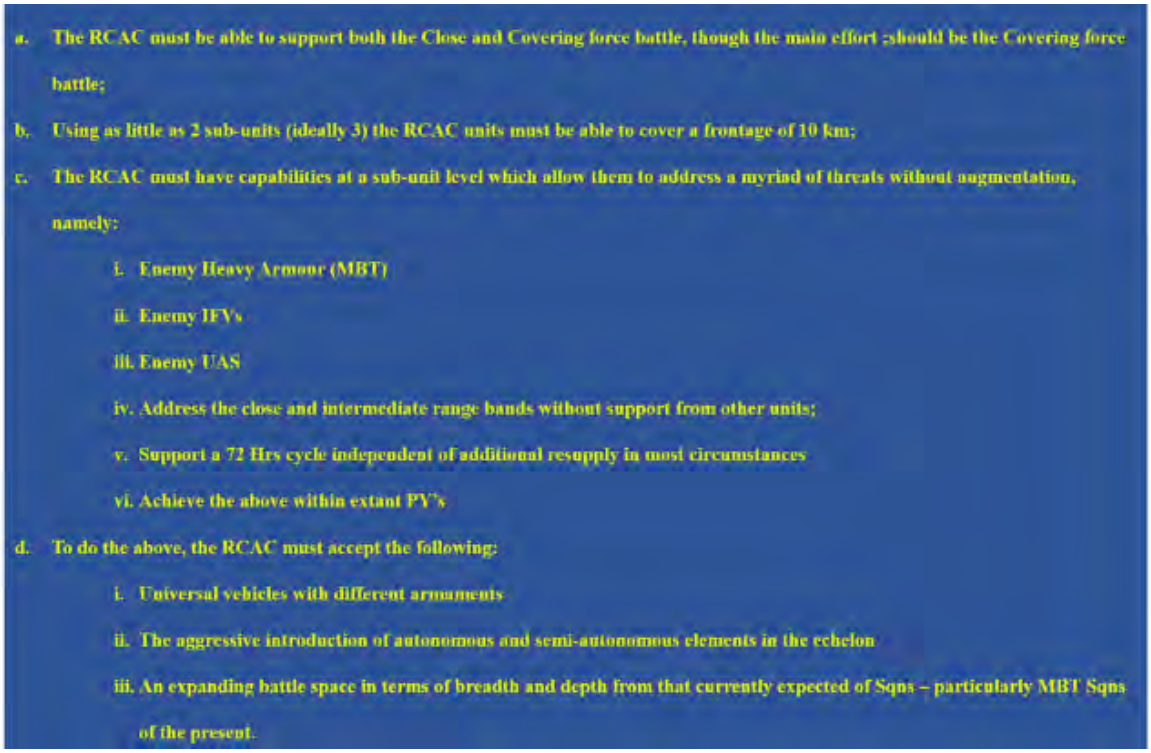

Figure 9. Characteristics of future RCAC AFVs

SQUADRON F ECHELON NEEDED TO MEET FUTURE THREATS

The F Echelon as established in the RCAC will need to change to remain relevant. First and foremost, the idea that the Armoured Squadrons will continue to operate Tank, Recce, and Cavalry needs to change.

The Recce Squadron

The Recce Squadron lacks the utility needed to remain relevant. While having an impressive sense capability, the lack of lethality's and effects beyond medium cannon, or with the TAPV only a modest anti-personnel capability means that the Recce Squadron is incapable of operating in LSCO, this combined with the idea that a single sub-unit (no matter how robust) can somehow manage the frontage of a Brigade is not nested in reality (Canadian Army, 2015).

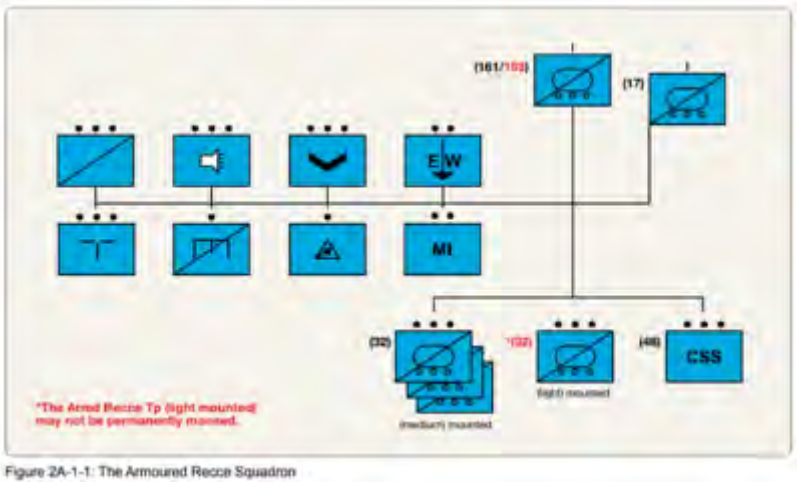

Figure 10. Current armoured recce Sqn. Source: (Canadian Army, 2015)

The Tank Squadron.

The war in Ukraine has continued to validate the necessity of Tank Squadrons. Though their employment has been expanded beyond what the CA would typically do. There is still a clear need to retain MBT, likely in significantly greater numbers than exist today.

WHAT DO WE NEED SQUADRONS TO BE ABLE TO DO?

The Armoured sub-unit must be able to cover and fight a frontage of 5+ km. The RCAC should consider several sub-unit organizations and determine which is best. While there are certainly options beyond those presented here, we will assume 3-4 manoeuvre troops with an SHQ and supporting A1, A2, B Ech remain extant[11] .

For the F Echelon this will mean fighting the battlespace in terms of what the author has called zones defined below and captured graphically at Figure 11 . \

Squadron Maneuver Zone. Will that portion of the battlefield where Squadron F echelon conducts its immediate tactical movement or bounding. Those vehicles at the leading edge are at Km '0' of the direct fire zone. Those supporting movement are, +/- 2km to the rear representing the back edge of the F echelon battlespace.

[11] Breaching. Being based upon a universal chassis, due consideration should be given to how these Squadrons will achieve classic breaching tasks. The only obstacle not suitable will be gap crossing typical of AVLB. All vehicles should be capable of being outfitted with a myriad of tools to include the standard dozer, plow rollers, and the ability to tow a trailer equipped with MICLIC/VIPER type device for rapid lane clearing. (Wikipedia, 2024), and consideration to having a design that incorporates the ability to carry fascine should be considered as well. Fascine and MICLIC are more often carried by dedicated engineering vehicles in Canadian army service, however other countries such as the UK have done this with standard tanks and AFVs with simplified/collapsible brackets to enable it (Churchill AVRE Fascine carrier, 2024) (Nasch, 2019). These vehicles differ from engineering vehicles in that they are not able to recover the fascine, or in the case of the MICLIC are only towing vice carrying the necessary equipment. Again, while not as robust as the full-time capabilities provided by the Combat Engineer Regiments, these limited capabilities would further expand the Armoured Squadrons ability to prosecute the covering force battle with a degree of independence they do not currently have.

Squadron Direct Fire Zone. Is that portion of the battlefield where the Squadron can both see and engage the enemy in direct fire engagements, forward of Km ‘0’ out to Km ‘6’.

Squadron Intermediate Zone. Is that portion of the battlefield that the Squadron will rely upon various uncrewed systems and longer-range effectors to fight the enemy. Importantly this is also the space where they will need to achieve overmatch in the autonomous systems realm. This realm will be from the Km ‘6’ of the direct fire zone, out to the maximum engagement range of effectors and autonomous systems, tentatively km ‘13’.

Contested Autonomous Zone. where adversary robotics both controlled and semiautonomous drones will be used to achieve superiority, much like the airspace; this autonomous realm will become heavily contested as opposing forces seek to gain advantage in support of their maneuvering forces – this fight will take place throughout the squadron battlespace but will likely be fought primarily through the Intermediate zone.

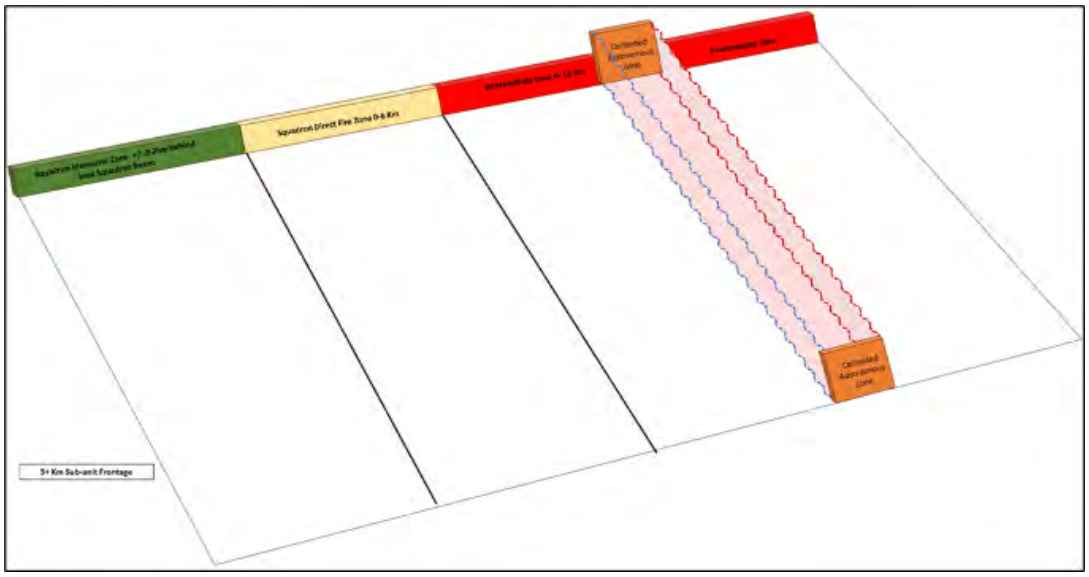

Figure 11. Future Squadron Zones. Source Author

This paper will consider the following Squadron arrangements using the previously discussed variants as a start point for discussion on how squadrons could be organised to fight the ‘zones’ of the sub-unit battlespace at Figure 12 .

Ver	V1.1	V1.2	V2.1	V2.2	V3.1	V3.2
SHQ	2 DFS-V (OC)	2 DFS-V (OC)	3 DFS-V (OC, BC)	3 DFS-V (OC, BC)	3 DFS-V (OC, BC)	3 DFS-V (OC, BC)
1 Tp	4 DFS-V	2 DFS-V 2 AA-V	4 DFS-V 1 BLOS-V 1 CUAS-V	2 DFS-V 2 AA-V 1 BLOS-V 1 CUAS-V	2 DFS-V 1 BLOS-V 1 CUAS-V	1 DFS-V 1 AA-V 1 BLOS-V 1 CUAS-V
2 Tp	4 DFS-V	2 DFS-V 2 AA-V	4 DFS-V 1 BLOS-V 1 CUAS-V	2 DFS-V 2 AA-V 1 BLOS-V 1 CUAS-V	2 DFS-V 1 BLOS-V 1 CUAS-V	1 DFS-V 1 AA-V 1 BLOS-V 1 CUAS-V
3 Tp	4 DFS-V	2 DFS-V 2 AA-V	4 DFS-V 1 BLOS-V 1 CUAS-V	2 DFS-V 2 AA-V 1 BLOS-V 1 CUAS-V	2 DFS-V 1 BLOS-V 1 CUAS-V	1 DFS-V 1 AA-V 1 BLOS-V 1 CUAS-V
4 Tp	1 DFS-V (BC) 3 BLOS-V 3 CUAS-V	1 DFS-V (BC) 3 BLOS-V 3 CUAS-V	Nil	Nil	2 DFS-V 1 BLOS-V 1 CUAS-V	1 DFS-V 1 AA-V 1 BLOS-V 1 CUAS-V
DFS-V	Direct Fire Support Vehicle					
AA-V	Anti-Armour Vehicle					
CUAS-V	Counter uncrewed Autonmous Systems Vehicle					
BLOS-V	Beyond Line of Sigh Vehicle					

Figure 12. Potential Future RCAC Armoured Squadron Organization

Strong forces	Weak forces	Description
Drone supremacy	Drone incapability	Drone supremacy is the highest level, where a side holds complete control of the autonomous battle space.
Drone superiority	Drone denial	*Drone superiority* is the second level, where a side is in a more favorable position than the opponent. degree of dominance in the autonomous battle space that permits the conduct of operations by [one side] and its related land, sea and air a given time and place without prohibitive interference by opposing autonomous forces.
Drone Favourable	Drone unfavourable	A drone situation in which the extent of effort applied by the enemy drone forces is insufficient to prejudice the success of friendly land autonomous operations.
Drone parity	Drone parity	Drone Parity is the lowest level of control, where no side holds any level of control of the autonomous zone.

Figure 13. Proposed definitions for drone power. Source Author (based on extant Airforce definitions (NATO, 2013))

Considering the Options.

None of these is clearly advantageous over the other. Greater simulation to assess which is the best balance across a myriad of tasks is needed. The end-result needs to be an armoured Squadron that can fight across ‘zones of the battlespace’.

Fighting Armoured Squadrons across zones. As envisioned, there will be a need to leverage the capabilities discussed to ensure that the Armoured Squadrons of the future take advantage of all the technologies, lethality’s and sense capabilities at their disposal (Figure 14

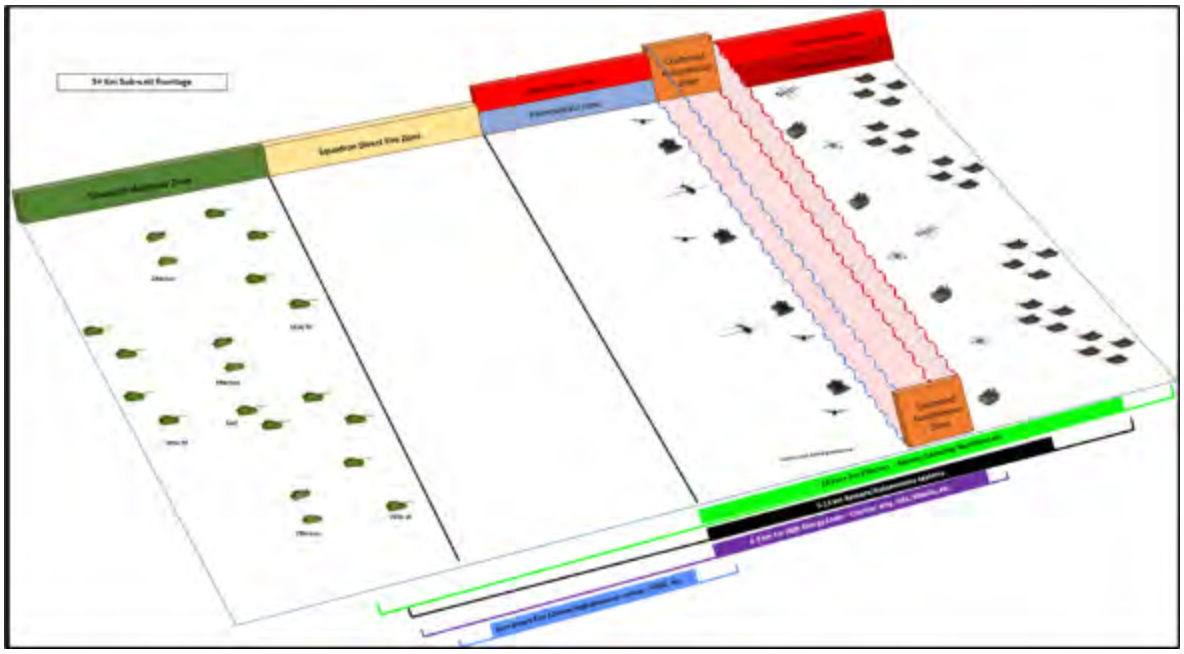

Figure 14. Initial friendly and enemy disposition

Initially Sqns will seek to achieve dominance in the contested Autonomous zone to ensure that they have the advantage in maneuvering forces and determining subsequent engagements (Figure 14). Ultimately the goal will be to achieve ‘drone supremacy’ (Figure 13).

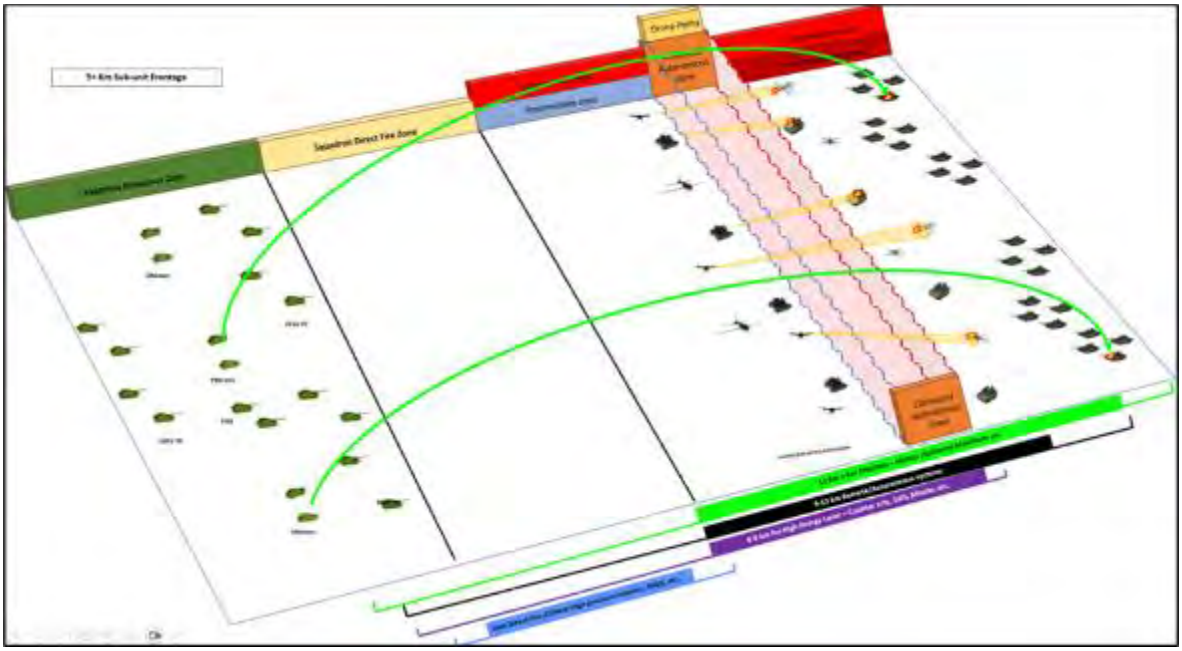

Figure 15.Armoured Squadron fights at range to achieve drone superiority and engage En at range with effectors.

Once the Squadron has set-the conditions to its advantage, or at a minimum prevented the enemy from gaining an advantage the Sqn will seek to continue to attrit both the mech and drone components of the Enemy in detail. Depending on the circumstances, these engagements will continue to be conducted primarily through the Intermediate zone (Figure 16). Concurrently, the Squadron will seek to choose the most favorable ground for engagements in the Direct fire zone, using the maneuver zone to do so.

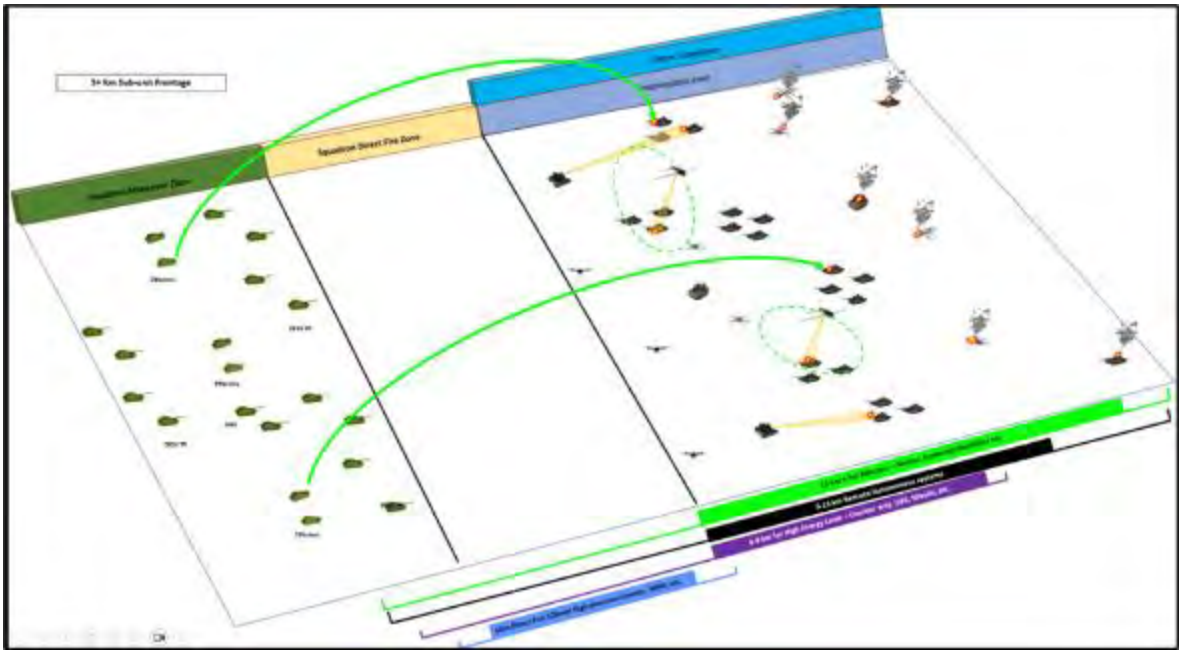

Figure 16. Attrition of En through Intermediate Zone

As the distance closes there will be elements that enter the direct fire zone; at this point the full weight of the Sqn will engage the enemy in detail leveraging direct fire, effectors and autonomous systems to simultaneously engage the enemy through both the direct fire and intermediate zones (Figure 17).

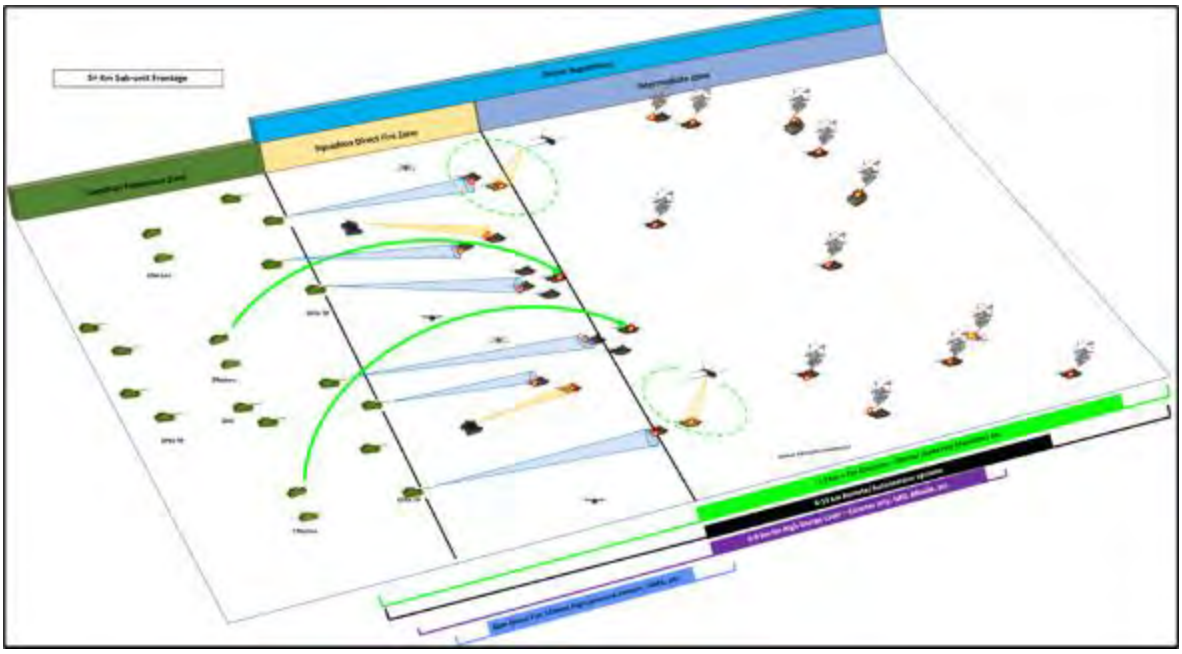

Figure 17. Armoured Squadron Defeats Enemy in detail through Squadron Direct Fire Zone, and in Intermediate zone where possible.

SQUADRON ECHELON TO MEET FUTURE NEEDS

While the RCAC is undergoing significant change in recent years the Echelon is here to stay –the changing battlespace requires the endurance and span of support it provides[12].

The Armoured Sqn A1/A2/B echelons is vital to the success of armoured units; however, the current Echelon is too personnel intensive (see Figure 18). Automation will allow the reestablishment of functional echelons. The A1/A2/B echelon could be resourced with 30 personnel +/- once autonomy is fully realized. This would allow significant personnel savings to ensure that F and support echelons are at strength.

[12] The heavy and light Armoured squadron admin troops are similar with the exception that the light armoured cavalry sqn has fewer prime movers. The current echelon as envisaged has one model with two variations; the Tank Echelon has 65 personnel and the Cavalry echelon 53. Between the 9 Squadrons this represents a total of 513 Positions or one third (+) of the RCAC strength in the field force in terms of Armd PYs. What this means units can field healthy Sqns with echelons, they cannot field healthy units as the complete staffing of the echelons is not achievable.

Current organization of the Armoured Sqn A1/A2/B Echelons.

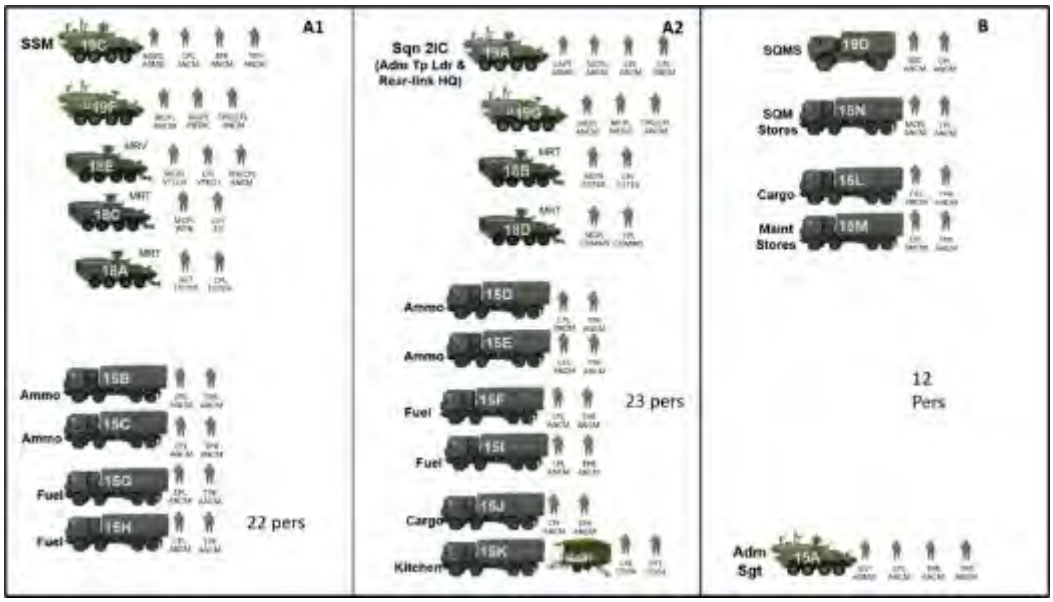

Figure 18. Demonstrative of current Armoured Squadron, different versions do exist based upon resources avail and force structures

Crewed armoured vehicles are not where PY's will be saved. These positions ensure the ongoing support and technical expertise required to keep the squadrons running. However, PYs supporting routine tasks, such as bulk stores – fuel, ammunition etc., are where savings could be realized using Ground Uncrewed Autonomous Systems (GUAS) (Figure 19).

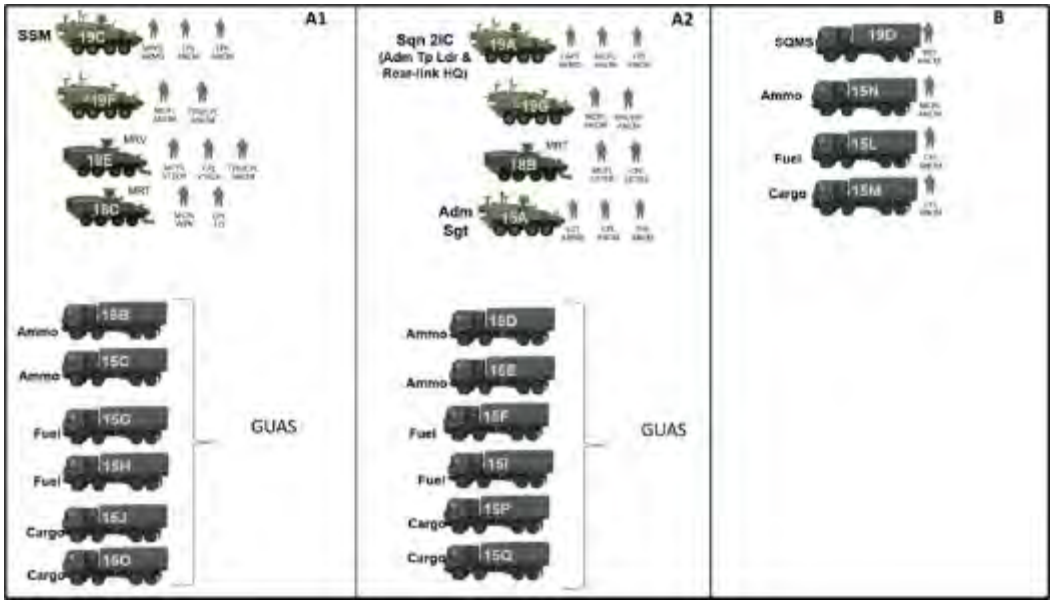

Figure 19. Armoured Squadron with GUAS/Automation

Squadrons currently employ significant numbers of personnel moving bulk supplies with additional positions in the HQ Sqn. These are important tasks that could be done by automation, to realise significant personnel savings.

Figure 20. Scani AXL -Driverless haulage vehicle

An example of autonomous technology is the trucks used for haulage in mining industry like the Scani AXL (Scania AXL, 2023). Using autonomous equipment to complete the movement of stores/fuel/munitions would do much to alleviate the personnel intensive nature of the echelon and could be managed using different levels of control (see Figure 21). A specific example of this is the 'Robofuel' system (Scott Industry, 2023). This system uses a state-of-the-art vision sensing and detection system to locate the position and orientation of the vehicles fuel tank, once located it fuels the vehicle.

1) **Direct Control. This would see an operator, most likely a co-driver of one of the vehicles drive the autonomous vehicle remotely; they could conceivably do this and have multiple vehicles follow theirs as well. As discussed, this would not be the normal default, rather this option would be used in complex scenarios/terrain where human intervention is required or desired.**

2) **Direct Monitoring. This would see a vehicle given a plotted destination and depending on the circumstances given a dictated route or told to determine the most efficient route to a given destination. From there is would navigate the route independently.**

3) **Follow Mode. The vehicle(s) are given the direction to follow one vehicle or another – this is an efficiency system and for longer moves one could readily imagine vehicle following other ones over long distances in simple terrain while still being monitored by operators.**

Figure 21. Autonomous system type/levels of control

Figure 22.Scott Robotic Fueling System

Moving large stores such as ammunition could be achieved with robotic arms The system would then select and place it on the vehicle in a manageable load - robotic arms can lift 2300 Kg (FANUC US, 2023).

Figure 23. FANUC M-2000iA lifting up to 2300kg

H2O Production. Squadrons require as much as 20 litres per person daily; up to 2900 litres a day amongst 145 jerry Cans. Given that a jerry can weighs 2.13 kg and the water 20 kg this represents a total 3208 kg that needs to be moved daily. Rather than produce the water at one location, transport it to the Bde and BG then to the Unit, to Sub-unit echelons, all while repackaging it from bladders to trucks to jerry cans, etc.; the use of atmospheric condensers could alleviate this entirely.

Figure 24. Water Gen 40V unit can produce up to 80litres a day

The Israeli firm Water-Gen has produced an atmospheric water condenser suitable for installation on vehicles that can produce up to 80 litres a day that should be considered (Solomon, 2017)[13].

Production of Parts.

While the Echelon typically has many parts held, these are finite and there is a risk of not what is needed. This can impact readiness of squadrons. 3D printing and CNC technologies could be used to alleviate this[14]. This technology is nascent in terms of a field applications; however, it has obvious uses and will improve.

Figure 25. ADF production of 3D metal parts

Individual Kit & Clothing.

The echelon invariably has a mix of clothing, boots etc. on hand for when replacements are required. There are options to produce what is needed in location that can be looked at. If a soldier had clothing

[13]This system has been in use for some time with the IDF, it has more recently been adopted by the French Army for their VBCIs (Eshel, 2014)

[14] A good example of this is the recent Australian Army field trials. Using 3D printing they were able to produce some simple component for M113's while operating in an austere location (Listek, 2021). Using this technology the SPEE3D team was able to produce parts weighing 40 Kg made of metal (Listek, 2021).

damaged; as the echelon receives the information, they use soldiers' sizes and produce them using mil-spec robots in situ.[15],[16]

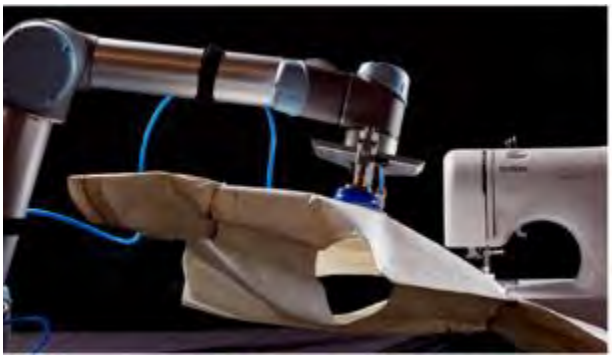

Figure 26 'Sewbo' putting together shirts with little/no human involvement

Figure 27. KEEN product the 'Uneekbot' can put a shoe together in 6 minutes

Operating the Echelon.

With new technologies it is prudent revisit how an echelon will function. Between the Brigade support area, HQ Sqn and the A1, A2, and B echelon there is a need to adapt to the increased of the battlespace. The traditional Echelon system moves supplies by getting them off-loaded/cross loaded at points while moving them. The introduction of GUAS prime-movers will better ensure the movement of resources. As an example, ammunition may be picked up by HQ Sqn, cross-loaded to a Sqn A1, then cross-loaded to the A2; finally, it is offloaded by the crew in their vehicle – this is inefficient.

[15] The Sewbo is an example of an emergent technology in the private sector that could be developed and leveraged to this end (Guy, 2017). With this technology in the echelon, it could make clothing on order based upon the needs of Sqn personnel – this could save time, money and improve readiness.

[16] The Uneekbot from Keen is a system which is designed to make footwear made in the private sector – this is an attractive option as instead of carrying a bit of everything, the echelon could simply have the aggregate resource required to make the boots on hand then produce them as required (Nikolov, 2019).

Rather than transferring stores at multiple points it would instead look to have the same vehicle passed across multiple ‘controlling stations’ to move stores more efficiently.

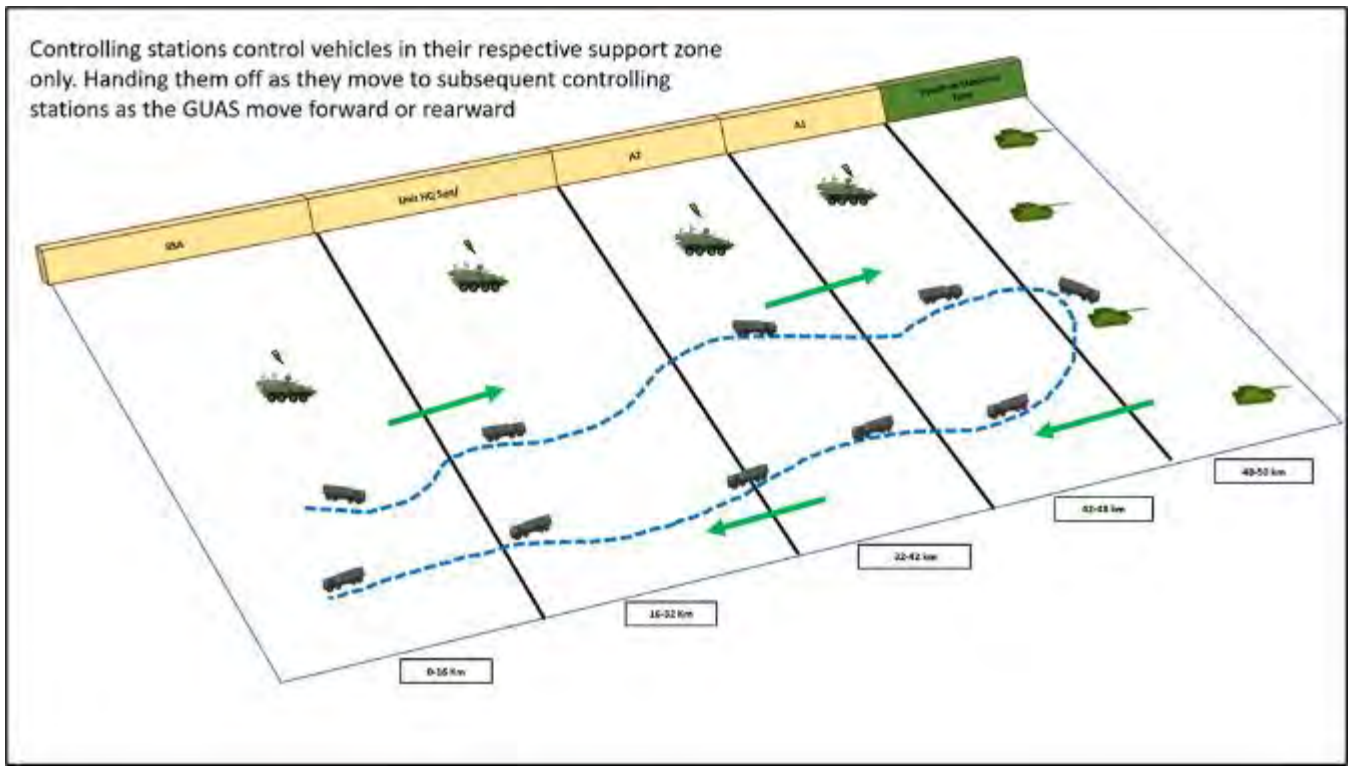

Figure 28. Movement of GUAS along controlling stations to support F-Echelon. (source: Author)

Under this each element of the supply chain would be responsible for controlling any GUAS within their part of the ‘chain’, both ingoing and outgoing. While the current practice of the A1, A2 is to have these elements grouped in their respective ‘part’ of the battle space (National Defense, 2005), GUAS will be better able to operate across increased distances more quickly and dispersed.

Architecture of the Resupply System.

The incorporation of a fully networked battlespace with echelon would allow a move from a pure ‘push’ to a ‘push to scale system’ in this respect the supply system of the future may resemble a modified ‘amazon. ca’ type delivery system. This will involve a fully integrated Health and Usage Monitoring System (HUMS). HUMS will identify not only when parts are broken and need repair, it will predict and warn when repairs need to take place, and via the network ensure that preventative vice corrective maintenance become the norm.

WHAT THE ARMOURED REGIMENT COULD LOOK LIKE

The current model adopted by the CA of having units well below their operational levels of personnel in the hopes that personnel will be available when needed is not sustainable, and negatively impacts readiness and morale. While there is certainly scope for variation of the proposed model, it is suitable for discussion. One assumption is that the grouping of capabilities along platform lines is not rigid, and that based upon needs, that the appropriate allocation of 4 Squadrons will be met. The structure of the

Regiments has been done within the existing envelope of personnel who would reasonably be available 'today', though aspects of it are aspirational. First, the force structure assumes that any personnel left out of battle/unavailable would be back filled by other RCAC personnel. Second, the model assumes that some personnel would be tasked to the unit upon deployment including medical, Int, MPs, CIMIC/Psyops, etc.

Based upon this the model put forward is assessed as being achievable if the strength per unit does not exceed a total of 575 personnel +20 for a total of 595 personnel complete to deploy – if automation is used.

When married up with the correct technology and personnel management, it would allow the RCAC 4 Squadrons per unit. This needs to be pursued as it brings the most value and allows units to operate across the breadth and depth of the battlespace. With the advent of multi-platforms in the same squadron there are some assumptions made. First that any of the Armoured Squadrons will be capable of fulfilling the Recce role if required; second that most of these will likely resemble GUARD and DELAY tasks typical of the covering force battle.

Being more agile, lethal, and better equipped to sense and navigate across the battlespace require allocating personnel from the Recce and Assault Troop. In a period where we expect every fighting vehicle to have drones operating out several Km's the need to retain a dedicated recce element is not essential. The capabilities of the assault troop would be retained in the sub-units, these and breaching as a skill set compliments the tasks of squadrons. For both the covering force battle and the close battle the Squadrons need limited, integral engineering capabilities. This point is driven home by both Russian and Ukrainian experiences with complex obstacles in their ongoing war (Mykhaylo Zabrodskyi, 2022).

CONCLUSION

While the ideas put forward are by no means the only options, they do challenge assumptions. First, that our current models for what an armoured regiment is unachievable with the resources available. Second, that how the RCAC is planning to fight the battlespace has not changed and is consequently poorly suited to the future. Third, that the Armoured corps, even if fully equipped with sufficient MBT as described in doctrine, is not equipped to meet the future. The RCAC must ensure that it continues to contribute to the battlespace in a meaningful manner. In the 'here and now' the RCAC must adapt to the changing depth, frontage, and threats to fight and sustain itself.

The current model of 3 sub-units severely curtails the ability of RCAC to conduct both covering force and close battles. Leveraging new structures and employment models will enable this; while current staffing levels will not allow as robust a structure as be desired; novel approach's, new technology, and new structures will make it achievable. Simply having healthy units, would uniquely position the RCAC to take a lead in both the covering force and close battles. The RCAC like the CA is at a crossroads. While the battlespace has continued to change at an unprecedented rate in recent decades, the RCAC has failed to keep apace, but it is not to late to recognise these changes and adapt.

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