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## TECHNOLOGICAL RELEVANCY: THREE IDEAS FOR THE CANADIAN ARMED FORCES TO MAINTAIN AN ADVANTAGE OVER ITS ADVERSARIES

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## **TECHNOLOGICAL RELEVANCY: THREE IDEAS FOR THE CAF TO MAINTAIN AN ADVANTAGE OVER ITS ADVERSARIES**

### **AIM**

1. The aim of this paper is to provide solutions to the following question: “In order to remain technologically relevant, how can the CAF utilize new and evolving technologies (e.g., Artificial Intelligence and Autonomous Systems) to maintain an advantage over its adversaries?”

### **INTRODUCTION**

2. There was a time where cavalry officers dismissed tanks over horses. The horse could be refueled with roadside grass and mechanical breakdowns were mostly remedied by the rider with spare horseshoes. Then came World War II and the German Panzer Divisions’ Blitzkriegs solidified the tanks place on the modern battlefield. Not all innovations were this promising, the blimp for example would not be put to large scale military use. Fast forward eighty years and concerns over powering large computer networks on the battlefield have replace the fuel concern. At the same time, the complexity of global technology is largely outpacing what the Canadian Armed Forces (CAF) can maintain. How does the CAF know what technology to invest in so that it ends up with proverbial tanks and not blimps?

3. Technology is advancing at a rapid pace. Private industry is outpacing defence research.<sup>1</sup> This paper proposes that adopting and militarizing commercial off the shelf (COTS) technology is an effective way to remain technologically relevant. Trialing and

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<sup>1</sup> Lewis, Larry. "Resolving the Battle Over Artificial Intelligence in War." *The RUSI Journal* 164, no. 5-6 (2019): 62-71. p. 64

testing new age technology will either prove that it is not suitable for the battlefield, not yet ready for the battlefield or ideally reap the immediate benefits on the battlefield. Even if the technology is not yet ready for the battlefield, having troops trial early versions of a promising technology develops an expertise for when it is fielded and not starting at step one years down the road when the technology is perfected. It is not when it is needed that the CAF should start looking at a given technology, it is a long process that the CAF needs be constantly investing in.

4. General James M. Holmes of the United States Air Force has said “the research money, the internal R&D money is being spent [in Apple, Google and Amazon]. It’s being spent in that commercial world and not in [the defence world] and to win we’re going to have to take advantage of that.”<sup>2</sup> Gary Kasparov gives a compelling reason why employing technology to assist in decision-making helps. Kasparov is known for being the former world chess champion. He is also known for losing to IBMs Deep Blue computer. What is less known is that Kasparov participated in a computer assisted tournament where chess masters assisted by computers played against one another. A pair of amateurs ended up winning the tournament. In accordance with Kasparov, he lost because the amateurs were better able to train their three computers.<sup>3</sup> In the modern battlefield where every move can be observed, militaries need to place adversaries in chess like dilemmas if they are to win. Returning to the United States Forces, Gen Holmes referring to Paul Rever’s “one if by land, two if by sea” states that the Chief

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<sup>2</sup> Joint all-Domain Operations - Gen James M. Holmes. Directed by Air Force Association. 2020. 11:45.

<sup>3</sup> Kasparov, Garry “Don't Fear Intelligent Machines. Work with them”. Technology, Education, Design (TED). Vancouver, BC: 2017. 9:38

(Chairman of the Joint Chiefs of Staff) “wants to make the enemy run out of lanterns.”<sup>4</sup>

Therefore, win because there are too many options, too many dilemmas, happening too fast. Are the Canadian Armed Forces ready for this modern battlefield?

5. This paper will lay out three types of technology currently available on the commercial market that would contribute to gaining advantage over the CAFs adversaries. First are autonomous vehicles. Driver assisted models are available for wide spread use whereas driverless vehicles are now allowed in some areas of the United States. Second piece of technology the CAF would benefit from exploring further are quadcopters. Not only increasingly available and increasingly simple to operate these small sky craft are finding more and more utility in commercial operations. Third is artificial intelligence (A.I.). Using the power of computing technology as a force multiplier has helped countless organizations develop and grow. A.I. is the next generation of computing. When combining A.I. with military forces it conjures up ethical questions. The intent of this paper is not to escalate into the ethics, rather to propose technology to assist current commanders to better do their current jobs on the battlefield. The first recommended technology for the modern battlefield are autonomous vehicles.

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<sup>4</sup> Joint all-Domain Operations - Gen James M. Holmes. Directed by Air Force Association. 2020. 6:18.

## DISCUSSION

### Autonomous Vehicles

6. Autopilot features are already available with the purchase of a Tesla car.<sup>5</sup> Waymo operates driverless taxis in Phoenix Arizona.<sup>6</sup> Toyota provided autonomous buses for the Tokyo Olympics.<sup>7</sup> However, there are still some regulatory hurdles before this technology is in widespread use on the roads. But, the point is that the technology exists and it works at the present time. This means that its integration into the CAF can begin now, knowing that the technology will only improve over time.

7. Waymo not only has cars and vans, but also autonomous semi-trucks. Even though they have yet to hit the roads, they exist. Initial ideas for implementation into the CAF would be to integrate the vehicles as part of a unit's echelon, then work back through the logistics tail to the point of delivery from the manufacturer of the goods. This will not be an easy integration. The logistics school has conducted tours to the fully automated Canadian Tire distribution center outside Toronto for at least a decade now. The warehouse lights are off and automated forklifts re-palletize loads on the own for onward shipping. However, the CAF is still struggling to implement bar codes for tracking materiel in the Defence Resource Management Information System (DRMIS). It still gets national vehicle off road (VOR) reports by e-mail in lieu of relying on DRMIS software. Procuring autonomous trucks as a fleet replacement project would likely run much faster than a logistics technology project.

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<sup>5</sup> Tesla. "Autopilot." Accessed 18 January, 2022. [https://www.tesla.com/en\\_CA/autopilot](https://www.tesla.com/en_CA/autopilot).

<sup>6</sup> BBC. "Waymo Self-Driving Taxi Confused by Traffic Cones Flees Help." <https://www.bbc.com/news/technology-57144755>.

<sup>7</sup> Bateman, Tom. "Tokyo 2020 Driverless Buses Lose Self-Driving Functions After Hitting Paralympic Athlete." <https://www.euronews.com/next/2021/08/30/toyota-halts-autonomous-e-palette-buses-after-one-hits-paralympic-athlete-in-tokyo-olympic>.

8. Logistics vehicles would be the start, but as the technology is adapted for different vehicles, other non-kinetic tasks can be undertaken. The Huskey, which is part of the Expedient Route Opening Package (EROC), looks for explosives in the road. Applying the autonomous technology to that vehicle means it could run all night on its own and the rest of the EROC suite of vehicles can investigate the hits with human operators come daylight. General reconnaissance type tasks can also benefit from the wide array of sensors already required for autonomous vehicles. Lidar technology available on most autonomous vehicles is also used in mapmaking. 3D real time maps will improve the reconnaissance reports considerably. The type of vehicles could also change, as no crew would be required for most general reconnaissance tasks. All-terrain vehicles could be used in lieu of full sized trucks or eight wheeled armored vehicles currently employed. This will be both more efficient and in many cases more covert. These are ground based possibilities, but there is also air options to consider as well.

### **Quadcopters**

9. Most drones on the market today are quadcopters. Most also weight under 25kgs which, in accordance with Transport Canada, means that all it takes to operate is a 90 minute, 35 question test and registration of the drone.<sup>8</sup> This means it is in the reach of just

<sup>8</sup> Canada, Government o. "Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems 250 G Up to and Including 25 kg, Operating within Visual Line-of-Sight (VLOS) - TP 15263." <https://tc.canada.ca/en/aviation/publications/knowledge-requirements-pilots-remotelypiloted-aircraft-systems-250-g-including-25-kg-operating-within-visual-line-sight-vlos-tp-15263>.

about anyone. They are available at any Wal-Mart, they are cheap and they are improving. Today's off the shelf technology is able to stabilize the quadcopter and even warn the operator of obstacles.<sup>89</sup> There are models available that are able to take action and navigate around obstacles and even fully autonomous prototypes that exist. This simplicity of operation significantly reduces training time required for proficiency.

10. During the Afghanistan conflict, the CAF did trial a number of drones, most of them fixed wing and most of them now retired.<sup>10</sup> It is interesting to note that a contract was awarded for an unmanned aerial system that resembles a helicopter in 2019 for the Royal Canadian Navy and Canadian Special Operations Forces Command.<sup>11</sup> With a maximum takeoff weight of 235kg,<sup>12</sup> this is much heavier than what is being recommended in this paper. The recommended light quadcopter is for troops on the ground to be able to see an aerial view of the battlespace for themselves. Something compact enough to fit in regular vehicle stowage or even in a backpack. The rotary wings allow it to take off and land off the back deck of a vehicle or out of the hands of the operator.

11. The easy to use and inexpensive nature of the quadcopter means it can be managed like equipment on an equipment issue scale (EIS). Meaning that it does not need to be managed like a vehicle that requires 404s (driver's license) to operate. Rather it is closer to a tool. In the combat engineer world there is a tools package where sappers

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<sup>8</sup> Koetsier, John. "Autonomous Drones Achieve 'Most Sophisticated Level of 3D Aerial Autonomy to Date'." Accessed 18 January,

<sup>9</sup> . <https://www.forbes.com/sites/johnkoetsier/2021/05/29/autonomous-drones-achieve-mostsophisticated-level-of-3d-aerial-autonomy-to-date/?sh=6184520e6531>.

<sup>10</sup> "List of Aircraft of Canada's Air Forces."

[https://en.wikipedia.org/wiki/List\\_of\\_aircraft\\_of\\_Canada%27s\\_air\\_forces](https://en.wikipedia.org/wiki/List_of_aircraft_of_Canada%27s_air_forces).

<sup>11</sup> "QinetiQ Wins C\$51m Contract with the Canadian Armed Forces' Unmanned Aircraft System Service Program." <https://www.qinetiq.com/en-ca/news/qinetiq-wins-c51m-contract-with-the-canadianarmed-forces-unmanned-aircraft-system-service-program>.

<sup>12</sup> "UMS Skeldar V-200." [https://en.wikipedia.org/wiki/UMS\\_Skeldar\\_V-200](https://en.wikipedia.org/wiki/UMS_Skeldar_V-200).



learn how to operate tools ranging from a hammer to a chainsaw. The quadcopter could be managed like one of those tools. After some basic training and testing on the equipment anyone who passed the test can pull it out and use it when it's needed. Like a chainsaw, operator maintenance and first line small engine repair technicians are responsible to fix the quadcopter. Any maintenance beyond their capabilities, the quadcopter is scrapped and replaced similar to the life cycle management of most hand tools.

12. As the global population continues its migration to urban centers, troops are going to need to work increasingly in three-dimensional battlefields.<sup>13</sup> The quadcopter can help in soft knock entry tactics, techniques and procedures (TTPs) rather than the hard knock entries which favor explosive entries. However, even in the rural battlefield, allowing commanders to see the battlefield geometry real time on their own will alleviate blue on blue. Unfortunately, blue on blue still occurs when units are pushed during the Canadian Army's annual Exercise Maple Resolve, therefore still a concern on today's battlefield. Admittedly, commanders cannot have their faces glued to a monitor, nor can their staff be expected to constantly monitor the information provided from the quadcopter and other sensors. A.I. can assist commanders with this large volume of data being produced.

### **Artificial Intelligence**

13. Deep blue's 1997 victory over Kasparov was a milestone in A.I. development.

Today, Facebook is using A.I. to suggest tagging people in pictures. Police are using it to identify suspects. Microsoft Viva can provide daily briefs in Outlook inbox. IBM is selling

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<sup>13</sup> Betz, David and Hugo Stanford-Tuck. "The City is Neutral: On Urban Warfare in the 21st Century." <https://tnsr.org/2019/10/the-city-is-neutral-on-urban-warfare-in-the-21st-century/>.

A.I. software to businesses so they may target consumers with tailored advertising.<sup>14</sup> A.I. has come a long way in a short time and, as IBM is showing, is becoming a marketable product that can be sold.

14. One area of interest in the field of A.I. for the CAF is how A.I. is leveraged to monitor the spread of invasive plants using aerial imagery.<sup>15</sup> If this A.I. can be trained to pick up knapweed in a cornfield, it is a short step away from picking up cam nets blended in the trees or armored vehicles taking cover in the brush. Using a software of this type in conjunction with a quadcopter's imagery will highlight areas for further investigation by a human. With minimal training, A.I. will be able to pick out areas of concern better than any human could ever do monitoring the video feed.

15. Machine translations are another area of interest for the CAF. As the CAF plugs into multinational headquarters, less would be lost in translation. Google translate already instantly translates text between numerous languages to a quality that is understandable. There are applications for your phone that use the camera to translate text from printed documents without having to type foreign characters. Speech to text and text to speech applications round off the multitude of apps that could replace a translator. Employing this technology means less interpreters are required on the battlefield and more soldiers can communicate directly with the local populace.

16. A.I. needs to be trained to provide benefit. The autonomous cars recommended earlier in this paper could provide imagery of pattern of life in a given urban setting. Inputting significant incidents into software that is looking at simple indicators like

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<sup>14</sup> Advertising, IBM W. "How AI is Changing Advertising."

<https://www.ibm.com/watsonadvertising/thought-leadership/how-ai-is-changing-advertising>.

<sup>15</sup> Bowles, Christopher, Mike Rawitch, Jamey Smith, Fabien Geier and Emilia Stepikski. "Galago." . Accessed 18 January, 2022. <https://www.galago.ai/>.

number of people in the city streets, vehicles and shops open could detect when locals know in advance of a significant incident. Step it up a notch and incorporate software with facial recognition noting specific people, software recording license plate or precise vehicles by their rust marks, bumps or dents, blended with activities of specific shops and the software will be able to pick up suspects linked to significant incidents. What doesn't feel right to a soldier that has been on the ground for months will be picked up by trained A.I. on day one of a soldier's tour. Leveraging this advantage is only possible if there are sensors deployed such as those used in autonomous vehicles, quadcopters or other available technology.

## **CONCLUSION**

17. There is a reason why technology companies have the highest valuation on the market. People believe what they do will render their lives easier. The CAF needs to capitalize on this development. Specifically, autonomous vehicles will alleviate the logistics burden of the forces. Quadcopters are a dime a dozen, equipping the soldier with them provides a technological assistance to their task. A.I. is able to notice information faster and better than any human can with the help of imagery produced by vehicles and drones amongst other valuable contributions.

18. The CAF needs to leverage the younger generations in the units to trial COTS technology today to determine what works, what has potential and what does not. It is with the ingenuity of this generation that has grown up with technology that the CAF can train their computers to assist in defeating a better-trained opponent like what happened to Kasparov in 1997. However, if the CAF never gets around to training with the

technology or in the case of A.I. training the technology, the CAF will never be able to employ it.

## **RECOMMENDATION**

19. The three areas of technology recommended in this paper will not fundamentally change military doctrine. It will lighten the number of people put in harm's way; it will maximize the use of the air domain; and it will speed up decision making by commanders. Like the main battle tank made the cavalry better, these relatively cheap elements of technology will make the CAF better. The CAF needs to invest in them now so that they are incorporated in TTPs the next time the CAF needs them in a high tempo battle against conventional forces.

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