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## Integration of Remotely Piloted Aircraft in Support of RCAF Missions

Lieutenant-Colonel Ismael Koussay

### JCSP 48

#### Master of Defence Studies

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### PCEMI 48

#### Maîtrise en études de la défense

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CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 48 – PCEMI 48

2021 – 2022

Master of Defence Studies – Maîtrise en études de la défense

**Integration of Remotely Piloted Aircraft in Support of RCAF Missions**

**Lieutenant-Colonel Ismael Koussay**

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## ABSTRACT

The modern military operating environment is growing increasingly complex. Climate change will increase demand for Canadian Armed Forces (CAF) deployments in future humanitarian assistance and disaster response (HADR) operations including in the transforming Arctic. The rapid global urbanization will defy the traditional methods of urban warfare. Moreover, Artificial Intelligence (AI) is expected to bring about huge potential change to warfare. All have significant implications for Remotely Piloted Aircraft (RPA), and by extension, the Royal Canadian Air Force (RCAF).

With the request for proposal for the acquisition of RPA submitted to the two qualified suppliers on 11 February 2022, what are the advantages and disadvantages of RPA to meet RCAF missions? This study will show that the RCAF integration of RPA will enhance current and future delivery of air power throughout the spectrum of operations to meet Canadian defence and non-defence missions in an increasingly complex security and defence environment.

RPA can achieve extreme persistence that far exceeds inhabited air assets. The altered risk calculation of air power through the reduced risk of human casualty combined with public casualty aversion will continue to favour RPA. The RCAF can also learn from Five Eyes and North Atlantic Treaty Organization (NATO) partners, who have proven the enhanced capability stemming from the integration of RPA to carry out kinetic and non-kinetic roles. However, the interpretation of International Law for the use of armed RPA remains an open question that continues to challenge the international legitimacy of armed RPA missions. These factors are vital considerations for any RCAF RPA capability.

# INTEGRATION OF REMOTELY PILOTED AIRCRAFT IN SUPPORT OF RCAF MISSIONS

## CHAPTER 1: INTRODUCTION

The procurement of the best, most effective and affordable hardware and software constitute a fundamental part of military power. As baseline Canadian military doctrine notes, the goal is to maintain “a technological advantage that represents a war-winning capability over our adversaries.”<sup>1</sup> As conflict and warfare evolve in the Information Age, the Canadian Armed Forces (CAF) is confronted by adversaries with evolving capabilities that pose significant threats in all domains both domestically and during expeditionary operations. Deterring and defeating these pan-domain<sup>2</sup> threats often require a concerted effort beyond the Whole-of-Government approach to include collaboration with partners and allies. It is therefore paramount for the CAF, which strives to remain a reliable partner as part of Canada’s contribution warfare approach, to develop, introduce to operational service, and sustain interoperable equipment that would provide war-winning military capabilities. It is also vital to understand the capabilities that potential adversaries might employ and procure the appropriate countermeasures to achieve the specific effects to ultimately support the strategic goals and end states put forth by the Government of Canada (GoC).<sup>3</sup> This is certainly the case for Remotely Piloted Aircraft,<sup>4</sup>

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<sup>1</sup> Department of National Defence, *B-GJ-005-000/FP-001, Canadian Military Doctrine*, (Ottawa: DND Canada, 2009), 2-9. Hereafter “*Canadian Military Doctrine*”

<sup>2</sup> Department of National Defence, *Pan-Domain Force Employment Concept: Prevailing in an Uncertain World*, (Ottawa: DND Canada, 2020), 16. Hereafter “*Pan-Domain Force Employment Concept*” The contemporary global battlespace consist of six interrelated domains: maritime, land, air, space cyber, and information.

<sup>3</sup> *Canadian Military Doctrine*, 2-9.

<sup>4</sup> This research paper will use the term “Remotely Piloted Aircraft” defined as a system whose components include the uninhabited aircraft, the supporting network and all equipment and personnel necessary to control the uninhabited aircraft in lieu of Unmanned Aircraft System (UAS) defined in the National Defence Flying Orders, *BGA-100-001/AA-000 UAS Amendments to Book 1*.

which present opportunities and challenges for the CAF. One such opportunity and challenge is the issue of distance.

As early as the 14<sup>th</sup> Century, humans have been distancing themselves from combat to gain advantage over an adversary. Consequently, the distance between combatants and their enemies has continuously increased – from archery to artillery to bomber aircraft and now to RPA. The uninhabited leap can be traced back to the ram-jet powered German V1 and V2 rockets developed during the 1940s, as the first glimpse of a remotely-controlled aircraft, preceding the 1950s era of Intercontinental Ballistic Missiles. The rapid pace of advances in technology as well as transformations in society, politics and relation to warfare are all contributing to changing the perception of war.<sup>5</sup> The public is increasingly expecting that militaries fight a clean, humane, or antiseptic war without any casualties, friendly or otherwise.<sup>6</sup> This study anticipates the continued public expectations of precision and accuracy in the application of lethal force to avoid war casualties. The public casualty aversion phenomenon combined with rapid advances in technology will continue for the foreseeable future to favour the development and proliferation of uninhabited weapons systems, especially RPA in military arsenal around the globe.

It is also equally important to understand and anticipate the current, near and long-term dynamic and complex global security environment in which the CAF may be expected to operate. Such an understanding is essential for the CAF to maintain the right mix of capabilities to ensure a joint and multi-national mission success throughout the full

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<sup>5</sup> Michell Binding, “Have Autonomous and Unmanned Systems Changed War Fundamentally?,” *Canadian Military Journal* 19, no. 1 (2018): 40-45.

<sup>6</sup> Richard Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 118.

spectrum of operations.<sup>7</sup> The complexity and unpredictability of the evolving security environment is compounded by the Canadian government's desire to demonstrate prudent stewardship of public resources and a constrained long-term Defence budget.<sup>8</sup> It is expected that the CAF as a whole and the Royal Canadian Air Force (RCAF) in particular would not grow appreciably beyond the current planned force structure out to 2035.<sup>9</sup> Effective innovation is therefore critical to ensure CAF success in achieving a modern and prepared armed forces.<sup>10</sup> In addition, the CAF must address capabilities gaps to fight alongside its allies and partners. Thus, Force Development to enhance existing CAF and RCAF capabilities will be adopted incrementally through a more effective integration of capabilities and concepts.<sup>11</sup> RCAF integration of RPA illustrates these requirements.

## Literature Review

For the past decades, RPA (commonly named “drones” by the public) have been that iconic platform that delivers air power that has captured the interest of decision makers, military leaders, and the public. RPA have a unique history, and their utilization can be separated into two “drone ages.” The first was characterized by the United States (U.S.) military monopoly over the use of military RPA and mainly for the purpose of targeted killing.<sup>12</sup> The first drone age is also characterized by the ethical controversies

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<sup>7</sup> *Canadian Military Doctrine*, 2-7.

<sup>8</sup> Department of National Defence, *Strong, Secure, Engaged: Canada's New Defence Policy*, (Ottawa: DND Canada, 2017), 47, 97. Hereafter “*Strong, Secure, Engaged*”

<sup>9</sup> Department of National Defence, *Royal Canadian Air Force Future Concepts Directive Part 2: Future Air Operating Concept*, (Ottawa: DND Canada, 2016), 1. Hereafter “FAOC.”

<sup>10</sup> Government of Canada. “Future Force Design,” 3 March 2021, Accessed 8 January 2022, <https://www.canada.ca/en/departement-national-defence/corporate/reports-publications/departemental-plans/departemental-plan-2021-22/planned-results/future-force-design.html>

<sup>11</sup> FAOC, 1.

<sup>12</sup> James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 482.

surrounding the targeted killing. The second drone age is defined by the global proliferation of military and weaponized commercial RPA by both state and non-state actors who are competing for power in the skies above.<sup>13</sup>

Originally, the RPA technology was accessible to mostly the United States, its Central Intelligence Agency (CIA) and the militaries of select allies, during an era, referred to by Dr James Rogers as the first drone age.<sup>14</sup> It was characterized by an extensive deployment of RPA in largely uncontested airspace to provide Close Air Support (CAS) and to hunt and kill from above those defined as terrorist or insurgents during often covert operations inside and outside the active battlespace.<sup>15</sup> However, the use of RPA in this way has been controversial.

Scholars, legal experts, human rights organizations, the United Nations (UN) Special Rapporteurs have written about the legal and ethical controversies associated with the conduct of RPA “targeted killing” under the International Humanitarian Law (IHL).<sup>16</sup> The indiscriminate killings of civilians in the vicinity of the RPA-targeted person has also exacerbated public stigma and resentment against the use of RPA.<sup>17</sup> Despite the ethical

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<sup>13</sup> *Ibid.*, 481. PAX Unmanned Ambitions, “Security Implications of growing proliferation in emerging military drone markets,” 23 August 2018, Accessed 4 September 2021, <https://paxforpeace.nl/what-we-do/publications/unmanned-ambitions>: 45.

<sup>14</sup> *Ibid.*, 483.

<sup>15</sup> Dr Shima D. Keene, “Lethal and Legal? The ethics of Drone Strikes,” United States Army War College, (2015): 13.

<sup>16</sup> PAX Unmanned Ambitions, “Security Implications of growing proliferation in emerging military drone markets,” 23 August 2018, Accessed 4 September 2021, <https://paxforpeace.nl/what-we-do/publications/unmanned-ambitions>: 44; United Nations, “All drone strikes in self-defence should go before Security Council, argues independent rights expert,” 9 July 2020, Accessed 7 November 2021, <https://news.un.org/en/story/2020/07/1068041> As an example which will be further discussed in Chapter 3, the UN Special Rapporteur on extrajudicial, summary or arbitrary executions qualified the January 2020 U.S. RPA strike against a high-level Iranian official, Major General Qasem Soleimani, on the territory of a third state (Iraq in this case) as a violation of the UN Charter. United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>; Dr Shima D. Keene, “Lethal and Legal? The ethics of Drone Strikes,” United States Army War College, (2015): 10.

<sup>17</sup> James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering



and legal challenges associated with RPA, during the first drone age, the U.S. remains committed to expanding RPA deployment in pursuit of its security, military and political objectives.

The second drone age is characterized by the global proliferation of RPA by both states and non-state actors which led to the degradation of the traditional asymmetric advantage that air superiority provided to state military organizations. There is an abundance of literature that assesses the potential impact to global peace and security of the weaponization of commercial-off-the-shelf RPA by violent non-state actors and terrorist groups during the second drone age.<sup>18</sup> Furthermore, the proliferation of RPA also raises the concerns of the development and implementation of effective counter-RPA solutions against the range of classes and categories of RPA used by both state and non-state actors.<sup>19</sup>

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Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 483; Human Rights Watch, “A Wedding That Became a Funeral,” 19 February 2014, Accessed 6 September 2021, <https://www.hrw.org/report/2014/02/19/wedding-became-funeral/us-drone-attack-marriage-procession-yemen>; Michael, Byers and Franks Kelsey, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs.” *Canadian Foreign Policy* 20, no. 3 (2014): 283; James S. Corum, “NATO Airpower and the Strategic Communication Challenge: About the JAPCC’s Airpower and Disinformation Study,” *Joint Air Power Centre Journal*, no. 21 (2015): 44.

<sup>18</sup> The Japanese “atomic RPA” flown on to the Japanese Prime minister’s residence in 2015, the ISIS “Trojan Horse RPA” used against allied forces in Iraq and Syria, the 2018 Venezuelan “assassination RPA” used against President Maduro and the RPA chaos that occurred at London’s Gatwick airport later the same year all illustrate the impact to global peace and security of the weaponization of commercial-off-the-shelf RPA as stated by James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 495; PAX Unmanned Ambitions, “Security Implications of growing proliferation in emerging military drone markets,” 23 August 2018, Accessed 4 September 2021, <https://paxforpeace.nl/what-we-do/publications/unmanned-ambitions/> 45; United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>; Clive Blount, and Charlie Sammut, “A Gift to Our People: The Use of Drone Technology by Islamist Insurgents,” *RAF Air Power Review* 19, no. 1 (2016): 8-25.

<sup>19</sup> James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 481; James S. Corum, “NATO

## Argument

Considering the valid concerns identified during both the first and second drone age, this Directed Research Project (DRP) intends to contribute to an informed RCAF operational integration of RPA. The request for proposal, for the acquisition of medium altitude and a range of RPA capable of conducting surveillance and precision strikes<sup>20</sup> was submitted to the two qualified suppliers on 11 February 2022 with the first delivery to the RCAF expected by 2025 timeframe.<sup>21</sup> Accordingly, this DRP builds on existing literature and examines how the integration of RPA could benefit RCAF missions. It will aim to answer the following questions. First, what geopolitical changes could impact current RCAF operating environments? What are existing and potential future RCAF RPA applications in support of defence and non-defence-missions? What RCAF core and enabling capabilities could benefit from RPA employment? Finally, how would RPA be integrated into the RCAF force structure?

This paper will argue that RCAF integration of RPA will enhance current and future delivery of air power throughout the spectrum of operations to meet Canadian defence missions in an increasingly complex security and defence environment. To support this argument, Chapter 2 will first examine the future security environment to provide insights on the most likely environments and battlespace in which CAF and subsequently RCAF operations are likely to occur. An analysis of the fundamental characteristics and challenges of RPA in Chapter 3 will determine whether this platform

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Airpower and the Strategic Communication Challenge: About the JAPCC's Airpower and Disinformation Study," *Joint Air Power Centre Journal*, no. 21 (2015): 44.

<sup>20</sup> *Strong, Secure, Engaged*, 39, 73.

<sup>21</sup> Government of Canada, "Remotely Piloted Aircraft System (RPAS)," 15 February 2022, Accessed 12 March 2022, <https://www.canada.ca/en/department-national-defence/services/procurement/remotely-piloted-aircraft-system.html>

would provide the required enhanced capabilities in support of defence and non-defence-missions. Chapter 4's evaluation of current and future RCAF core capabilities assists in determining the functions within which RPA could enhance current and future RCAF capabilities. Finally, an assessment of the RCAF force structure in Chapter 5 provides options for the integration of RPA into the RCAF to optimize the use of limited air power resources in support of defence and non-defence missions.

As a fundamental part of military power, the CAF overall and the RCAF must maintain a technological advantage that represents a war-winning capability over adversaries that pose pan-domain threats. In addition, the CAF and subsequently the RCAF must remain a reliable and interoperable partner, as part of Canada's contribution warfare approach. To that end, while it is important to procure the best, most effective and affordable hardware and software, it is vital to first understand and anticipate the current, near and long-term dynamic and complex global security environment in which the CAF may be expected to operate. For this reason, an examination of the security environment is warranted in Chapter 2.

## CHAPTER 2 – FUTURE SECURITY ENVIRONMENT

### Introduction

The intent of this chapter is to frame the potential Royal Canadian Air Force RPA operational environment by depicting a common picture of the future security environment. Focusing on major environmental and demographic trends, this analysis will provide insights on the most likely environments and battlespace in which CAF operations are likely to occur.<sup>22</sup> This chapter does not pretend to comprehensively cover all possible trends, but rather select salient ones with potential ramifications and relevance to RCAF integration of RPA capabilities in support of current and future defence and non-defence-missions.

This study anticipates that the current trend of climate change will continue to affect human society globally and the conduct of military operations for the foreseeable future. Therefore, this chapter will first examine the effect of climate change on the global peace and security and more specifically its impact on the Canadian Arctic. It will then examine GoC foreign and defence policy priorities which in light of the future security environment will both shape the CAF and subsequently RCAF strategy and force development requirements.

### Climate Change: A Threat Multiplier and Accelerant of Instability

Since the ninetieth century, human activities related to fossil fuel combustion, deforestation, industrial and agricultural practices have resulted in climate change and global warming.<sup>23</sup> The majority of the recent temperature increase can be explained by

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<sup>22</sup> Department of National Defence, *Capability Based Planning Handbook*. Accessed 3 November 2021.

<sup>23</sup> Yasmeen, Samina, “Climate Change and Human Security: In Context of Global Economy, Culture and Conflict.” *Journal of the Research Society of Pakistan* 58, no. 3 (2021): 203.; United Nations,

greenhouse gas emissions, which consists of more than 90% of carbon dioxide and methane, with “near-zero statistical probabilities that natural climate variability could account for observed trends.”<sup>24</sup> Unless significant reductions in carbon dioxide and other greenhouse gas emissions materialize in the upcoming decades, global warming of 1.5-2°C will be exceeded during the 21<sup>st</sup> century which directly amplifies changes in climate system.<sup>25</sup>

Climate change is rapidly disrupting human stability by hindering access to natural resources, forced migration of refugees, destruction of infrastructure which can all lead to humanitarian disasters, regional tensions and violence.<sup>26</sup> Climate change has therefore been identified by the UN Security Council and the NATO Secretary General as a threat multiplier for peace and accelerant of instability.<sup>27</sup> The GoC considers the effect

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Intergovernmental Panel on Climate Change, “*Climate change 2021: The Physical Science Basis*,” Accessed 29 October 2021,

[https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_FullReport\\_smaller.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport_smaller.pdf)

<sup>24</sup> *Ibid.*; Richard Hodgkins, “The twenty-first-century Arctic environment: accelerating change in the atmospheric, oceanic and terrestrial spheres,” *The Geographical Journal* 180, no.4 (2014): 429-436.

<sup>25</sup> These changes include heightened frequency and intensity of hot extremes, marine heatwaves, heavy precipitation, agricultural and ecological droughts in some regions, intense tropical cyclones, as well as significant reductions in Arctic Sea ice, snow cover and permafrost. United Nations, “Intergovernmental Panel on Climate Change, *Climate change 2021: The Physical Science Basis*,” Accessed 29 October 2021, [https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC\\_AR6\\_WGI\\_FullReport\\_smaller.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport_smaller.pdf) 41.

<sup>26</sup> Three studies conducted from 2012-2015 brought considerable evidence that climate change contributed to extreme drought that resulted in the displacement of nearly 2 million farmers and herders in Syria from 2007-2010 which led to political unrest in the country prior to the outbreak of civil war. Caitlin E. Werrell and Femia Francesco, “The Thirty Years’ Climate Warming: Climate Change, Security and the Responsibility to Prepare,” *Seton Hall Journal of Diplomacy and International Relations* 20, no. 1 (2018): 21; Elizabeth, Ferris and Weerasinghhe Sanjula, “Promoting Human Security: Planned relocation as a Protection Tool in a Time of Climate Change,” *Journal on Migration and Human Security* 8, no.2 (2020): 136; Yasmeen, Samina, “Climate Change and Human Security: In Context of Global Economy, Culture and Conflict,” *Journal of the Research Society of Pakistan* 58, no. 3 (2021): 203; North Atlantic Treaty Organization, “Environment, climate change and security,” 3 December 2021, Accessed 21 January 2022, [https://www.nato.int/cps/en/natohq/topics\\_91048.htm](https://www.nato.int/cps/en/natohq/topics_91048.htm); Chad M. Briggs, “Climate Change and Hybrid Warfare Strategies,” *Journal of Strategic Security* 13, no. 4 (2020): 45-57.

<sup>27</sup> Yasmeen Samina, “Climate Change and Human Security: In Context of Global Economy, Culture and Conflict,” *Journal of the Research Society of Pakistan* 58, no. 3 (09, 2021): 203; RAND Europe, “Crisis Response in a Changing Climate,” 4 May 2021, Accessed 6 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/983194/RAND\\_RRA1024-1\\_1\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/983194/RAND_RRA1024-1_1_.pdf); Chmutina Ksenia, Peter Fussey, Andrew Dainty, and Lee Bosher, “Implications

of climate change through a security lens that requires an urgent call for innovation, increased international attention and military activity.<sup>28</sup>

The impacts of climate change must be considered and its implications contextualized.<sup>29</sup> To name a few, climate change will impact air operations as the rising temperatures degrade aircraft's performance and may require runway extensions or engine updates, which was the case with transport planes and helicopters in Afghanistan.<sup>30</sup> The changing climate and severe weather events are also a continual threat to military installations.<sup>31</sup> It is therefore vitally important for the CAF to understand the effect of climate change on operational and strategic goals. At home, the CAF will not be exempt from the demands to meet national net zero emissions by 2050 while operating in a more environmentally sustainable way.<sup>32</sup> The tensions between the growing impact of climate change and the demand for environmental sustainability is likely to manifest strongly between now and 2040. Climate change is likely to increase demand for CAF deployments in future humanitarian assistance and disaster response operations and imposing a wide range of strategic, operational, and tactical challenges from coordination

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of Transforming Climate Change Risks into Security Risks" *Disaster Prevention and Management* 27, no.5 (2018): 460-477.

<sup>28</sup> *Strong, Secure, Engaged*, 52.

<sup>29</sup> Department of National Defence, *A-FD-005-001/AF-003, The Future Security Environment 2013-2040*, (Ottawa: DND Canada, 2014), 43. Hereafter "*The Future Security Environment*"

<sup>30</sup> NATO Review, "NATO is responding to new challenges posed by climate change," 3 December 2021, Accessed 23 January 2022, <https://www.nato.int/docu/review/articles/2021/04/01/nato-is-responding-to-new-challenges-posed-by-climate-change/index.html>

<sup>31</sup> Department of the Air Force, "Department of the Air Force Posture Statement Fiscal Year 2022," Accessed 29 January 2022, [https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20\(v23.1\)1.pdf](https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20(v23.1)1.pdf) 13.

<sup>32</sup> Government of Canada, "Net-Zero Emissions by 2050," 29 March 2022, Accessed 10 April 2022, <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html>; RAND Europe, "Global Mobility: Future Force Design 2040," 14 October 2021, Accessed 6 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1025139/RAND\\_RRA1309-1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025139/RAND_RRA1309-1.pdf)

to equipment performance and water supply.<sup>33</sup> In the context of the Arctic, the CAF should consider the myriad of logistical and intelligence challenges associated with the conduct of HADR and SAR operations.<sup>34</sup>

### **Arctic Transformation: Impact on North American Defence**

The Arctic is central to Canada's national identity, prosperity, security, values and interests. The Canadian Arctic covers 40% of Canada's landmass and comprises 75% of Canada's overall coastline and is home to more than 200,000 inhabitants, half of whom are Indigenous.<sup>35</sup> The Arctic is experiencing some of the most dramatic transformation due to human-induced climate change and the region is warming at least twice the global average.<sup>36</sup> The ice that has long maintained the Arctic as "a uniquely placid international space"<sup>37</sup> is receding at an accelerated rate for the past decades, due to a human-induced global warming and a multitude of factors. As a result, the Canadian Arctic has become more accessible to sea traffic, economic and resources exploitation such as petroleum or

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<sup>33</sup> RAND Europe, "Global Mobility: Future Force Design 2040," 14 October 2021, Accessed 6 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1025139/RAND\\_RRA1309-1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025139/RAND_RRA1309-1.pdf)

<sup>34</sup> Chad M. Briggs, "Climate Change and Hybrid Warfare Strategies," *Journal of Strategic Security* 13, no. 4 (2020): 45-57; *The Future Security Environment*, 44; *Strong, Secure, Engaged*, 52.

<sup>35</sup> Government of Canada, "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 11 December 2021, <https://www.rcaanccimac.gc.ca/eng/1562939617400/1562939658000>; Government of Canada, "Canada and the circumpolar Arctic," 28 October 2021, Accessed 11 December 2021, [https://www.international.gc.ca/world-monde/international\\_relations-relations-internationales/arctic-arctique/index.aspx?lang=eng](https://www.international.gc.ca/world-monde/international_relations-relations-internationales/arctic-arctique/index.aspx?lang=eng)

<sup>36</sup> I.V. Canosa, J.D. Ford, G. McDowell, J. Jones, and T. Pearce, "Progress in Climate Change Adaptation in the Arctic," *Environment Research Letters* 15, no. 9 (2020); Government of Canada, "Canada's Arctic and Northern Policy Framework," 10 September 2019, Accessed 10 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>; Dylan G. Clark, James D. Ford, and Taha Tabish, "What Role Can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada," *PLOS One* 13, no.12 (2018). 1.

<sup>37</sup> Rob Huebert, Heather Exner-Pirot, Adam Lajeunesse, and Jay Gulledge, "Climate Change as International Security: The Arctic as a Bellwether," *North America and Arctic Defence and Security Network (NAADSN)*, (2012) :91-104, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/11/DebatingArcticSecurity-RH-PWL-nov2021.pdf>

fishery activities; all of which contribute to foreign presence in the Canadian Archipelago commonly referred to as Northwest Passage. This waterway has opened up every summer since 2007.<sup>38</sup> International shipping will likely migrate to Northern waters, including the Northwest Passage between which Canada considers internal waters and not an international strait.<sup>39</sup> Although scientific projections of Arctic Sea ice loss vary, a median projection of a virtually ice-free Arctic is forecasted in 2037.<sup>40</sup>

The changing weather patterns in Canada's Arctic are altering the environment, making it more accessible to sea traffic, economic and resources exploitation such as petroleum or fishery activities that all contribute to foreign presence in the Northwest Passage.<sup>41</sup> Due to scientific as well as commercial interests in petroleum, sea traffic and resources, the Arctic is expected to become an increasingly competitive and contested region.<sup>42</sup> The GoC is committed to demonstrate the full extent of Canada's enduring Arctic sovereignty now and into the future through a wide range of activities including

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<sup>38</sup> Rob Huebert, Heather Exner-Pirot, Adam Lajeunesse, and Jay Gulledge, "Climate Change as International Security: The Arctic as a Bellwether," North America and Arctic Defence and Security Network (NAADSN), (2012): 91-104, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/11/DebatingArcticSecurity-RH-PWL-nov2021.pdf>; Rob Huebert, "The Newly Emerging Arctic Security Environment," North America and Arctic Defence and Security Network (NAADSN), (2010): 39-72, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/11/DebatingArcticSecurity-RH-PWL-nov2021.pdf>

<sup>39</sup> Unique Ships refers to each ship counted once but can enter the area multiple times according to the Arctic Council website. Arctic Council, "Report On Shipping In The Northwest Passage Launched," Accessed 13 December 2021, <https://arctic-council.org/news/report-on-shipping-in-the-northwest-passage-launched/>. Major diplomatic concerns for Canada include the claim by some states that the waters comprising the Northwest Passage as international for trans-navigation purposes, disputed Canada-US boundaries in the Beaufort Sea. The number of unique<sup>39</sup> ships passing through the Northwest Passage area increased by 44 percent from 2103 to 2019 with the most common types include bulk carriers, cargo ships, fishing vessels and cruise ships. Rob Huebert, "Canada and Future Challenges in the Arctic," North America and Arctic Defence and Security Network (NAADSN), (2014) 315-319.

<sup>40</sup> Rob Huebert, Heather Exner-Pirot, Adam Lajeunesse, and Jay Gulledge, "Climate Change as International Security: The Arctic as a Bellwether," North America and Arctic Defence and Security Network (NAADSN), (2012): 91-104, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/11/DebatingArcticSecurity-RH-PWL-nov2021.pdf>

<sup>41</sup> Rob Huebert, "The Newly Emerging Arctic Security Environment," North America and Arctic Defence and Security Network (NAADSN), (2010): 39-72, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/11/DebatingArcticSecurity-RH-PWL-nov2021.pdf>

<sup>42</sup> *The Future Security Environment*, 21.



improved situational awareness.<sup>43</sup> The CAF plays a key role in safeguarding Canada's sovereignty and the RCAF with its space and air capabilities will continue to contribute a vital role in enhancing joint situational awareness, sovereignty operations and continental defence, including in the Arctic.<sup>44</sup>

Climate change has also reinforced the importance of the Arctic region in the defence of North America and Canada-United States defence cooperation.<sup>45</sup> While Canada sees no immediate threat, the Arctic is becoming an area of strategic international importance with both Arctic and non-Arctic states expressing a variety of economic and military interests in the region.<sup>46</sup> Canada must have the ability to respond to Arctic security situations that may arise from the increase in international activity, ranging from an environmental emergency caused by a vessel to illegal activity and military threats.<sup>47</sup> This is reflected in Government of Canada's policy.

Released in 2019, Canada's Arctic and Northern Policy Framework provides overarching direction to the priorities, activities, and investments in the Arctic through 2030. One of the primary objectives of the GoC is to protect the safety and security of Northerners and defend both the Canadian Arctic and North America now and into the

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<sup>43</sup> Government of Canada. "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 11 December 2021, <https://www.rcaanccimac.gc.ca/eng/1562939617400/1562939658000>; *Strong, Secure, Engaged*, 90.

<sup>44</sup> *Strong, Secure, Engaged*, 65; Department of National Defence. *Royal Canadian Air Force Vectors*. (Ottawa: DND Canada, 2019), 56; Hereafter "*Royal Canadian Air Force Vectors*" Government of Canada. "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 11 December 2021, <https://www.rcaanccimac.gc.ca/eng/1562939617400/1562939658000>

<sup>45</sup> Andrea Charron, James Fergusson, Joseph Jockel, Chris Sands and Joel Sokolsky, "NORAD: Beyond Modernization," Centre for Defence and Security Studies, 31 January 2019, Accessed 11 December 2021, [https://umanitoba.ca/centres/cdss/media/NORAD\\_beyond\\_modernization\\_2019.pdf](https://umanitoba.ca/centres/cdss/media/NORAD_beyond_modernization_2019.pdf)

<sup>46</sup> Government of Canada. "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 10 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>

<sup>47</sup> Rob Huebert, "North America and Arctic Defence and Security Network (NAADSN), Canada and Future Challenges in the Arctic," (2014): 315-319.

future.<sup>48</sup> To meet this goal, the GoC will continue to enhance Canada's military presence as well as respond to safety and security incidents in the Arctic and the North.

Furthermore, the GoC intends to strengthen domain awareness, surveillance, and control capabilities in the Arctic and North while committed as new initiatives to "Prioritize Arctic Joint Intelligence, Surveillance and Reconnaissance as a defence research and development priority to produce innovative solutions to surveillance challenges in the North."<sup>49</sup> There are also implications for Canada's NORAD connection.

As the Arctic makes up a large portion of the air and maritime approaches to North America,<sup>50</sup> Canada will continue to work in close partnership with the U.S. under the auspice of the binational NORAD to ensure the North American continent is positioned well into the future to deter and defend against threats.<sup>51</sup> It is vital for Canada and the U.S. to remain firmly committed to modernizing NORAD.<sup>52</sup> NORAD Modernization is naturally focused on the next generation of the North Warning System (NWS).<sup>53</sup> For the foreseeable future, the key threats to North America "will be associated

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<sup>48</sup> Government of Canada, "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 10 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>

<sup>49</sup> *Ibid.*; *Strong, Secure, Engaged*, 65. Quote from latter.

<sup>50</sup> *Strong, Secure, Engaged*, 79.

<sup>51</sup> Government of Canada, "Canada's Arctic and Northern Policy Framework: Safety, Security, and Defence," 10 September 2019, Accessed 10 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>

<sup>52</sup> Andrea Charron, James Fergusson, Joseph Jockel, Chris Sands and Joel Sokolsky, "NORAD: Beyond Modernization", Centre for Defence and Security Studies, 31 January 2019, Accessed 11 December 2021, [https://umanitoba.ca/centres/cdss/media/NORAD\\_beyond\\_modernization\\_2019.pdf](https://umanitoba.ca/centres/cdss/media/NORAD_beyond_modernization_2019.pdf); Government of Canada, "Message from the new Deputy Minister", 11 January 2022, Accessed 11 January 2022, <https://www.canada.ca/en/departement-national-defence/maple-leaf/defence/2022/01/message-new-deputy-minister.html>. This was reinforced during the first visit to Canada of General VanHerck, Commander of NORAD with the Minister of National Defence and Chief of Defence Staff, in Ottawa on 29 November 2021. North American Aerospace Defense Command, "Commander NORAD completes first visit to Canada," 30 November 2021, Accessed 16 December 2021, <https://norad.mil/Newsroom/Article/2857152/commander-norad-completes-first-visit-to-canada/>

<sup>53</sup> Andrea Charron and James Fergusson, "Beyond NORAD and Modernization to North American defence Evolution," Canadian Global Affairs Institute, May 2017, Accessed 11 December 2021, [https://www.cgai.ca/beyond\\_norad\\_and\\_modernization\\_to\\_north\\_american\\_defence\\_evolution](https://www.cgai.ca/beyond_norad_and_modernization_to_north_american_defence_evolution); *Strong,*

with great-power competition, including increased activity in the Arctic.”<sup>54</sup> To defend North America against these new threats, the goal is to create an all Domain Awareness capabilities provided by a multi-layered sensor system that enables threat detection and identification at its “birth and track until its death.”<sup>55</sup>

RPA equipped with specialized sensors for collection of imagery and other intelligence information can form a vital part of the aforementioned multi-layered sensor system. RPA sensors will provide airspace situational awareness allowing greater standoff ranges and reducing impact of obscurants and adverse weather. Lastly, next generation RPA will be able to provide pre-launch detection and airborne missile tracking and engagement.<sup>56</sup> As will be discussed below, RPA can form a vital part of this new system and can enhance the security of Canada’s Arctic and the North in other ways.

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*Secure, Engaged*, 79. The NWS, a series of uninhabited, long-and short-range radars dotting the North American Arctic and Greenland in support of air defence and frontier control, using 1970s technology, is reaching its end of service life. It was designed to detect air bomber threats from the Soviet Union travelling in a north-south direction. Andrea Charron, “Beyond the North Warning System”, War on the Rocks, 7 September 2020, Accessed 11 January 2022, <https://warontherocks.com/2020/09/beyond-the-north-warning-system/>. However, it will require an evolution of the command and control arrangements and some mix of ground, air, space and sea-based sensors considering a new generation of Russian nuclear and conventional military capabilities, which pose the most pressing concerns to North American defence. Government of Canada, “Future Force Design,” 3 March 2021, Accessed 8 January 2022, <https://www.canada.ca/en/departement-national-defence/corporate/reports-publications/departemental-plans/departemental-plan-2021-22/planned-results/future-force-design.html>.; Andrea Charron and James Fergusson, “Beyond NORAD and Modernization to North American defence Evolution,” Canadian Global Affairs Institute, May 2017, Accessed 11 December 2021, [https://www.cgai.ca/beyond\\_norad\\_and\\_modernization\\_to\\_north\\_american\\_defence\\_evolution](https://www.cgai.ca/beyond_norad_and_modernization_to_north_american_defence_evolution)

<sup>54</sup> Andrea Charron, “Beyond the North Warning System”, War on the Rocks, 7 September 2020, Accessed 11 January 2022, <https://warontherocks.com/2020/09/beyond-the-north-warning-system/>

<sup>55</sup> CDA Institute, “NORAD Modernization: Report One: Awareness & Sensors” 16 September 2020, Accessed 17 December 2021, <https://cdainstitute.ca/norad-modernisation-report-one-awareness-sensors/>

<sup>56</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 23 October 2021, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 18, 35, 50.

Increased human activity in the Arctic bring new risks for people, infrastructure and ecosystems that further stress SAR and HADR capacity.<sup>57</sup> The transforming Arctic is likely to experience a growth in civilian aviation<sup>58</sup> coupled with international shipping, offshore resources exploitation such as fisheries, tourism and northern economic development over the next decade.<sup>59</sup> The event of a natural or human-induced disaster in the Arctic Archipelago would significantly pressure the capacities of all levels of government and the local communities, to support impacted population and minimize damage to affected wildlife, infrastructure and ecosystems.<sup>60</sup> As a result, the CAF may be called upon to assist the civilian authority to address these challenges.<sup>61</sup>

The requirements for RCAF assets and capabilities will continue to grow, particularly in the Arctic<sup>62</sup> characterized by vast distances, remoteness, inhospitable natural environment, sparse population with little existing infrastructure to support

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<sup>57</sup> Government of Canada, “Canada’s Arctic and Northern Policy Framework: Safety, Security, and Defence,” 10 September 2019, Accessed 11 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>; Dylan G. Clark, James D. Ford, and Taha Tabish, “What Role Can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada,” *PLOS One* 13, no.12 (2018). 2.

<sup>58</sup> Andrea Charron, James Fergusson, Joseph Jockel, Chris Sands and Joel Sokolsky, “NORAD: Beyond Modernization,” Centre for Defence and Security Studies, 31 January 2019, Accessed 11 December 2021, [https://umanitoba.ca/centres/cdss/media/NORAD\\_beyond\\_modernization\\_2019.pdf](https://umanitoba.ca/centres/cdss/media/NORAD_beyond_modernization_2019.pdf); FAOC, 8.

<sup>59</sup> Government of Canada, “Canada’s Arctic and Northern Policy Framework: Safety, Security, and Defence,” 10 September 2019, Accessed 11 December 2021, <https://www.rcaanc.gc.ca/eng/15605233306861/1560523330587>

<sup>60</sup> *Ibid.*

<sup>61</sup> The National Search and Rescue Secretariat under Public Safety Canada is responsible for coordinating the national SAR programme which is inherently integrated activity. The RCAF supports national aerial SAR missions with the appropriate equipment and personnel which are largely located in the south. Department of National Defence, *B-GA-400-000/FP-00, Royal Canadian Air Force Doctrine*, (Ottawa: DND Canada, 2016), 36; Hereafter “*Royal Canadian Air Force Doctrine*” Nancy Teeple and Ryan Deans, eds., “Shielding North America: Canada’s Role in NORAD Modernization,” North America and Arctic Defence and Security Network (NAADSN), March 2021, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/03/NAADSN-engaged4-NORAD-NT-RD-upload.pdf>. The current SAR posture that produces the slowest response time in the Arctic where a fast response is needed most constitutes one of the greatest challenge of the current Canadian SAR system. Dany, Poitras, “Search and Rescue in the Arctic,” in *Canadian Arctic Operations, 1945-2015: Lessons Learned, Lost and Relearned*, edited by Whiteny Lackenbauer and Adam Lajeunesse, 387-425. 401 Fredericton: The Gregg Centre for War & Society, 2017; *Royal Canadian Air Force Vectors*, 13; FAOC, 17.

<sup>62</sup> *Royal Canadian Air Force Vectors*, 13; FAOC, 8.

them.<sup>63</sup> The RCAF integration of RPA will enhance the delivery of air power to meet the transforming Arctic defence and non-defence mission needs in an increasingly complex Arctic security and defence environment. Moreover, the RCAF ability to deliver air power in the demanding Canadian Arctic must be balanced against the current global urbanization trend.

### **Urbanization: The Changing Character of War**

According to the United Nations Population Division, the world population is forecasted to reach 8.5 billion in 2030, and further increase to 9.7 billion in 2050 and culminate at 11.2 billion by 2100.<sup>64</sup> The growing world population is also expected to accelerate the current urbanization trend by transforming formerly rural into urban settlements. According to UN Department of Economic and Social Affairs, the world's population has gone through a rapid urbanization since 1950 when more than two thirds (70%) of people worldwide lived in rural settlements with Africa and Asia urbanizing more rapidly than any other regions of the world. By 2030, it is expected that 60% of world's population reside in urban areas, which is projected to reach two thirds (68%) by 2050, roughly the reverse of the global rural-urban population distribution of the mid-twentieth century.<sup>65</sup>

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<sup>63</sup> *The Future Security Environment*, 21.; North America and Arctic Defence and Security Network (NAADSN), "Shielding North America: Canada's Role in NORAD Modernization," March 2021, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/03/NAADSN-engaged4-NORAD-NT-RD-upload.pdf>; Danny, Garrett-Rempel, "Will JUSTAS Prevail? Procuring a UAS Capability for Canada," *RCAF Journal*, no. 4 (2015): 25.

<sup>64</sup> United Nations, "Population", Accessed 8 November 2021, <https://www.un.org/en/global-issues/population>

<sup>65</sup> United Nations, "World Urbanization Prospects 2018", Accessed 8 November 2021, <https://population.un.org/wup/Publications/Files/WUP2018-Highlights.pdf>

As urbanization accelerates in many developing regions, the emerging consensus is that armed violence and conflict tend to increasingly affect these population centres.<sup>66</sup> Western countries are faced with a disparity between the geopolitical phenomenon of mass urbanization and the apparent unwillingness to prepare their militaries to meet the challenges of increased urban operations across the spectrum of armed conflict, from HADR to conventional warfare. Recent U.S. Army and Marine Corps research anticipate that operating in megacities pose the most dangerous and demanding urban environment for Western forces in the future and will defy traditional methods of urban warfare.<sup>67</sup> From a mobility perspective, urbanization present unique challenges for personnel and freight transportation stemming from the location of airfields or ports and their force protection in the vicinity of intense civilian activity.<sup>68</sup> The nature of operations in large urban environments will elevate the demand on joint enablers such as Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), aviation and timely application of precision effects.<sup>69</sup> Considering these factors and in light of limited future troop numbers, the use of robotics, high-altitude RPA, precision strikes and special operation forces are likely for future urban warfare.<sup>70</sup> Furthermore, the CAF and the GoC as a whole recognize the importance of a close collaboration with military allies and international partners to ensure the safety and security of Canadian in

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<sup>66</sup> Antonio Sampaio, "Before and After Urban Warfare: Conflict Prevention and Transitions in Cities," *International Review of the Red Cross* 98, no. 901 (04, 2016): 71-95.

<sup>67</sup> Michael Evans, "Future war in cities: Urbanization's challenge to strategic studies in the 21<sup>st</sup> century," *International Review of the Red Cross* 98, no. 901 (2016): 38, 44.

<sup>68</sup> RAND Europe, "Global Mobility: Future Force Design 2040," 14 October 2021, Accessed 6 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1025139/RAND\\_RRA1309-1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1025139/RAND_RRA1309-1.pdf)

<sup>69</sup> *The Future Security Environment*, 50.

<sup>70</sup> Michael Evans, "Future war in cities: Urbanization's challenge to strategic studies in the 21<sup>st</sup> century," *International Review of the Red Cross* 98, no. 901 (2016): 50.

the current and future complex security and defence environment. This is reflected in the GoC foreign and defence policy priorities.

### **Government of Canada Foreign and Defence Policy Priorities**

Defending Canada and North-America have consistently been the number one and two priorities for every Canadian Defence policy since 1964.<sup>71</sup> As highlighted in the most current Canadian Defence Policy and recognizing the dynamic nature of global security environment, the GoC shares the vision for Canada that is Strong at Home, Secure in North America and Engaged in the World while further specifying the CAF missions which include the partnership with the United States including through NORAD and the contribution to NATO.<sup>72</sup> As a middle power, Canadian foreign policymakers leverage heavily international organizations, especially those under the UN umbrella.<sup>73</sup>

Since the end of the Cold War, the lack of overt security threats on the North American continent turned much of Canada's foreign policy toward foreign economic policy.<sup>74</sup> At this juncture, trends indicate that the likelihood of war among the major powers has declined; however, "crises, miscalculations and conflicting national goals are inevitable and war between states can never be ruled out."<sup>75</sup> A limited examination of the current global powers, outside the partners identified in the bilateral engagements mentioned above, is hereby attempted in order to inform this research paper on the

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<sup>71</sup> Andrea Charron and James Fergusson, "Out of sight, out of mind NORAD vis-à-vis CANUS politics," *Canadian Foreign Policy Journal* 26, no 2 (2020): 137-151.

<sup>72</sup> *Stong, Secure, Engaged*, 14-17. Specifically, the May 2006 NORAD Agreement renewal added a maritime warning mission which entails a shared awareness and understanding of the activities conducted in US and Canadian maritime approaches, maritime areas, and inland waterways. Department of National Defence. *Canadian Military Doctrine*, 3-5.

<sup>73</sup> Peter Howard and Reina Neufeldt, "Canada's Constructivist Foreign Policy: Building Norms for Peace," *Canadian Foreign Policy* 8, no. 1 (2000): 11-38.

<sup>74</sup> *Ibid.*

<sup>75</sup> *The Future Security Environment*, 3.

geopolitical global environment out to 2040. First, China is leveraging its military modernization, influence operations and predatory economics to reorder the Asia-Pacific region and to exert increasing international influence, which will alter the global balance of power in the decades to come.<sup>76</sup> Therefore, the CAF could be required to deploy forces in the Asia-Pacific region in support of GoC interests.<sup>77</sup>

Second, Russia has exerted influence on global affairs, for several decades. This has been for various reasons and chief among them is oil and gas resources. Despite the changing global energy map, Russia will likely remain influential on the international stages beyond 2040.<sup>78</sup> Russia seeks “veto authority over nations on its periphery in terms of their governmental, economic, and diplomatic decisions, to shatter the NATO and change European and Middle East security and economic structures to its favor.”<sup>79</sup> This is illustrated by the invasion of the sovereign state of Ukraine by Russian Forces on 24 February 2024 to end Ukraine’s aspiration to join the western defence Alliance.<sup>80</sup> Therefore, the CAF and its allies will likely continue to encounter Russian expeditionary forces on stability or expeditionary operations close to Russian territory.<sup>81</sup> From the Canadian domestic and continental North America security perspective, as academic Andrea Charron has observed, “Russia’s growing military capabilities and assertiveness

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<sup>76</sup> *Ibid.*, 11.; Australian Government Department of Defence, “2020 Defence Strategic Update,” 1 July 2020, Accessed 23 January 2022, <https://www.defence.gov.au/about/publications/2020-defence-strategic-update>

<sup>77</sup> *The Future Security Environment*, 11.

<sup>78</sup> *Ibid.*

<sup>79</sup> Summary of the 2018 National Defense Strategy of The United States of America, *Sharpening the American Military’s Competitive Edge*, Accessed 3 January 2022, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>

<sup>80</sup> BBC News, “Why has Russia invaded Ukraine and what does Putin want?,” Accessed 1 April 2022, <https://www.bbc.com/news/world-europe-56720589>

<sup>81</sup> *The Future Security Environment*, 11.



mean that NORAD's detection, deterrence, and defeat mandate has never been so important. The Arctic is still the fastest avenue of approach to North America."<sup>82</sup>

Although states remain the main actors of the global geopolitical environment, non-state actors have the mean to threaten the security environment with increasingly sophisticated capabilities<sup>83</sup> by often leveraging "leading edge technologies that become accessible over time or proliferated by many other states."<sup>84</sup> Terrorists, trans-national criminal organizations, cyber hackers and other malicious non-state actors have the means to threaten peace and security with increased capabilities of mass disruption.<sup>85</sup> The nature of conflict "is near certain to become more dynamic as the forecast diffusion of global power empowers a growing number of actors."<sup>86</sup> Canada and its allies face long-term, dynamic and persistent competition from multiple directions. Russia is likely to remain belligerent. Non-state actors, terrorist groups and organization such as al-Qaeda, have proven resilient and adaptable while new ones are likely to emerge. Moreover, China is developing the world's leading military by 2050, including expeditionary capabilities.<sup>87</sup> The RCAF will therefore have to operate within a spectrum of conflict, in support of a whole-of-government effort to protect Canadians and advance the national interest, with

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<sup>82</sup> Andrea Charron, "Beyond the North Warning System", War on the Rocks, 7 September 2020, Accessed 11 January 2022, <https://warontherocks.com/2020/09/beyond-the-north-warning-system/>

<sup>83</sup> Summary of the 2018 National Defense Strategy of The United States of America. *Sharpening the American Military's Competitive Edge*, Accessed 3 January 2022, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>

<sup>84</sup> FAOC, 21.

<sup>85</sup> Summary of the 2018 National Defense Strategy of The United States of America. *Sharpening the American Military's Competitive Edge*, Accessed 3 January 2022, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>

<sup>86</sup> Department of National Defence, *CANSOFCOM Future Operating Environment Handbook*, (Ottawa: DND Canada, 2017), 12.

<sup>87</sup> NATO Review, "NATO's Warfighting Capstone Concept: anticipating the changing character of war," 9 July 2021, Accessed 23 January 2022, <https://www.nato.int/docu/review/articles/2021/07/09/natos-warfighting-capstone-concept-anticipating-the-changing-character-of-war/index.html>

at one end non-state actors and at the other the nation states, with a varying level of technological sophistication and integration that reaches its highest level for nation states.<sup>88</sup>

## **Conclusion**

As this chapter has demonstrated, climate change is anticipated to pose a major threat to global economy, peace, and stability. The Canadian Arctic is experiencing the most dramatic transformation due to human-induced climate change with a scientific median projection of a virtually ice-free Arctic forecasted in 2037. Along with climate change, the share of world's urban population is projected to reach two thirds of people worldwide by 2050. The emerging consensus is that armed violence and conflict tend to increasingly affect these population centres and will defy traditional methods of urban warfare. Finally, as a middle power, Canadian foreign policymakers leverage heavily international organizations through Canadian commitments to NATO, NORAD, and UN peacekeeping.

Although states remain the main actors of the global geopolitical environment, non-state actors have the mean to threaten the security environment with increasingly sophisticated capabilities. It is therefore paramount to determine whether air power writ large, and RPA specifically, possesses the fundamental characteristics to enhance RCAF capabilities in support of defence and non-defence missions throughout the spectrum of conflict within a complex and evolving future security environment.

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<sup>88</sup> FAOC, 4.

### CHAPTER 3 – FUNDAMENTAL CHARACTERISTICS AND CHALLENGES OF RPA

*You can see video of tanks being hit by an unmanned aerial system, artillery positions being hit by an unmanned aerial system, troops being hit by an unmanned aerial system.*

- Colonel Scott Shaw, USAF, Fall 2020<sup>89</sup>

#### Introduction

The fall 2020 Azerbaijan air assaults against Armenia over the disputed enclave of Nagorno-Karabakh illustrates the pivotal role that RPA plays in the modern battlespace. During the six week conflict, Azerbaijan successfully deployed Turkish Bayraktar TB2 drones and Israeli-made loitering munitions<sup>90</sup> to “shrink the battlefield and chip away at Armenia’s armored forces as well as the logistical tail that hadn’t even reached the front lines.”<sup>91</sup> Colonel Scott Shaw, formerly of the United States Army’s Asymmetric Warfare Group, stated following the Azerbaijan air assaults that “not only [does] the U.S. military no longer enjoy uncontested air superiority against peer rivals like China – something Defense Department officials have long resigned themselves to – but that poorer nations can buy themselves a respectable air force mostly off the shelf.”<sup>92</sup> Furthermore, United Kingdom (U.K.) Defence officials believe that the Azerbaijan’s use of cheaper Turkish drones was crucial in defeating the Armenians, leading the British military to embark on a

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<sup>89</sup> Foreign Policy, “The U.S. Army Goes to School on Nagorno-Karabakh Conflict. Off-the-shelf air power changes the battlefield of the future,” 30 March 2021, Accessed 5 January 2021, <https://foreignpolicy.com/2021/03/30/army-pentagon-nagorno-karabakh-drones/>

<sup>90</sup> ADBR, Defence Industry Intelligence, “Loitering Menace,” 24 May 2021, Accessed 6 January 2021, <https://adbr.com.au/loitering-menace/>

<sup>91</sup> Foreign Policy, “The U.S. Army Goes to School on Nagorno-Karabakh Conflict. Off-the-shelf air power changes the battlefield of the future,” 30 March 2021, Accessed 5 January 2022, <https://foreignpolicy.com/2021/03/30/army-pentagon-nagorno-karabakh-drones/>

<sup>92</sup> *Ibid.*

new armed drone programme.<sup>93</sup> The British Prime Minister and U.S. Defence official praised once again the terrific use of the Turkish Bayraktar TB2 drones by Ukrainian Forces in slowing down or by blocking the Russian Forces advance following the invasion of Ukraine by Russian Forces on 24 February 2022.<sup>94</sup>

The Nagorno-Karabakh and Russia-Ukraine conflicts have demonstrated that the airspace above modern battlefield is becoming more and more contested and congested with the proliferation of RPA. At the same time, threats to Canada's national interest have become diverse and increasingly sophisticated. This chapter explores the fundamental characteristics and challenges of RPA. It examines air power as the preferred option of national power by decision-makers to achieve national objectives. Using RCAF doctrinal air power characteristics as a framework, this chapter will then analyze the fundamental characteristics and limitations of RPA. Next, it assesses the proliferation of RPA by both states and non-state actors and determine whether it has degraded the asymmetric advantage that air power provided to professional or state militaries over non-state actors. Moreover, this chapter will explore the current development of AI and determine its

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<sup>93</sup> The Guardian, "UK wants new drones in wake of Azerbaijan military success," 30 December 2020, Accessed 5 January 2022, <https://www.theguardian.com/world/2020/dec/uk-defence-secretary-hails-azerbaijans-use-of-drones-in-conflict>

<sup>94</sup> AP News, "Cheap but lethal Turkish drones bolster's Ukraine's air defenses," 17 March 2022, Accessed 1 April 2022, <https://apnews.com/article/russia-ukraine-middle-east-africa-libya-europe-ecb9e820ea4bddb4464d7e8cb40e82fc>; NBC News, "Why are Ukraine's cheap and slow drones so successful against Russian targets?," 14 March 2022, Accessed 1 April 2022, <https://www.nbcnews.com/news/world/are-ukraines-cheap-slow-drones-successful-russian-targets-rcna19982>; War on The Rocks, "Of Roadside Bombs and Drones: Putin's Looming Insurgency Problem," 8 April 2022, Accessed 9 April 2022, [https://warontherocks.com/2022/04/of-roadside-bombs-and-drones-putins-looming-insurgency-problem/?\\_s-dgircdm\)iybe9gpb8pg](https://warontherocks.com/2022/04/of-roadside-bombs-and-drones-putins-looming-insurgency-problem/?_s-dgircdm)iybe9gpb8pg)

impact on the conduct of military affairs. It will then evaluate how public casualty aversion is pushing towards the digitalization of the battlespace. Lastly, an exploration of the gaps in international arms control regulations and its legal application over the territory of a sovereign state indicate the security implications that RPA proliferations pose to global peace and security while highlighting the legal challenges associated with remote warfare.

### **Air Power, National Power, and Advantages and Disadvantages of RPA**

A nation's ability to impose its will and achieve its national objectives emanates from its instrument of national power which are: diplomacy, information, military and economy.<sup>95</sup> Furthermore, a nation's ability to identify and employ the appropriate mix of the instruments of national power to achieve its national objectives are considered a successful application of national power.<sup>96</sup>

Since Realists see the international system as an anarchy, states with economic clout and especially military might are viewed as decisive.<sup>97</sup> While a military option should normally be considered as the last resort to achieve national objectives, politicians now regard air power as a diplomatic tool of initial recourse.<sup>98</sup> Moreover, air power brings a full spectrum of effects to bear, from humanitarian to electronic to kinetic.<sup>99</sup> These factors, combined with air power's distinguishing characteristics of reach, speed,

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<sup>95</sup> Timothy D. Gann, "Decision from the sky: Airpower as a Decisive Instrument of National Power," Army War College, (1997): 6.

<sup>96</sup> *Canadian Military Doctrine*, 2-1.

<sup>97</sup> Anne-Marie Slaughter, and Thomas Hale, "International Relations, Principal Theories." In Max Planck Encyclopedia of Public International Law, edited by Rudiger Wolfrum. Oxford: Oxford University Press, (2013).

<sup>98</sup> R.A. Renner, "America's asymmetric advantage: The utility of airpower in the new strategic environment," *Defence Studies*. Abingdon Vol.4, Iss 1, (2004): 87-113.

<sup>99</sup> Allen G. Peck, "Airpower's Crucial Role in Irregular Warfare." *Air & Space Power Journal* 21, no. 2 (2017): 10-15,125.

precision and stealth, offer decision makers with various options to achieve national objectives.<sup>100</sup>

Air power will therefore usually be the first preferred option for politicians seeking to be perceived as taking action when other military or non-military options are unavailable or slow to implement with uncertain outcome.<sup>101</sup> The ability “of technology-enabled air forces to deliver precise, discriminatory and proportional effects has made air power the force of first resort for political leadership.”<sup>102</sup> RAND Corporation researcher Benjamin S. Lambeth goes even further by advocating that air power alone can be decisive in a conflict.<sup>103</sup> However, this view needs to be balanced against the idea that almost any political objective can be achieved by the right application of air power.<sup>104</sup> Robert Farley argues that the decisive view of air power and the privileged position of the Air Force stems from political leaders being seduced by the assurance of efficient, almost bloodless war.<sup>105</sup> Martin Van Creveld expands on this line of thinking by concluding that air power, especially jet-powered aircraft are of limited utility since the Second World War, while the future of air power resides in RPA considering that it is cheaper than inhabited air assets.<sup>106</sup> With this last point in mind, it is important to analyze the fundamental characteristics and limitations of RPA using RCAF doctrinal air power characteristics as a framework.

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<sup>100</sup> *Royal Canadian Air Force Doctrine*, 14.

<sup>101</sup> Mark Clodfelter, “Theory, Implementation, and the Future of Airpower,” *Air & Space Power Journal* 28, no.5 (2014): 118-127.

<sup>102</sup> FAOC, 1.

<sup>103</sup> Benjamin S. Lambeth, “Airpower, Spacepower, and Cyberpower” *Joint Force Quarterly* 60, no.1 (2011): 46.

<sup>104</sup> Robert M. Farley, *Grounded: The Case for Abolishing the United States Air Force*, Lexington: (University Press of Kentucky, 2014): 132.

<sup>105</sup> *Ibid.*, 42.; Ryan D. Wadle, “Grounded: the Case for Abolishing the United States Air Force,” *Parameters* 44, no. 3 (2014): 150-151.

<sup>106</sup> Richard L. DiNardo, “The Age of Airpower.” *Parameters* 42, no. 3 (2012): 112-114. The term inhabited is hereby used as a gender neutral terminology for piloted air asset.

In light of the assessment of the future security environment and climate change in Chapter 2, the distinguishing characteristics of air power (in bold) that are embodied in RPA makes these platforms suitable to address Arctic challenges and a variety of applications to achieve national objectives. Based on the fundamental air power applications of observation, and thanks to air power's capacity to be employed above the surface of the Earth, **elevation** gives RPA the ability to locate and monitor activities on the surface.<sup>107</sup> In addition, the distinctive global **reach** characteristic of air power provides strategic options to decision makers for RPA usage in the Arctic while contributing to the CAF's power projection. Moreover, the unique air power characteristic of **speed** ensures a swift response capability by RPA over great distances.<sup>108</sup>

RPA embodiment of the air power doctrinal tenet of persistence also offers unique advantages compared to inhabited platforms. In general, the **persistence** employment of air power gives the commander influence and presence in air environment while its characteristics of **speed** and **reach** allow the operational environment to be revisited persistently over time.<sup>109</sup> In particular RPA, unencumbered by human performance or physiological characteristics, can achieve extreme **persistence** that far exceeds inhabited air assets and manoeuvrability.<sup>110</sup> For example, the loitering time of a RQ-4 Global Hawk<sup>111</sup> could exceed 28 hours while an inhabited CP-140 Aurora long range patrol

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<sup>107</sup> *Royal Canadian Air Force Doctrine*, 16.

<sup>108</sup> *Ibid.*, 14.

<sup>109</sup> *Ibid.*, 16.

<sup>110</sup> Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems, Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302> 51.

<sup>111</sup> United States Air Force RPA VECTOR, "Vision and Enabling Concepts 2013-2038," Accessed 23 October 2021, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 56.

aircraft loitering time is just over eight hours.<sup>112</sup> ISR was originally the *raison d'être* for RPA and is often conducted in a joint, multi-agency effort to gain Situational Awareness and subsequently decision superiority.<sup>113</sup> It is therefore not surprising that the use of RPA in support of ISR represents a significant portion of its military application.<sup>114</sup> Air power possesses the required characteristics to conduct ISR and SAR, which are two fundamental RCAF doctrinal core and role capabilities that are particularly suited to operations in the Arctic.<sup>115</sup>

RPA also can take advantage of the Remote Split Operations (RSO) concept to “flex assets between areas of responsibility.”<sup>116</sup> RSO refers to “geographical separation of the launch and recovery cockpit and crew from the mission cockpit and crew. RSO enables the employment of the aircraft by the mission crew at a location other than where the aircraft are based.”<sup>117</sup> Most United States Air Force (USAF) RPA are operated beyond line of sight (BLOS) from geographically separated location; therefore, they produce sustained combat capability more efficiently with a reduced forward footprint.<sup>118</sup> RSO

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<sup>112</sup> Department of National Defence, “CP-140 Aurora,” 14 October 2020, Accessed 6 January 2022, [www.rcaf-arc.forces.gc.ca/en/aircraft-current/cp-140.page](http://www.rcaf-arc.forces.gc.ca/en/aircraft-current/cp-140.page); Wikipedia, “Lockheed CP-140 Aurora,” Accessed 6 January 2022, [https://en.wikipedia.org/wiki/Lockheed\\_CP-140\\_Aurora](https://en.wikipedia.org/wiki/Lockheed_CP-140_Aurora)

<sup>113</sup> Department of National Defence, *B-GA-401-002/FP-001, Royal Canadian Air Force Doctrine: Intelligence Surveillance and Reconnaissance*. (Ottawa: DND Canada, 2017), 5.

<sup>114</sup> Teal Group, World Military Unmanned Aerial Systems Market Profile and Forecast 2020/2021, Accessed 4 September 2021, <https://shop.tealgroup.com/product/wmuav>

<sup>115</sup> *Royal Canadian Air Force Doctrine*, 32; Richard Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 139.

<sup>116</sup> United States Air Force Unmanned Aircraft Systems, “Flight Plan 2009-2047,” Accessed 11 December 2021, [https://irp.fas.org/program/collect/uas\\_2009.pdf](https://irp.fas.org/program/collect/uas_2009.pdf) .15; As indicated below, the Canadian equivalent of flex assets is the multirole and swing-role capabilities.

<sup>117</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 15 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> . 20.

<sup>118</sup> United States Air Force Unmanned Aircraft Systems, “Flight Plan 2009-2047,” Accessed 11 December 2021, [https://irp.fas.org/program/collect/uas\\_2009.pdf](https://irp.fas.org/program/collect/uas_2009.pdf) .15



therefore offer significant advantages for RCAF RPA capability. This is especially the case considering the limited infrastructure available in Canada's Arctic<sup>119</sup> and likely during expeditionary operations, combined with the changing character of war in light of the urbanization trend discussed in the previous Chapter 2. Moreover, the RSO concept is also consistent with the RCAF's preference for multirole and swing-role platforms.<sup>120</sup> RCAF aviation capabilities must be multi-purpose, relevant to domestic and international operations, interoperable with core allies while adapting to the latest technology.<sup>121</sup> This trend towards multi-role capabilities will increasingly define air operations by the desired effects and the context of employment, not by the type of platform used.<sup>122</sup>

RPA could offer certain advantages that meet government desire to demonstrate prudent stewardship of public resources.<sup>123</sup> Although still Person Year (PY) intensive (similar to inhabited platforms), the lower unit cost of RPA compared to inhabited aircraft further increases its attractiveness.<sup>124</sup> For example, the MQ-1 Predator, armed, multi-role and long endurance RPA costs approximately one-thirtieth that of new habited fighter aircraft while it is capable of performing many of the same functions.<sup>125</sup> Acknowledging that RCAF "does not have the foundation needed to build and sustain a full-ISR-

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<sup>119</sup> North America and Arctic Defence and Security Network (NAADSN), "Shielding North America: Canada's Role in NORAD Modernization," March 2021, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/03/NAADSN-engaged4-NORAD-NT-RD-upload.pdf>

<sup>120</sup> Multirole and swing-role platforms constitute a more viable option for the RCAF as stated preference in the RCAF Vectors and by the RCAF Commander. *Royal Canadian Air Force Vectors*, 57; Richard Goette, "Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations," Trenton: Royal Canadian Air Force Warfare Center, 2020, 44.

<sup>121</sup> *Strong, Secure, Engaged*, 39.

<sup>122</sup> Brad W. Gladman, "The future of allied air power: The Royal Air Force," Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 31.

<sup>123</sup> *Strong, Secure, Engaged*, 47.

<sup>124</sup> Michell, Binding. "Have Autonomous and Unmanned Systems Changed War Fundamentally?," *Canadian Military Journal* 19, no. 1 (Winter 2018): 40-45

<sup>125</sup> *Ibid.*

capability enterprise on the lines of USAF,”<sup>126</sup> a thorough PY assessment in support of RPA operation and sustainment would be advisable. It should include operators, maintenance technicians and specialized skill set in the data Processing, Exploitation and Dissemination (PED) to contribute to informed decision-making process. In addition, consideration should also be given to assess the reliability of satellite-based RPA navigation systems in the Polar Regions.

The Arctic poses unique challenges to remote ground-based sensors and space-based sensors in polar orbits.<sup>127</sup> RPA operations in the North, specifically at latitudes greater than 70 degrees, could be limited by adequate acquisition of geostationary BLOS satellite communication “locks” for proper RPA control<sup>128</sup> due to a very low elevation that increases signal interference with ground clutter.<sup>129</sup> Therefore, in order to expand the use of RPA in the North, in support of ISR and SAR mandates, the BLOS satellite communication challenges must be addressed.<sup>130</sup> Despite the above mentioned limitations, RPA has become commonplace in civilian use and in military arsenals around the globe.

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<sup>126</sup> Richard, Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 139.

<sup>127</sup> CDA Institute, “NORAD Modernization: Report One: Awareness & Sensors,” 16 September 2020, Accessed 17 December 2021, <https://cdainstitute.ca/norad-modernisation-report-one-awareness-sensors/>

<sup>128</sup> All About Circuits, “The Limits of Satellite Navigation: GPS Challenges in the Arctic,” 24 July 2018, Accessed 16 December 2021, <https://www.allaboutcircuits.com/news/navigating-the-arctic-why-gps-might-fail-you/>

<sup>129</sup> Rob Huebert, “North America and Arctic Defence and Security Network (NAADSN) “The Newly Emerging Arctic Security Environment,” (2010): 39-72.; Department of National Defence, *Canadian Forces UAV Campaign Plan*. Ottawa, ON: (2006): 34.

<sup>130</sup> North America and Arctic Defence and Security Network (NAADSN), “The Newly Emerging Arctic Security Environment (2010) Rob Huebert :39-72; Canada. Department of National Defence. *Canadian Forces UAV Campaign Plan*. (Ottawa: DND Canada, 2006), 34.

### **Proliferation of Remotely Piloted Aircraft: Contested Air Superiority**

In the last several years, the use of RPA has proliferated worldwide as the world has entered the second drone age (see Literature Review Section in Chapter 1). For the next decade, the military and civilian RPA market will continue to expand considerably as it continues to prove its utility across several different applications. In terms of the civilian market, the growth is expected to increase from \$5 billion in 2020 to nearly quadruple to \$18.5 billion by 2029 with RPA applications ranging from public safety to commercial applications.<sup>131</sup>

In terms of military application, RPA is central in the intelligence, surveillance and reconnaissance portion while expanding into other kinetic missions.<sup>132</sup> According to the Teal Group Corporation, the forecasted worldwide RPA military procurement will continue to increase from almost \$11 billion in 2020 to \$14.6 billion by 2029.<sup>133</sup> As of 2020, at least 102 countries acquired military drones while another 40 possess or are in the process of acquiring armed RPA. Within the next 10 years, over 40 per cent of RPA will be armed with 90 per cent belonging to the largest and most lethal military RPA categories.<sup>134</sup>

While the number of states possessing armed RPA has significantly increased, so is the number of violent non-state actors possessing RPA. At least 20 armed non-state actors have reportedly obtained armed and unarmed RPA systems.<sup>135</sup> Since 2015, armed

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<sup>131</sup> Teal Group, “World of Civilian Unmanned Aerial Systems Market Profile and Forecast 2020/2021.” Accessed 4 September 2021, <https://shop.tealgroup.com/collections/annual-sector-studies/products/2020-2021-world-civil-unmanned-aerial-systems-market-profile-forecast>: 4.

<sup>132</sup> Teal Group, “World Military Unmanned Aerial Systems Market Profile and Forecast 2020/2021.” Accessed 4 September 2021, <https://shop.tealgroup.com/products/wmuav>

<sup>133</sup> *Ibid.*

<sup>134</sup> United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>

<sup>135</sup> *Ibid.*

RPA have been used against domestic targets on national territories, within and outside non-international armed conflicts.<sup>136</sup> As of writing, there are 23 non-state actors that are listed on the New America World of Drones database such as Boko Haram, Houthi Rebels or Hezbollah. Among these non-state actors, a total of five groups such as Islamic State of Iraq and the Levant have armed these commercial-off-the-shelf RPA and used them in combat.<sup>137</sup>

Although non-state actors do not necessarily have the resources, training, or technical know-how at this juncture to access or operate sophisticated RPA owned by state actors around the world, commercial-off-the-shelf RPA has provided them with the capability to deliver air power. Traditionally, air power was recognized as an asymmetric advantage of professional or state militaries that non-state actors can neither meet with parity nor counter in kind.<sup>138</sup> However, with the proliferation of RPA, non-state actors are now able to exploit and contest the control of the air and are increasingly moving towards a scenario where professional or state militaries “high tech strategic superiority provides only an illusion of strategic superiority.”<sup>139</sup>

Control of the air as embodied by air superiority is a (if not the) fundamental capability of air power.<sup>140</sup> Therefore, the proliferation of commercial-off-the-shelf RPA has allowed non-state actors and states with minimal resources to contest control of the

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<sup>136</sup> *Ibid.*

<sup>137</sup> New America. “World of Drones Non-State Actors with Drone Capabilities,” 30 July 2020, Accessed 4 September 2021, <https://www.newamerica.org/international-security/reports/world-drones/non-state-actors-with-drones-capabilities>

<sup>138</sup> Allen G Peck, “Airpower’s Crucial Role in Irregular Warfare,” *Air & Space Power Journal* 21, no. 2 (Summer 2017): 10-15.

<sup>139</sup> Clive Blount, and Charlie Sammut, “A Gift to Our People: The Use of Drone Technology by Islamist Insurgents,” *RAF Air Power Review* 19, no. 1 (2016): 8-25.

<sup>140</sup> As stated in the RCAF doctrine, “in any military campaign, gaining air superiority is a critical first objective as it then allows freedom of movement of friendly forces across the area of operations.” *Royal Canadian Air Force Doctrine*, 33.

air. Moreover, the consequences are not limited to the air domain but also have joint implications. As Kelly Sayler observes, commercial-off-the-shelf RPA could lead to a “paradigm shift in ground warfare for the U.S and its NATO allies by ending more than a half-century of air dominance in which its ground forces have not had to fear air attacks.”<sup>141</sup> Not only in a peer to peer but also during lower tier conflicts, the adversarial use of RPA against NATO forces by both state and non-state actors has to be anticipated throughout the entire range of RPA capabilities.<sup>142</sup> For example, at the height of its offensive edge, ISIL conducted an estimated 60-100 weaponized RPA attacks per month in Iraq.<sup>143</sup> Thus, the weaponization of RPA has provided a new tool for the delivery of air power and lethal force by both states and violent non-state actors in and outside the battlespace. The expected capability enhancement of RPA thanks to the unprecedented progress and development in AI will further increase the attractiveness of RPA by both state and non-state actors.

### **Artificial Intelligence: Revolution in Military Affairs**

The advances in the field of AI is bound to further expand the capability and autonomy of uninhabited vehicles including RPA for the foreseeable future. The increased computational power and software innovations are the first driver of the unprecedented developments in AI and machine learning and ultimately to autonomous

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<sup>141</sup> Kelley Sayler, “A world of Proliferated Drones: A technology Primer,” (Washington DC: Center for a New America Security, 2015), Accessed 20 January 2022, <https://cnas.org/publications/reports/a-world-of-proliferated-drones-a-technology-primer.29>.

<sup>142</sup> André Haider, “Unmanned Aircraft System Threat Vectors,” Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems,” Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/39>.

<sup>143</sup> Kelley Sayler, “A world of Proliferated Drones: A technology Primer,” (Washington DC: Center for a New America Security, 2015), Accessed 20 January 2022, <https://cnas.org/publications/reports/a-world-of-proliferated-drones-a-technology-primer.29>.

weapon systems.<sup>144</sup> AI is commonly defined as “a system’s ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.”<sup>145</sup> Concurrently, tremendous progress has also been accomplished in making human-machine interaction more efficient and fluid.<sup>146</sup> As it relates to autonomy, the U.S. Department of Defense defines autonomous weapon system as one that once activated, can select and engage targets without further human operator intervention.<sup>147</sup> There are therefore different levels of autonomy that is best viewed as a range rather than as a binary.<sup>148</sup>

For many years, the U.S. Army’s Patriot Missile system and the U.S. Navy’s Aegis combat system have had the capacity to automatically defeat incoming artillery or missile attacks against ground or maritime forces.<sup>149</sup> Since then, advances in computing technology, are pushing the boundary of weapon system towards increased autonomy. In light of technological breakthrough in other research areas such as nanotechnology, the future of autonomous systems are predicted to become increasingly compact, lethal and able to operate over increased distances and time with the ability to operate collectively as

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<sup>144</sup> Sherry, Wasilow and Thorpe B. Joelle, “Artificial Intelligence, Robotics, Ethics, and the Military: A Canadian Perspective,” *AI Magazine* 40, no.1 (2019): 37.; Thurnher, Jeffrey S. “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 182. Additionally, advances in uninhabited vehicles is not limited to RPA only but has seen applications on land and sea as well. Michell, Binding. “Have Autonomous and Unmanned Systems Changed War Fundamentally?,” *Canadian Military Journal* 19, no. 1 (2018): 40-45

<sup>145</sup> Michael Haenlein, and Andreas Kaplan, “A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence,” *California Management Review* 61, no. 4 (2019): 5-14; Amandeep Singh Gill, “Artificial Intelligence and International Security: The Long View,” *Ethics & International Affairs* 33, no.2 (2019): 169-179.

<sup>146</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems.” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 182.

<sup>147</sup> *Ibid.*, 180.

<sup>148</sup> Mitchell Binding, “Have Autonomous and Unmanned Systems Changed War Fundamentally?” *Canadian Military Journal* 19, no. 1 (Winter 2018): 40-45.

<sup>149</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems.” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 182.

a swarm to swiftly overwhelm the enemy forces.<sup>150</sup> The rise of AI is expected to bring about the greatest potential change in how RPA operates.<sup>151</sup>

The second driver of autonomous weapon systems is their general resilience to electronic or cyber-attacks.<sup>152</sup> The cyber domain has seen exponential advances in the past decades. As state and non-state actors are becoming increasingly sophisticated and competent in attacking computer networks, communications links represent critical vulnerabilities. For example, remotely controlled weapon systems including RPA, are often dependent on their computer systems, information technology, network connectivity and satellite links with the human operator.<sup>153</sup> Without the reliance on a constant link with a human operator, autonomous systems, however, could conceivably continue operations even in adverse and electronically contested battlespace while presenting less vulnerabilities against cyber-attacks.<sup>154</sup> The exploitation of data analytics, particularly cyber and influence activities will create opportunities and challenges for military.<sup>155</sup> Programs that will employ and “react to countermeasures” autonomously are also being actively pursued.<sup>156</sup>

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<sup>150</sup> Chris Jenks, “The Gathering Swarm: The Path to Increasingly Autonomous Weapons Systems.” *Jurimetrics* 57, no. 3 (2017): 341-359; Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law,” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 151.

<sup>151</sup> Michael J. Boyle, “The Drone Age: How Drone Technology Will Change War And Peace.” Oxford Scholarship Online (2020): 280.

<sup>152</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems.” In *Targeting: The Challenges of Modern Warfare*, Asser Press (2016): 185.

<sup>153</sup> André Haider, “Introduction,” Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems,” Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 19.

<sup>154</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, Asser Press (2016): 185.

<sup>155</sup> *The Future Security Environment*, 71.

<sup>156</sup> The use of a computer virus known as Stuxnet is believed to cause significant damage to Iranian nuclear facilities in 2009 which illustrates the potential and power of autonomous cyber weapon systems. Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, Asser Press (2016): 183.

The third driver of autonomous weapon systems is based on the prediction that “future conflicts will be waged in an environment too fast and too complex for humans to direct.”<sup>157</sup> Furthermore, the current demand in military personnel to operate, maintain and analyze the huge volume of data generated by current remotely controlled systems are unsustainable and AI will enable information processing, analysis, sense-making and support to decision making, to name a few.<sup>158</sup> Autonomous systems may have the capability to operate apace with future combat environment.<sup>159</sup> Military RPA will also require increasing autonomous control to operate in an increasingly complex aviation environment and contested military airspace.<sup>160</sup> Hence, nations will seek to develop and expand their autonomous weapons arsenal in order to maintain a competitive advantage in future conflicts.<sup>161</sup>

NATO sees AI as the foundational technology that will likely affect the full spectrum of the alliance’s activities.<sup>162</sup> Advancement in AI will gradually improve the prospects of automated and eventually autonomous RPA which combined with a cost-sensitive budgetary environment makes that option hard to resist.<sup>163</sup> These developments

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<sup>157</sup> Amandeep Singh Gill, “Artificial Intelligence and International Security: The Long View,” *Ethics & International Affairs* 33, no.2 (2019): 169-179; Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 185.

<sup>158</sup> Department of National Defence, “Pan-Domain Force Employment Concept: Prevailing in an Uncertain World” (Ottawa: DND Canada, 2020), 22.; Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 184.

<sup>159</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 185.

<sup>160</sup> Justin A. Jaussi, and Hoffmann O. Herbert, “Manned Versus Unmanned Aircraft Accidents, Including Causation Rates,” *International Journal of Aviation, Aeronautics and Aerospace* 5, no. 4 (2018): 3.

<sup>161</sup> Jeffrey S. Thurnher, “Means and Method of the Future: Autonomous Systems,” In *Targeting: The Challenges of Modern Warfare*, *Asser Press* (2016): 185.

<sup>162</sup> North Atlantic Treaty Organization, “Summary of the NATO Artificial Intelligence Strategy,” 22 October 2021, Accessed 22 January 2022, [https://www.nato.int/cps/en/natohq/official\\_texts\\_187617.htm](https://www.nato.int/cps/en/natohq/official_texts_187617.htm)

<sup>163</sup> Michael. J. Boyle “The Drone Age: How Drone Technology Will Change War And Peace,” Oxford Scholarship Online (2020): 284.



have led to ethical concerns in AI and lethal autonomous weapon systems (LAWS) focused on the risk and accountability of fratricide by killing one's own soldiers, being hacked by an enemy, or may act in a manner inconsistent with the intent of its designer.<sup>164</sup> The International Committee of the Red Cross recently raised the perspective that LAWS risk destroying the basic notions of humanity of giving an adversary the opportunity to surrender where the use of lethal force is manifestly unnecessary.<sup>165</sup>

As of writing, fully autonomous systems have yet to exist in any nation's military arsenal.<sup>166</sup> However, experts anticipate that the use of such systems in armed conflicts would be common within a generation.<sup>167</sup> Although there is no consensus yet among scholars and military practitioners regarding what constitute a fundamental change in the conduct of war or Revolution in Military Affairs, most experts believe that a revolution is presently unfolding and autonomous systems will "fundamentally alter the way wars are waged."<sup>168</sup> That being said, as the technology matures, it is more likely that military forces will incrementally adopt increased autonomy within their weapon systems arsenal in light of the tremendous operational benefit inherent to autonomous weapon systems.<sup>169</sup> The unprecedented development in the field of AI will undoubtedly accelerate the

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<sup>164</sup> Peter Vamplew, Richard Dazeley, Cameron Foale, Sally Firmin, and Jane Mummary, "Human-Aligned Artificial Intelligence is a Multiobjective Problem," *Ethics and Information technology* 20, no.1 (2018): 28.; Michael J. Boyle, "The Drone Age: How Drone Technology Will Change War And Peace," Oxford Scholarship Online (2020): 284.

<sup>165</sup> Filippo Ruschi, "The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law," *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 148.

<sup>166</sup> Amandeep Singh Gill, "Artificial Intelligence and International Security: The Long View," *Ethics & International Affairs* 33, no.2 (2019): 169-179.

<sup>167</sup> Jeffrey S. Thurnher, "Means and Method of the Future: Autonomous Systems," In *Targeting: The Challenges of Modern Warfare*, Asser Press (2016): 181.

<sup>168</sup> *Ibid.*, 177. ; Michell, Binding, "Have Autonomous and Unmanned Systems Changed War Fundamentally?," *Canadian Military Journal* 19, no. 1 (2018): 40-45.

<sup>169</sup> Jeffrey S. Thurnher, "Means and Method of the Future: Autonomous Systems," In *Targeting: The Challenges of Modern Warfare*, Asser Press (2016): 184.

digitalization of the battlespace which suits well the current trend of casualty-averse western society.

### **Casualty Aversion: Digitalization of Battlespace**

Several studies indicate that public tend to tolerate limited military interventions and public support decreases with increasing military casualties.<sup>170</sup> The support for military interventions falls also as civilian casualties increase regardless of the way the civilian group is described or whether the military forces are likely to be successful.<sup>171</sup> CAF targeting doctrine defines the complex phenomenon of collateral damage as “inadvertent casualties and destructions in civilian areas caused by military operations.”<sup>172</sup> The delicate subject of casualty aversion is influenced by collateral damage with essentially three types of casualty aversion: the casualties of one’s own forces (i.e., blue-force attrition), civilian casualties, and adversary/enemy combatant (red force) casualties.<sup>173</sup> Therefore, casualty aversion (also called casualty phobia among the public), which focuses mainly on the first two types to prevent civilians and friendly forces casualties,<sup>174</sup> constitutes a significant influencing factor in Western democracies way of waging war since the end of the Cold War.<sup>175</sup>

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<sup>170</sup> Kuijpers, Dieuwertje and Gijs Schumacher, “Don’t Mention the War Versus Escalating Commitment: Political Party Responses to Military Casualties,” *Foreign Policy Analysis* 16, no. 4 (2020): 587-607; Charles K. Hyde, “Casualty Aversion,” *Aerospace Power Journal* 14, no. 2 (200):17-27.

<sup>171</sup> Johns, Robert and A. M. Davies Graeme, “Civilian Casualties and Public Support for Military Action: Experimental Evidence,” *The Journal of Conflict Resolution* 63, no. 1(2019): 251-281.

<sup>172</sup> Department of National Defence, *B-GJ-005-309/FP-001, Targeting*, (Ottawa: DND Canada, 2014), Glossary-1.

<sup>173</sup> Richard Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 118.

<sup>174</sup> *Ibid.*

<sup>175</sup> Niklas Schornig, and Alexander C. Lembcke, “The Vision of War without Casualties: On the Use of Casualty Aversion In Armament Advertisements,” *The Journal of Conflict Resolution* 50, no. 2 (2006): 204-227.

Political leaders aim to avoid potential casualties when engaging in a war campaign to prevent any domestic challenges to its foreign policy agenda.<sup>176</sup> Public casualty aversion is a strong deterrent to political leaders from initiating and escalating military campaigns in the first place;<sup>177</sup> while it also influences their choice towards the acquisition and use of stand-off weaponry and precision-guided munitions that provide enhanced protection to soldiers while minimizing collateral damage.<sup>178</sup> The ability to apply joint precision effects will remain an important requirement to achieve future military success.<sup>179</sup> Both casualty aversion and security threats are firmly established mechanisms to explain state interest in the generation of military power.<sup>180</sup>

The use of air power writ large and RPA specifically, may also minimize the requirement for boots on the ground. This not only reduces the risk of potential blue force casualties, but also drastically minimizes the cost of the campaign.<sup>181</sup> The empirical test tends to support the aforementioned condition with the overall use of armed RPA by the U.S. government to target members of al-Qaeda grew by 1,200 percent between 2005 and

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<sup>176</sup> Michell, Binding, "Have Autonomous and Unmanned Systems Changed War Fundamentally?," *Canadian Military Journal* 19, no. 1 (2018): 40-45.

<sup>177</sup> During the Bosnia and Croatia conflict that took place from 1992 to 1995, nations who contributed troops to the United Nations Protection Force (UNPROFOR) or even to the North Atlantic Treaty Organization (NATO) were unwilling to expose their troops to unnecessary risk let alone to engage them into battle; Michell, Binding, "Have Autonomous and Unmanned Systems Changed War Fundamentally?," *Canadian Military Journal* 19, no. 1 (2018): 40-45.

<sup>178</sup> Hansel Mischa, and Simon Ruhnke, "A revolution of Democratic Warfare? Assessing Regime Type and Capability-Based Explanations of Military Transformation Processes," *International Journal* 72, no. 3, (2017): 356-379.; Niklas Schornig, and Alexander C. Lembcke. "The Vision of War without Casualties: On the Use of Casualty Aversion In Armament Advertisements," *The Journal of Conflict Resolution* 50, no. 2 (2006): 204-227.

<sup>179</sup> *The Future Security Environment*, 96.

<sup>180</sup> Moritz Weiss, "How to become a First Mover? Mechanisms of Military Innovation and the Development of Drones," *European Journal of International Security* 3, no. 2 (2018): 187-210.

<sup>181</sup> Dr. Sebastian Ritchie, "UK Air Power in Operation Unified Protector, Libya 2011," *Air Power review* 21, no.3 (2018): 104.

2013 both within and outside theatres of conflict.<sup>182</sup> However, there are growing concerns regarding RPA and civilian casualties.

The US-led reliance on RPA technology has raised concerns about the virtualization of violence. RPA warfare de-humanizes victims who are “reduced to anonymous simulacrum that flickers across the screen”<sup>183</sup> and distances RPA operators physically and psychologically from the destructive and lethal actions.<sup>184</sup> Civilian casualties and RPA operations also alienate local populations and further reduce their willingness to provide intelligence while generate grievances that can further prolong the conflict.<sup>185</sup> The populations that live under a constant anticipation of RPA attack experiences significant psychological harm, including post-traumatic stress disorder.<sup>186</sup> Their fear of RPA attacks cripple daily activities and creates largely unaccounted socioeconomic burdens, particularly on women.<sup>187</sup> David Hastings Dunn characterizes RPA as a “disembodied threat that enables its use with domestic political impunity, minimal international response and political risk and cost.”<sup>188</sup> The aforementioned concerns about the virtualization of violence has increased legal challenges and scrutiny over RPA operations.

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<sup>182</sup> Dr Shima D. Keene, “Lethal and Legal? The ethics of Drone Strikes,” United States Army War College, (2015): 1.

<sup>183</sup> Alex Edney-Browne, “Embodiment and Affect in a Digital Age Understanding Mental Illness among Military Drone Personnel,” *Krisis* no. 1 (2017)

<sup>184</sup> *Ibid.*

<sup>185</sup> United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>

<sup>186</sup> *Ibid.*; Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 153.

<sup>187</sup> United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>

<sup>188</sup> David H. Dunn, “Drones: Disembodied Aerial Warfare and The Unarticulated Threat,” *International Affairs* 89, no. 5 (2013): 1238; Michael J. Boyle, “The Race for Drones,” *Orbis, Foreign Policy Research Institute* (2015): 89.

## Ethical Concerns and Legal Challenges to Remote Warfare

Back in 2013, United States President Barack Obama stated that because RPA operations do not attract the same level of public scrutiny that a troop deployment does, the typical decision-making barriers to the use of force become eroded due to the little or no risk to those directing or operating RPA, including of legal accountability.<sup>189</sup> The intensive CIA or the Joint Special Operations Command (JSOC) targeted killing in Yemen, Pakistan, Somalia and outside conventional battlefields caused significant collateral damages for which, it is near impossible to determine the exact counts of innocent civilian or non-combatants casualties.<sup>190</sup> The two-decades' long Afghanistan war seriously undermined the public perception of the RPA warfare and raised valid ethical questions related to its employment and precision.<sup>191</sup> It is further compounded by the legitimacy of the conduct of RPA military operations against individuals labeled by one party as “terrorists” to justify the violation of state borders and sovereignty.<sup>192</sup> A further ethical consideration relates to psyche of the RPA operator, based thousands of miles from the battlefield and hence faces no risk as a result of the geographical distance.<sup>193</sup> The ethical concern related to physical distance of RPA operators is compounded by the concern arising from the perceived disconnected “PlayStation” mentality to killing of

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<sup>189</sup> United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>

<sup>190</sup> Human Rights Watch, “A Wedding That Became a Funeral,” 19 February 2014, Accessed 6 September 2021, <https://www.hrw.org/report/2014/02/19/wedding-became-funeral/us-drone-attack-marriage-procession-yemen>; Michael, Byers and Franks Kelsey, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs.” *Canadian Foreign Policy* 20, no. 3 (2014): 283.

<sup>191</sup> Human Rights Watch, “A Wedding That Became a Funeral,” 19 February 2014, Accessed 6 September 2021, <https://www.hrw.org/report/2014/02/19/wedding-became-funeral/us-drone-attack-marriage-procession-yemen>

<sup>192</sup> *Ibid.*

<sup>193</sup> Dr Shima D. Keene, “Lethal and Legal? The ethics of Drone Strikes,” United States Army War College, (2015): 21. This is discussed further in Chapter 5.

RPA operators.<sup>194</sup> An increase in physical and cognitive distance from the target “lessens the degree of responsibility and guilt felt for one’s action, making it easier to kill.”<sup>195</sup> The technological distancing aims at developing asymmetry and invulnerability by elevating oneself above one’s enemy and allowing not only a geographical distance but also a moral or cognitive distance with potential significant consequences for the rule of law and judgement in killing.<sup>196</sup>

Since the use of military force has long been considered the main threat to international peace and security, the UN Charter made clear in Article 2(4) that all member states shall refrain in their international relations from the threat or use of force. The only two exceptions to the general prohibition of the use of force are a collective enforcement mandate issued by the UN Security Council and the right of self-defence defined in article 51.<sup>197</sup> All use of force for national self-defence or the individual use of force in the conduct of military operations is governed by the principles of imminence, necessity and proportionality.<sup>198</sup>

A Non-International Armed Conflict is defined as the use of force between the armed forces of state against one or more organized armed groups or between two or more such groups. The determination of the use of force during non-international armed

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<sup>194</sup> Ministry of Defence, Joint Doctrine Publication 0-30.2, “Unmanned Aircraft Systems,” Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302> 48.; Dr Shima D. Keene, “Lethal and Legal? The ethics of Drone Strikes,” United States Army War College, (2015): 22.

<sup>195</sup> Michael, Byers and Franks Kelsey, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs.” *Canadian Foreign Policy* 20, no. 3 (2014): 283.

<sup>196</sup> Ioannis Kalpouzos, “Double Elevation: Autonomous Weapons and the Search for an Irreducible Law of War.” *Leiden Journal of International Law* 33, no. 2 (2020): 297.

<sup>197</sup> Warren, Aiden and Ingild Bode, “Altering the Playing Field: The U.S. Redefinition of the use-of-Force.” *Contemporary Security Policy* 36, no. 2 (2015):174.

<sup>198</sup> JFR Boddens, Hosang, “The Effects of Paradigm Shifts on the Rules on the use of Force in Military Operations.” *Netherlands International Law Review* 64, no. 3 (2017): 353-373; Warren, Aiden and Ingild Bode, “Altering the Playing Field: The U.S. Redefinition of the use-of-Force.” *Contemporary Security Policy* 36, no. 2 (2015):174.

conflict must be based on the conduct of the group carrying out hostilities against government forces.<sup>199</sup> These legal distinctions have consequences for the use of air power in general and RPA in particular as the preferred option of national power.

These factors, along with the fundamental cognitive and physical distance characteristics in the operation of RPA away from the battlespace, has placed RPA under greater scrutiny. As more government and non-state actors acquire armed RPA, the UN Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions raises the prospect of war being normalized as a necessary companion to peace and killing might be justified by state actors on the grounds of necessity and not imminence.<sup>200</sup> The growing use of RPA increases the danger of states reinterpreting the law of self-defence under article 51 of the UN Charter; hence the legitimate concerns of human rights organizations, UN Special Rapporteurs and national parliaments that RPA proliferation has the potential of lower threshold use of force by both state and non-state actors.<sup>201</sup>

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<sup>199</sup> Boddens J.F.R. Hosang, “The Effects of Paradigm Shifts on the Rules on the use of Force in Military Operations,” *Netherlands International Law Review* 64, no. 3 (2017): 353-373.

<sup>200</sup> United Nations, “All drone strikes in self-defence should go before Security Council, argues independent rights expert,” 9 July 2020, Accessed 7 November 2021, <https://news.un.org/en/story/2020/07/1068041>

<sup>201</sup> PAX Unmanned Ambitions, “Security Implications of growing proliferation in emerging military drone markets,” 23 August 2018, Accessed 4 September 2021, <https://paxforpeace.nl/what-we-do/publications/unmanned-ambitions:4>; United Nations, “All drone strikes in self-defence should go before Security Council, argues independent rights expert,” 9 July 2020, Accessed 7 November 2021, <https://news.un.org/en/story/2020/07/1068041>. RPA strikes pose challenges on International Law as its legality under Article 51 of the Charter does not preclude “its wrongfulness under international humanitarian or human rights law. Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 152. In January 2020, the U.S. conducted a RPA strike against a high-level Iranian official, Major General Qasem Soleimani, on the territory of a third state (Iraq in this case). United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>. Furthermore, International Law (Articles 2.4 and 51 of the United Nations Charter on self-Defense) “prohibits a member state from using armed force except in cases of genuine and strict legitimate defense.” Although the United Nations Charter is applicable only in the context of relations between states, “the International Court of Justice judges understand that the self-defence article can also be invoked when the armed attack comes from a non-state actor.” However, there is not yet a universally shared opinion whether armed attack, be it by RPA strikes under the cover of self-defence or against a non-state actor on the territory of a sovereign state that does not give its permission, would be in conformity with existing International Law.<sup>201</sup> Cesareo G. Espada, “Counter-Drone Defense

The interpretation of International Law for the use of armed RPA remains an open question that continues to challenge the international legitimacy of armed RPA missions. In 2013, the Special Rapporteur on extrajudicial, summary or arbitrary executions warned that the use of armed RPA could “structurally damage the cornerstones of international security and undermine the protection of life across the globe.”<sup>202</sup> RPA could be seen as the ideal use of air power, “vertical and immune from all physical restraints: State territory is thus neutralised and reduced to a uniform field of observation subject to sudden lethal projections of violence.”<sup>203</sup> By virtue of this vertical power, not only the individual but sovereignty of states is compressed.<sup>204</sup>

In addition, in the absence of armed conflict, the International Human Rights Law (IHRL) only authorizes the intentional use of lethal force when “strictly necessary and proportionate to protect against a threat to life where there are no other means of preventing that threat to life.” Hence, “targeted killings,” which are typically intentional and premeditated killings, cannot be lawful under IHRL.<sup>205</sup> It is therefore not surprising that the UN Special Rapporteur on extrajudicial, summary or arbitrary executions

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Systems in the Light of International Law,” *The Journal of Applied Business and Economics* 22, no. 11 (2020): 105-118, <https://www-proquest-com.cfc.idm.oclc.org/scholarly-journals/counter-drone-defence-systems-light-international/docview/2497234613/se-2?accountid=9867>

<sup>202</sup> United Nations, “Use of armed drones for targeted killings,” 29 June 2020, Accessed 6 September 2021, <https://undocs.org/en/A/HRC/44/38>

<sup>203</sup> Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 152.

<sup>204</sup> *Ibid.*

<sup>205</sup> Living Under Drones, “Death, Injury and Trauma to civilians From US Drone Practices in Pakistan,” 25 September 2012, Accessed 7 November 2021, <https://www-cdn.law.stanford.edu/wp-content/Uploads/2015/07/Stanford-NYU-Living-Under-Drones.pdf>



qualified the RPA strike against Major General Qasem Soleimani mentioned above as a violation of the UN Charter.<sup>206</sup>

For air power to be successful in the future, it must be acceptable for an ethical and moral perspective.<sup>207</sup> The use of RPA clearly remains a legal challenge. Hence, the CAF as a military institution needs to maintain awareness of the legal implications of technologies for integration into CAF capability portfolio. It is particularly true for the RCAF when considering the integration of RPA to enhance current and future delivery of air power throughout the spectrum of operations to meet Canadian defence and non-defence missions in an increasingly complex security and defence environment.<sup>208</sup>

## **Conclusion**

The distinguishing characteristics of RPA have significantly impacted current and future warfare. Unencumbered by human performance or physiological characteristics, RPA can achieve extreme persistence that far exceeds inhabited air assets and maneuverability. The rise of AI is expected to bring about the greatest potential change in how RPA operates. Furthermore, the increased casualty aversion in the public eyes has influenced the choice towards the acquisition and use of stand-off weaponry and precision-guided munitions.

The interpretation of International Law for the use of armed RPA remains an open question that continues to challenge the international legitimacy of armed RPA missions. However, “targeted killings,” which are typically intentional and premediated killings,

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<sup>206</sup> United Nations, “All drone strikes in self-defence should go before Security Council, argues independent rights expert,” 9 July 2020, Accessed 7 November 2021, <https://news.un.org/en/story/2020/07/1068041>

<sup>207</sup> Clive Blount, “Staying Relevant: The Future Utility of Air Power” *Air Power Review* 20, no. 1 (2017): 113.

<sup>208</sup> *The Future Security Environment*, 109.

cannot be lawful under IHRL. For air power writ large and RPA specifically, it must be acceptable for an ethical and moral perspective to be successful in the future.

Based on the analysis of RPA fundamental characteristic by leveraging air power doctrinal framework and despite its limitations, RPA is well suited to meet the challenges presented by an increasingly complex security and defence environment highlighted in Chapter 2. Therefore, the ability of RPA to perform RCAF current and core capabilities would position well this platform for potential integration into the RCAF.

## CHAPTER 4 – RCAF CURRENT AND FUTURE CORE CAPABILITIES

*If we lose the war in the air, we lose the war, and we lose it very quickly.*

- Field Marshal Bernard Montgomery

### Introduction

Canadian Defence Policy recognizes that the success of the CAF in a complex and evolving security environment relies on fielding advanced capabilities to keep pace with allies while maintaining a war-winning advantage over adversaries. As demonstrated in Chapter 2, this policy is grounded in a comprehensive analysis of the global security environment.<sup>209</sup> However, a certain amount of caution is warranted for the CAF in attempting to frame a complex and evolving future security environment, considering its uncertainty and unpredictability.<sup>210</sup>

This chapter addresses such concerns by exploring the current and future air power core capabilities of the RCAF, its Five Eyes partners along with NATO. With particular focus on consistent doctrinal application of RPA, it will dive into the Five Eyes and NATO current applications and future vision in terms of RPA employment. Considering the advancement in RPA operational capabilities observed for the past decades, it is anticipated that the Five Eyes partners and NATO intends to increase the reliance on RPA platforms in conducting kinetic strikes and ISR. Moreover, this chapter will explore specific institutional challenges such as the anticipated RCAF pilot and technician shortages, leadership, and Human/Machine Integration that could potentially undermine the integration of a new capability into operational services. In addition, to

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<sup>209</sup> *Strong, Secure, Engaged*, 14.

<sup>210</sup> Brad W. Gladman, “The future of allied air power: The Royal Australian Air Force,” Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 26.

harness the full capabilities of fifth-generation platforms, the RCAF may need a transformation of traditional organizational structures, concept of operations and training.

### **RCAF Current and Future Core Capabilities**

To assist RCAF future development and planning, Dr Brad W. Gladman proposes a comprehensive understanding of the capability investment and concept development initiatives that Canada's key allies are exploring. This would in turn inform the understanding of the future directions in warfare which would then enlighten the CAF development of military capability requirements.<sup>211</sup> Furthermore, this approach would mitigate an attempt to frame an unpredictable future security environment and is consistent with Canada's defence commitments centred on interoperability of future military capability.<sup>212</sup>

RCAF core capabilities include Control of the Air, Air Attack, Air Mobility, and ISR.<sup>213</sup> Control of the Air provides friendly forces with the freedom to conduct operations at the time and place of their choosing without prohibitive adversary interference. The Air Attack capability includes the air roles of counter-land and counter-sea which are in support of land and naval forces operations. The core Air Mobility capability relates in its broadest form to the delivery of personnel and materiel by air regardless of the platform

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<sup>211</sup> Brad W. Gladman, "The future of allied air power: The Royal Australian Air Force," Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 26; Brad W. Gladman, "The future of allied air power: The United States Air Force," Defence Research and Development Canada, October 2014, Accessed 3 February 2022, [https://publications.gc.ca/collections/collection\\_2015/rddc-drdr/D68-2-82-2014-eng.pdf](https://publications.gc.ca/collections/collection_2015/rddc-drdr/D68-2-82-2014-eng.pdf). 54.

<sup>212</sup> *The Future Security Environment*, 24; Brad W. Gladman, "The future of allied air power: The Royal Australian Air Force," Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 26

<sup>213</sup> According to the RCAF doctrine, a capability is the ability to carry out a military operation to create an effect and air power effects are delivered through air power capabilities. The RCAF distinguishes core and enabling air power capabilities with the former being a set of direct air power effects that leverage air power's strengths and advantages. Enabling capabilities play an essential part in accomplishing the mission. *Royal Canadian Air Force Doctrine*, 31.

type and across the spectrum of conflict. Air mobility includes the airlift, air-to-air refueling and search and rescue roles. Finally, ISR encompasses both the activities of Processing, Exploitation and Dissemination along with the platforms assigned to information collection. ISR is part of a multi-environment, multi-agency and often a multinational capability to gain situational awareness and subsequent decision superiority.<sup>214</sup>

Space capability was integrated within RCAF portfolio as this new domain leadership responsibility since 1 July 2016.<sup>215</sup> It is expected that the current RCAF doctrinal core capabilities may evolve soon to reflect the delivery of air and space power. RCAF Vectors and force development considerations already highlight the development of a balanced mix of air and space capabilities that includes inhabited and uninhabited remotely operated systems with a varying level of autonomy which can operate anywhere in Canada and its approaches.<sup>216</sup>

Notwithstanding the potential amendment of RCAF doctrinal core capabilities, the RCAF “must increase interoperability”<sup>217</sup> with its Five Eyes and NATO allies to maintain a war-winning capability. This requires the seamless integration of RCAF air and space power to remain relevant in the defence of North America and as part of Canada’s contribution warfare approach now and into the future.<sup>218</sup> In a battlespace where speed and broad interoperability translate to significant advantage, proprietary developments is

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<sup>214</sup> *Royal Canadian Air Force Doctrine*, 33-37.

<sup>215</sup> *Royal Canadian Air Force Vectors*, iv.; Government of Canada. “RCAF leads Canadian Armed Forces space initiatives,” Accessed 29 January 2022, <https://rcf-arc.forces.gc.ca/en/article-template-standard.page?doc=rcf-leads-canadian-armed-forces-space-initiatives/jyk96x80>

<sup>216</sup> *Royal Canadian Air Force Vectors*, ix; FAOC, 22.

<sup>217</sup> *Royal Canadian Air Force Vectors*, 2.

<sup>218</sup> *Ibid.*

increasingly a national security liability.<sup>219</sup> In addition, as allies are moving towards multi-domain operations, cross-domain synergy based on deeper inter-domain connectivity, and applied holistically with other instruments of national power, are at the heart of new pan-domain thinking.<sup>220</sup> Therefore, it is paramount that RCAF air power core capabilities seamlessly integrate into its allies and coalition partners.

### **Five Eyes and NATO Use of RPA: Vision and Applications**

#### **USAF**

Following the formation of the United States Space Force (USSF) in 2019, as the sixth independent branch of the U.S. Armed Forces purposely built to compete and deter in the space domain, the USAF mission statement has been altered to exclude space and cyberspace. This alteration highlights the USAF's sole focus on air power while maintaining core air domain missions. The five USAF core missions include Air Superiority, Global Strike, Rapid Global Mobility, ISR and command and control (C2).<sup>221</sup> Air Superiority is the ability to control the air using the right mix of capability and capacity regardless of the threat. Global Strike entails the capability to attack at a time and place of USAF choosing. USAF both conventional and nuclear strike must be integrated, precise and can be delivered through standoff and penetrating platforms. Rapid Global Mobility consists of the projection and sustainment of combat power by moving personnel, material, fuel, and supplies across the globe, in and through permissive

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<sup>219</sup> Harris Alberts, "Preparing for Multidomain Warfare: Lessons from Space/Cyber Operations," *Air & Space Power Journal* 32, no. 3 (2018): 39.

<sup>220</sup> *Ibid.*, 29; *Pan-Domain Force Employment Concept*, 6.

<sup>221</sup> Airforce Technology, "US Air Force announces release of its new mission statement," \* april 2021, Accessed 29 January 2022, <https://www.airforce-technology.com/news/us-air-force-new-mission-statement/>; Department of the Air Force, "Department of the Air Force Posture Statement Fiscal Year 2022," Accessed 29 January 2022, [https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20\(v23.1\)1.pdf](https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20(v23.1)1.pdf) 6.

and contested threat environments on short timelines. The USAF conducts ISR missions to analyze, inform, and provide joint force commanders with the knowledge needed to achieve decision advantage. Finally, C2 of the joint force is the inherent ability to outthink adversaries through an agile military that operates seamlessly across domain at both speed and scale.<sup>222</sup>

The USAF pursue the development of RPA when it is justified within the Core Function Master Plan Mission Integration (CFMP) construct as an alternative to an inhabited platform. The CFMP links strategic planning and programming to enhance USAF contribution to the joint fight. In some instances, RPA may provide advantages and opportunities; however some missions are better suited for inhabited platforms based on factors such as interoperability of data systems or airspace access constraints.<sup>223</sup>

The USAF RPA Vector shares a vision of the next-generation RPA that is capable of operating in contested and A2/AD [anti-access/area denial] environments and strike quickly from over the horizon while further enabling cross-domain synergies in adverse weather.<sup>224</sup> Another future critical capability for which the USAF has invested in is the “manned-unmanned Teaming (MUMT) operations. This capability would provide, low-

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<sup>222</sup> Department of the Air Force, “Department of the Air Force Posture Statement Fiscal Year 2022,” Accessed 29 January 2022, [https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20\(v23.1\)1.pdf](https://www.armed-services.senate.gov/imo/media/doc/FY22%20DAF%20Posture%20Statement%20-%20Final%20(v23.1)1.pdf) 6-12.

<sup>223</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 15 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf>. 48, 49.

<sup>224</sup> In addition, next-generation RPA must be, multi-mission capable, net-centric, interoperable and must employ appropriate levels of autonomy with long-range, long-endurance capability. It should also be able to carry any standard payload within their performance envelope with an adjustable explosive yield and provide multimode seeker capability. United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 15 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf>. 30.

cost and expendable fighter-like RPA not remotely controlled from the ground like existing RPA, capable of collaborative operations with inhabited assets such as the F-16 to fly as a “loyal wingmen” to scout terrain, confuse or overwhelm radar defenses, deliver lethal weapons or even swarm an adversary in a contested environment.<sup>225</sup> The long-range, high speed and maneuverable XQ-58A Valkyrie and UTAP-22 Mako loyal wingmen RPA have been developed to this end.<sup>226</sup>

During the first drone age (see Literature Review section in Chapter 1), RPA was also used to provide Close Air Support and over-watch for friendly forces deployed as part of the Global War on Terror (GWOT). The long-endurance and payload capabilities of RPA have enabled extended time over target which allows for enhanced situational awareness and direct support to warfighters.<sup>227</sup> The AGM-114 Hellfire missile strike, launched from a MQ-1 Predator, to eliminate Taliban’s supreme commander Mullah Omar, demonstrated the delivery of air power from uninhabited aircraft that possessed

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<sup>225</sup> Michael J. Boyle, “The Drone Age: How Drone Technology Will Change War And Peace,” Oxford Scholarship Online, (2020): 288.

<sup>226</sup> Kratos Defense, “Tactical UAVs,” Accessed 3 February 2022, <https://www.kratosdefense.com/systems-and-platforms/unmanned-systems/aerial/tactical-uavs>; Michael J. Boyle, “The Drone Age: How Drone Technology Will Change War And Peace,” Oxford Scholarship Online, (2020): 288.

<sup>227</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 18 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 54; James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 483. RPA such as MQ-1 Predator, MQ-9 Reaper and unarmed RQ-4 Global Hawk became symbolic of a post-9/11 period that spearheaded the deployment of American and allied forces. RPA power projection was introduced to the world at the opening stage of Operation Enduring Freedom over Afghanistan on 7 October 2001. John D. Duray, “Remotely Piloted Aircraft Operations: Lessons Learned and Implications for Future Warfare”, *Mitchell Institute For Aerospace Studies*, no. 28 (2019): 2.



unparalleled loiter and ISR capabilities.<sup>228</sup> Alternatively, it could be considered the turning point when RPA went from being eyes to full-fledged offensive tools.<sup>229</sup>

Further advancement in RPA operational capabilities has led to its increased USAF reliance in conducting ISR and kinetic strikes.<sup>230</sup> Today, the primary mission of RPA is to conduct globally integrated ISR as an airborne ISR collection platform and to support ISR analysis and PED. Other RPA applications as a subsets of the core ISR function includes, battle damage assessment (BDA) and Strike Coordination and Reconnaissance (SCAR).<sup>231</sup>

RPA also support Personnel Recovery missions by enabling identification and communication capabilities with isolated U.S. military and civilians. In the past, Predator and RQ-4 Global Hawk have also supported humanitarian assistance missions after natural and human-induced disasters by tracking wildfires, flood impact areas, nuclear reactor damage and locations of isolated personnel.<sup>232</sup> The Pentagon estimates RPA will make up seventy percent of USAF aircraft by 2035.<sup>233</sup> The USAF has paved the way for allies to increase the integration of RPA in the delivery of air power.

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<sup>228</sup> John D. Duray, “Remotely Piloted Aircraft Operations: Lessons Learned and Implications for Future Warfare”, *Mitchell Institute For Aerospace Studies*, no. 28 (2019): 2.

<sup>229</sup> *Ibid.*; Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 149.

<sup>230</sup> John D. Duray, “Remotely Piloted Aircraft Operations: Lessons Learned and Implications for Future Warfare”, *Mitchell Institute For Aerospace Studies*, no. 28 (2019): 2.

<sup>231</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 18 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 52.

<sup>232</sup> *Ibid.*, 54, 56. This role will increase for National Guard units especially with the integration of new platform capabilities that may deliver supplies (food, water, blankets) or land to recover personnel.

<sup>233</sup> Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 150.

## Royal Air Force

According to the Joint Doctrine Publication (JDP) 0-30, United Kingdom (UK) Air and Space Power, which is the keystone air and space domain publication, there are four roles of Royal Air Force (RAF) air power. They are: Control of the air to secure freedom of action within the air environment; Intelligence, surveillance and reconnaissance to inform the development of understanding across all environments; Attack can coerce and influence actors in changing or maintaining behaviour; and Air mobility enables movement, manoeuvre and sustainment.<sup>234</sup> Several of these roles apply to the RAF's RPA capabilities.

The RAF deployed its ten-strong fleet of armed RPA platform MQ-9 Reaper during the war in Afghanistan, Iraq, and Syria from 2007 to 2019. Furthermore since 2019, UK Reapers are also conducting military operations outside Iraq and Syria however, the government has not disclosed the purpose of the RPA sorties or the area of operation.<sup>235</sup> Although capable of kinetic strike, UK MQ-9 Reaper conducted ISR during 80% of its assigned missions.<sup>236</sup>

In October 2015, the UK Prime Minister announced the procurement of the newest version of the MQ-1 Predator, called SkyGuardian by its manufacturer General Dynamics and Protector by the RAF, to double the UK fleet of armed RPA.<sup>237</sup> Scheduled

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<sup>234</sup> Ministry of Defence, "Joint Doctrine Publication 0-30 UK Air and Space Power," Accessed 24 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/668710/doctrine\\_uk\\_air\\_space\\_power\\_jdp\\_0\\_30.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/668710/doctrine_uk_air_space_power_jdp_0_30.pdf). 4.

<sup>235</sup> Drone Wars, "An overview of Britain's drones and drone development projects," February 2021, Accessed 23 January 2022, <https://dronewars.net/british-drones-an-overview/>

<sup>236</sup> Ministry of Defence, "Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems," Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf)

<sup>237</sup> Drone Wars, "An overview of Britain's drones and drone development projects," February 2021, Accessed 23 January 2022, <https://dronewars.net/british-drones-an-overview/>

to enter operational service by 2024, the Protector will be certified to fly unrestricted in UK airspace and meet NATO airworthiness standards while its extended wings and fuel tanks will enable persistence over 40 hours.<sup>238</sup>

In July 2019, Ministry of Defence (MoD) announced the contract award for the development of a new “loyal wingman” RPA under a project name “Mosquito.”<sup>239</sup> The vision associated with the “loyal wingman” is to fly with a high degree of autonomy alongside or slightly ahead of inhabited aircraft to perform various tasks such as ISR, electronic warfare, target designation, air-to-air or air-to-ground strikes.<sup>240</sup> Lastly, the MoD is also undertaking development around swarming with up to 20 small RPAs under the ALVINA programme.<sup>241</sup> The UK’s Armed Forces Chief of Defence Staff estimates RPA will make up 80% of RAF fleet by 2030<sup>242</sup> with a game-changing mix of swarming drones, and mixed formations of uncrewed combat aircraft as well as next-generation piloted aircraft.<sup>243</sup> The Royal Australian Air Force (RAAF) is embarking on a similar air power capability transformation.

### Royal Australian Air Force

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<sup>238</sup> Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 22; Drone Wars, “An overview of Britain’s drones and drone development projects,” February 2021, Accessed 23 January 2022, <https://dronewars.net/british-drones-an-overview/>

<sup>239</sup> Drone Wars, “An overview of Britain’s drones and drone development projects,” February 2021, Accessed 23 January 2022, <https://dronewars.net/british-drones-an-overview/>

<sup>240</sup> *Ibid.*

<sup>241</sup> GOV.UK, “Swarming drones concept flies closer to reality,” Accessed 14 February 2022, <https://www.gov.uk/government/news/swarming-drones-concept-flies-closer-to-reality>; Drone Wars, “An overview of Britain’s drones and drone development projects,” Accessed 23 January 2022, <https://dronewars.net/british-drones-an-overview/>;

<sup>242</sup> AIRFORCE TECHNOLOGY, “Future RAF will mix crewed fighters, UAVs and swarming drones: CDS,” 31 March 2021, Accessed 14 February 2022, <https://www.airforce-technology.com/features/future-raf-will-mix-crewed-fighters-uavs-and-swarming-drones-cds/>

<sup>243</sup> GOV.UK, “The Chief of the Air Staff’s speech at the Global Air Chiefs’ Conference 2021,” Accessed 14 February 2022, <https://www.gov.uk/government/speeches/the-chief-of-the-air-staffs-speech-at-the-global-air-chiefs-conference-2021>

According to the Air Force Capability Guidebook 2020, the RAAF air power core roles include Control of the Air, Strike, Air Mobility, Intelligence, Surveillance and Reconnaissance.<sup>244</sup> Control of the air is the ability “to conduct operations in the air, land and maritime domains without effective interference from adversary air and air defence capabilities.”<sup>245</sup> Strike is the ability to attack with the intention of damaging, neutralizing or destroying a target and can be conducted with weapons to deliver lethal or non-lethal effects while minimizing risk of collateral damage. Air mobility is the ability to move personnel and material using airborne platforms within or between theatres of operations. Air mobility also includes air-to-air refueling. Lastly, the ISR role synchronizes and integrates the planning and operation of sensors, assets, PED systems in support of joint operations to enable decision superiority.<sup>246</sup>

Back in August 2020, the Australian Defence Minister announced the acquisition of up to seven MQ-4C Triton RPA for the RAAF to provide advanced maritime patrol and surveillance capability.<sup>247</sup> The MQ-4C Triton is a high-altitude, long endurance RPA, capable of all-weather surveillance and reconnaissance tasks over maritime and land environments. The MQ-4C Triton builds on elements of the RQ-4 Global Hawk that include reinforcements to the airframe and wing, along with de-icing and lightning protection systems to allow the MQ-4C Triton to descend through cloud layers and gain a closer view of ships and other targets at sea. The fleet of MQ-4C Triton will operate

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<sup>244</sup> Air and Space Power Centre, “Air Force Capability Guidebook 2020,” Accessed 24 January 2020, <https://airpower.airforce.gov.au/publications/air-force-capability-guide-2020>. 23.

<sup>245</sup> *Ibid.*

<sup>246</sup> *Ibid.*, 23, 24.

<sup>247</sup> Australian Aviation, “Australia Invests \$1.3BN In New Drone Defence Program,” 6 August 2020, Accessed 23 January 2022, <https://australianaviation.com.au/2020/08/australia-invests-1.3bn-in-new-drone-defence-program/>; Royal Australian Air Force, “Air Force Capacity Guidebook 2020,” Accessed 23 January 2022, <https://airpower.airforce.gov.au/publications/air-force-capability-guide-2020>. 70.

alongside the RAAF 15-strong aircraft fleet of P-8A Poseidon and is expected to enter operational service by 2023 at RAAF Base Edinburgh with a forward base at RAAF Base Tindal.<sup>248</sup>

With the acquisition of fifth-generation platforms such as the F-35A Lightning II fighter, the P-8A Poseidon and MQ-4C Triton, the Australian Defence Force and RAAF embarked on a considerable amount of institutional transformation through Plan Jericho to harness the potential of fifth-generation platforms capabilities.<sup>249</sup> The specific vision of Plan Jericho is “to develop a future force that is agile and adaptive, fully immersed in the information age and truly joint.”<sup>250</sup>

In May 2020, the Australian Prime Minister announced a historic investment in the Boeing Loyal Wingman RPA program (now referred to as the MQ-28A Ghost Bat designation)<sup>251</sup> which is designed to explore how autonomous uninhabited aircraft can support existing inhabited aircraft such as the Joint Strike Fighters, Super Hornets and Growlers from ISR to tactical early warning and more.<sup>252</sup> The Head of RAAF Capability highlighted that the teaming of the Loyal Wingman RPA with air power platforms opens up significant capability agility for the RAAF, particularly with features such as the Loyal

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<sup>248</sup> Royal Australian Air Force, “Air Force Capacity Guidebook 2020,” Accessed 23 January 2022, <https://airpower.airforce.gov.au/publications/air-force-capability-guide-2020>. 70.

<sup>249</sup> Brad W. Gladman, “The future of allied air power: The Royal Australian Air Force,” Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 22.; Royal Australian Air Force, “Plan Jericho- At the Edge,” Accessed 31 January 2022, <https://raafsca.files.wordpress.com/2012/10/plan-jericho-booklet.pdf>. 3.

<sup>250</sup> Royal Australian Air Force, “Plan Jericho- At the Edge,” Accessed 31 January 2022, <https://raafsca.files.wordpress.com/2012/10/plan-jericho-booklet.pdf>. 3.

<sup>251</sup> ADBR, “Loyal Wingman given MQ-28A Ghost Bat Designation,” 21 March 2022, Accessed 26 March 2022, <https://adbr.com.au/loyal-wingman-given-mq-28a-ghost-bat-designation/>

<sup>252</sup> Prime Minister of Australia, “Media Release 05 May 2020 Prime Minister, Minister for Defence, Minister for Defence Industry,” Accessed 24 January 2022, <https://www.pm.gov.au/media/air-force-and-boeing-roll-out-first-loyal-wingman-aircraft>; Boeing, “Boeing Airpower Teaming System,” Accessed 24 January 2022, <https://www.boeing.com/defense/airpower-teaming-system/>

Wingman reconfigurable nose.<sup>253</sup> Following the above review of the current and future air power core capabilities of the Five Eyes, the next paragraph will now explore NATO air power core capabilities.

## NATO

According to the NATO 2010 Strategic Concept, the alliance's core tasks are: Collective defence, crisis management and cooperative security.<sup>254</sup> NATO Joint Air Power (JAP) plays a key role in the accomplishment of the core tasks and identifies counter-air, attack, air mobility and contribution to Joint Information, Surveillance and Reconnaissance (JISR) as interdependent core roles. Counter-air operations enable to achieve a desired degree of control of the air at a certain place and/or time primarily by opposing the adversary's air power. JAP's decisive influence can be exercised through its attack role which can be executed on very short notice. JAP's speed and responsiveness support a wide range of air mobility functions in support of NATO's core tasks. JAP's continuous contribution to JISR allows for the rapid collection of information for enhanced awareness in support of decision-making, planning, preparation and execution of operations at all levels.<sup>255</sup>

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<sup>253</sup> Australian Government Department of Defence, "Australia's Loyal Wingman surges ahead," Accessed 16 February 2022, <https://news.defence.gov.au/media/media-releases/australias-loyal-wingman-surges-ahead>

<sup>254</sup> North Atlantic Treaty Organization Active Engagement, Modern Defence, "Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization," Accessed 29 January 2022, [https://www.nato.int/nato\\_static/assets/pdf/pdf\\_publications/20120214\\_strategic-concept-2010-end.pdf](https://www.nato.int/nato_static/assets/pdf/pdf_publications/20120214_strategic-concept-2010-end.pdf) 7.

<sup>255</sup> North Atlantic Treaty Organization, "NATO's Joint Air Power Strategy," 26 June 2018, Accessed 4 February 2022, [https://www.nato.int/nato\\_static\\_fl2014/assets/pdf/pdf\\_2018\\_06/20180626\\_20180626-joint-air-power-strategy.pdf](https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2018_06/20180626_20180626-joint-air-power-strategy.pdf) 1, 4.

The Alliance has long recognized the fundamental importance of JISR to its strategic preparedness and to the success of its operations and missions.<sup>256</sup> To address the operational shortfalls, witnessed during NATO operations in both Afghanistan and Libya and to enhance the Alliance capability and interoperability, Allied Defence Ministers formally launched NATO Joint ISR project in February 2016.<sup>257</sup> A very important future NATO Joint ISR project is the Alliance Ground Surveillance (AGS) system based on the five-strong fleet of RPA platform RQ-4 Global Hawk along with its deployable ground stations.<sup>258</sup> The AGS will enable wide areas persistent surveillance from high-altitude using advanced radar sensors to detect and track moving objects while providing radar image of areas of interest. The jewel in the crown is the AGS advanced exploitation centre in Sigonella, Sicily where AGS missions will be commended, and intelligence generated.<sup>259</sup> The AGS complements the NATO Airborne Warning and Control System (AWACS). The AWACS will continue to be modernized and extended in service until 2035. At the 2016 NATO summit in Warsaw, NATO leaders launched the Alliance Future Surveillance and Control initiative to determine how NATO will maintain situational awareness and command Allied forces following the AWACS retirement in

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<sup>256</sup> North Atlantic Treaty Organization, "NATO's Capabilities," Accessed 29 January 2022, [https://www.nato.int/cps/en/natolive/topics\\_49137.htm](https://www.nato.int/cps/en/natolive/topics_49137.htm)

<sup>257</sup> Joint Air Power Competence Centre, "How NATO Makes the Unknown Known," 27 June 2016, Accessed 20 January 2022, <https://www.japcc.org/nato-makes-unknown-known/>

<sup>258</sup> DefenseNews, "NATO's new fleet of surveillance drones is deemed mission-ready," 15 February 2021, Accessed 23 January 2022, <https://www.defencenews.com/global/europe/2021/02/15/natos-new-fleet-of-surveillance-drones-is-deemed-mission-ready/>; Joint Air Power Competence Centre, "How NATO Makes the Unknown Known," 27 June 2016, Accessed 20 January 2022, <https://www.japcc.org/nato-makes-unknown-known/>

<sup>259</sup> Joint Air Power Competence Centre, "How NATO Makes the Unknown Known," 27 June 2016, Accessed 20 January 2022, <https://www.japcc.org/nato-makes-unknown-known/>

2035. The solution could include combinations of interconnected air, ground, space inhabited and uninhabited systems to collect and share information.<sup>260</sup>

#### Analysis

Canada's current air power doctrinal core capabilities of Control of the Air, Air Attack, Air Mobility and ISR are closely aligned with the Five Eyes and NATO current air power core capabilities. The Five Eyes and NATO have proven the enhanced capability stemming from the integration of RPA in the conduct of Control of the Air, Air attack specifically CAS and ISR. In addition, the USAF has also demonstrated the enhanced capability provided by RPA in the conduct of HADR operations. With the advance in autonomous vehicles, USAF, RAF, and RAAF allies are exploring the teaming of inhabited and uninhabited platforms capable of collaborative operations as a loyal wingman in a contested environment. That is consistent with RCAF Vectors and force development considerations which already highlight the development of a balanced mix of air and space capabilities that includes inhabited, remotely operated, and autonomous assets to support operations in both contested and uncontested environments.<sup>261</sup> Finally, the USAF is expanding further its RPA applications to all future USAF core capabilities to include Command and Control and Air Mobility.

The RCAF and the CAF, where operators and commanders as a networked force, will need to transcend traditional organizational structures, concept of operations and training. The organization will have to embark on a similar RAAF Plan Jericho transformation to fully harness the capabilities of these fifth-generation platforms into all

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<sup>260</sup> North Atlantic Treaty Organization, "NATO's Capabilities," Accessed 29 January 2022, [https://www.nato.int/cps/en/natolive/topics\\_49137.htm](https://www.nato.int/cps/en/natolive/topics_49137.htm)

<sup>261</sup> FAOC, 26.



aspects of how CAF fights. Finally, it will also transition to a pan-domain force that can deliver air and space power in the information age.<sup>262</sup>

### **RCAF Pilot and Technician Shortages**

People are the RCAF's most valuable resources. They are essential for generating the air and space power of today while concurrently implementing the required changes to evolve and improve the delivery of future air and space power.<sup>263</sup> However, RCAF pilot retention has been a long standing issue.<sup>264</sup> Although the COVID-19 global pandemic has delayed the looming pilot shortage, there is a projected global gap between 34 to 50 thousands pilots by 2025 with the most severe shortages experienced in North America, Asia Pacific and the Middle East.<sup>265</sup> The RCAF is currently short of close to 195 pilots.<sup>266</sup> The efforts to address the RCAF pilot shortage was initiated in 2019 with

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<sup>262</sup> *Pan-Domain Force Employment Concept*, 16.; Royal Australian Air Force, "Plan Jericho- At the Edge," Accessed 31 January 2022, <https://raafsca.files.wordpress.com/2012/10/plan-jericho-booklet.pdf>. 3; Brad W. Gladman, "The future of allied air power: The Royal Australian Air Force," Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 22.

<sup>263</sup> *Royal Canadian Air Force Vectors*, 1. Canada Defence Policy aims to increase the CAF Regular Force to 71,500 total and the Reserve Force to 30,000 total. Department of National Defence, *Strong, Secure, Engaged: Canada's New Defence Policy*, (Ottawa: DND Canada, 2017), 19. Acknowledging that there will always be a cap to the number of CAF military personnel, as of November 2021, the CAF is short of 12,000 regular forces and reservists on top of 10,000 troops that were unavailable for duty for the same reporting period due to be either untrained, sick or injured. National Post, "Military dealing with more than 10,000 unfilled positions amid growing pressures," 18 January 2022, Accessed 29 January 2022, <https://nationalpost.com/pmnl/news-pmnl/canada-news-pmnl/military-dealing-with-more-thna-1000-unfilled-positions-amid-growing-pressures>

<sup>264</sup> Canadian Global Affairs Institute, "RCAF's Pilot Shortage Being Felt in Romania," November 2018, Accessed 18 February 2022, [https://www.cgai.ca/rcafs\\_pilot\\_shortage\\_being\\_felt\\_in\\_romania](https://www.cgai.ca/rcafs_pilot_shortage_being_felt_in_romania). This is also illustrated, for example, in the replacement rate reported by the auditor general in the CF-188 Hornet community, to be 30 newly trained pilots for every 40 leaving the service. Global News, "Canada's Air Force is losing too many experienced pilots-and the clock is ticking," Accessed 18 February 2022, <https://globalnews.ca/news/4945534/canada-air-force-pilot-shortage>

<sup>265</sup> Skies, "Perfect storm: the looming pilot shortage," 11 November 2021, Accessed 30 January 2022, <https://skiesmag.com/features/perfect-storm-looming-pilot-shortage/>

<sup>266</sup> Out of the 1,500 pilots if one adds the 60 pilot unfilled position that were reclassified as Air Operations Officers. The Globe and Mail, "RCAF looking overseas to fill pilot shortage as commercial aviators stay away," 9 May 2021, Accessed 30 January 2022, <https://www.theglobeandmail.com/canada/article-rcaf-looking-overseas-to-fill-pilot-shortgae-as-commercial-aviators/>

Operation EXPERIENCE that focuses on stabilizing and increasing levels of pilot experience while operation TALENT focuses on the quality of life and service of all RCAF personnel and their families.<sup>267</sup>

The aforementioned pilot shortages are compounded by a predicted shortage of aviation mechanics. Between now and 2027, a record number of baby boomers maintenance technicians will be eligible for retirement and will outpace the number of qualified technicians preparing to enter it. The workforce gap is further compounded by a projected 40 percent growth of the airlines' fleet.<sup>268</sup> The RCAF is unlikely to be immune from the global aerospace personnel shortages that could impact its ability to force generate and employ mostly in area with stiff competition with the commercial sectors. The CAF must therefore ensure that personnel employed in the initially niche RPA operation have a challenging and fulfilling career.<sup>269</sup>

### **RCAF Leadership**

A significant cultural challenge is to be anticipated as the RCAF transitions from a force comprised solely of inhabited platforms to a mix of inhabited and uninhabited remotely piloted platforms.<sup>270</sup> Leadership will be key to facilitate the transition and “the selection of the individual who runs the Air Force is important because the development of new ways of fighting depend on the support of senior leaders. It is human nature to pursue initiatives that reinforce vested interests rather than adopt disruptive new weapons

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<sup>267</sup> Government of Canada, “Operation TALENT: Quality of Life – Quality of Service,” Accessed 1 February 2022, <https://www.rcaf-arc.forces.gc.ca/en/services/benefits-military/quality-life-quality-service.page>

<sup>268</sup> Oliver Wyman, “Aviation Growth Is Outpacing Labor Capacity,” Accessed 30 January 2022, <https://www.oliverwyman.com/our-expertise/insights/2017/sep/oliver-wyman-transport-and-logistics-2017/operations/aviation-growth-is-outpacing-labor-capacity.html>

<sup>269</sup> Department of National Defence, *Canadian Forces UAV Campaign Plan*, (Ottawa: DND Canada, 2006), 36. Hereafter “*Canadian Forces UAV Campaign Plan*”

<sup>270</sup> *Ibid.*

and doctrine.”<sup>271</sup> It is difficult to quantify how disruptive to internal RCAF culture RPA introduction could be. However, some friction should be expected as experienced by the RAAF when senior officers wrote about the rise of the “warrior geeks” in reference to RPA and cyber-warfare operators in articles titled “boys Toys a Part of Defence” published in civilian papers.<sup>272</sup> Without the buy-in from the leadership at the top of the organization, innovation cannot succeed as they recognize the need for change and formulate a new way of warfare.<sup>273</sup> To that end, the barriers to the transition will need to be identified while the CAF as whole is also engaged in a culture change led by the Chief, Professional Conduct and Culture.<sup>274</sup>

### **Human/Machine Integration**

The GoC announced on 28 March 2022, that it will now enter into the finalization phase of the procurement of the F-35 fighters with Lockheed Martin and the U.S. government as the replacement of the CF-188 Hornet.<sup>275</sup> In addition, the GoC is committed to replacing the CP-140 Aurora with next generation multi-mission aircraft.<sup>276</sup> The RPA integration with these fifth-generation platforms along with other combat assets within the RCAF, the CA and RCN, and also with key allies will therefore have to be

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<sup>271</sup> Lawrence Spinetta, “The Glass Ceiling for Remotely Piloted Aircraft,” *Air & Space Power Journal* 27, no. 4 (2013): 101-118.

<sup>272</sup> Conrad E. Orr, “Can Unmanned Aircraft Systems meet Canadian Air Power Needs?” *Royal Canadian Air Force Journal* no. 3 (2016): 21.

<sup>273</sup> Gary, Schaub Jr., “JUSTAS for All? Innovation and UAVs in the Canadian forces,” *Defence Studies* 15, no. 2 (2015): 127.

<sup>274</sup> Department of National Defence, “Chief, Professional Conduct and Culture,” Accessed 12 December 2021, <https://www.canada.ca/en/department-national-defence/corporate/organizational-structure/chief-professional-conduct-culture.html>; *Canadian Forces UAV Campaign Plan*, 36.

<sup>275</sup> Government of Canada, Public Works and Government Services Canada, “Canada moves closer to delivering 88 advanced fighter jets for the Royal Canadian Air Force as it begins negotiations with the top-ranked bidder, the United State government and Lockheed Martin, for the F-35,” Accessed 1 April 2022, <https://www.canada.ca/en/public-services-procurement/news/2022/03/canada-moves-closer-to-delivering-88-advanced-fighter-jets-for-the-royal-canadian-air-force-as-it-begins-negotiations-with-the-top-ranked-bidder-th.html>

<sup>276</sup> *Strong, Secure, Engaged*, 39.

considered.<sup>277</sup> It is therefore critical for CAF to foster a culture of innovative and inquiring minds and facilitate the exposure of its members to augmented and virtual reality. This would assist CAF human/machine integration with these fifth-generation platforms by visualizing future complex military problems and familiarity and comfort with the technology.<sup>278</sup>

Regarding the RPA training, the International Society of Air Safety Investigators identified that the key operational and physical difference in uninhabited aircraft is the absence of direct feedback of the aircraft condition, trajectory and surrounding airspace to the pilot and operator.<sup>279</sup> Hence, RPA aircrew training needs to be continually updated and tailored to unique challenges of operating an aircraft remotely.<sup>280</sup>

Finally, as the number of sensors in use in the RCAF from RPA and inhabited platforms multiplies hence exponentially more data becomes available, the intelligence function will be linked with the AI enhancement element as previously discussed in Chapter 3.<sup>281</sup> To make sense of the volume of information collected by various national

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<sup>277</sup> This is to ensure a meaningful contribution to domestic and coalition air operations at the higher level of the conflict spectrum – either in the defence of North America through NORAD or as a part of an expeditionary abroad. Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 14; Brad W. Gladman, “The future of allied air power: The Royal Australian Air Force,” Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 22.

<sup>278</sup> Plan Jericho: Program of Work 2016, 28.; Samuel Barns, “RAAF Plan’s Jericho: Breaking Down Walls, JCSP 44 Service Paper, 2017, 5.; Department of National Defence, “Pan-Domain Force Employment Concept: Prevailing in an Uncertain World,” (Ottawa: DND Canada, 2016), 16.;

<sup>279</sup> Justin A. Jaussi, and Hoffmann O. Herbert, “Manned Versus Unmanned Aircraft Accidents, Including Causation Rates,” *International Journal of Aviation, Aeronautics and Aerospace* 5, no. 4 (2018): 12.

<sup>280</sup> *Ibid.*, 27.

<sup>281</sup> *Pan-Domain Force Employment Concept*, 23.

and coalition ISR systems, requires a robust capability to direct, collect, process and assess and finally disseminate intelligence to commanders at all levels.<sup>282</sup>

## Conclusion

Canada's current air power doctrinal core capabilities of Control of the Air, Air Attack, Air Mobility and ISR closely aligned with the Five Eyes and NATO current air power core capabilities. RCAF Vectors and force development considerations already highlight the development of a balanced mix of air and space capabilities that includes inhabited and uninhabited remotely operated systems.

Furthermore, considering the advancement in RPA operational capabilities, the Five Eyes partners and NATO intends to increase the reliance on RPA platforms in conducting kinetic strikes and ISR. The USAF is expanding further the RPA applications to all future USAF core capabilities to include Command and Control and Air Mobility. With the advance in autonomous vehicles, USAF, RAF and RAAF allies are exploring the teaming of inhabited and uninhabited platforms capable of collaborative operations as a loyal wingman.

As it relates to RCAF institutional challenges, the looming global shortages of pilot and aviation technician shortages estimated between 34 to 50 thousands pilots by 2025 could hamper the efforts to address the RCAF pilot shortage initiated in 2019 with Operation EXPERIENCE and Operation TALENT. In addition, the RCAF and the CAF as a whole will need to transcend traditional organizational structures, concept of

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<sup>282</sup> Brad W. Gladman, "The future of allied air power: The Royal Air Force," Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 19.; Department of National Defence, *B-GA-401-002/FP-001, Royal Canadian Air Force Doctrine: Intelligence, Surveillance and Reconnaissance*, (Ottawa: DND Canada, 2017), 1.

operations, training and embark on a similar RAAF Plan Jericho transformation to fully harness the capabilities of fifth-generation platforms into all aspects of how CAF fights.

Therefore, to avoid a capability gap while contributing to future coalition operations, the RCAF would benefit from the integration of RPA capable to operate in the anticipated threat environment, whose systems integrate seamlessly and provide valued capability to its Five Eyes and NATO allies.<sup>283</sup> A mix of advanced fifth-generation inhabited fighters or aircraft with more advanced weapons, along with combat RPA whose production could be increased in a crisis would be a viable option for the RCAF.<sup>284</sup> With that perspective, the integration of RPA into RCAF will then be explored further.

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<sup>283</sup> Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 22.

<sup>284</sup> Brad W. Gladman, “The future of allied air power: The North Atlantic Treaty Organization,” Defence Research and Development Canada, June 2021, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc360/p813120\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc360/p813120_A1b.pdf). 27.

## CHAPTER 5 – RPA INTEGRATION INTO RCAF

*A modern, autonomous, and thoroughly trained Air Force in being at all times will not alone be sufficient, but without it there can be no national security.*

- General H.H. ‘Hap’ Arnold, USAF

### Introduction

Canada’s Defence Policy identifies the acquisition and employment of Medium-Altitude and Long Endurance (MALE) RPA capable of both surveillance and precision strikes.<sup>285</sup> To understand how an RPA capability can be integrated into the RCAF, however, requires analysis of various factors considering the inherent complexity associated with the operation of such a sophisticated multi-role weapon system.

This chapter will analyze the advantages and challenges associated with the delivery of air power by RPA to inform its near future integration into the RCAF capability. Firstly, this chapter will show that, on one hand, the extreme RPA persistence compared to inhabited air assets has proven to be of enormous value in delivering ISR and attack, attributes that is expected to increase in the future. On the other hand, the public stigma along with the perceived physical and cognitive distance from the battlefield of RPA operators remain at the centre of ethical and legal controversies. Through the lens of RCAF core capabilities, the chapter will then explore the potential RPA force structure to optimize its seamless integration with RCAF wings core capabilities. This chapter will then explore the RPA concept of operations by leveraging the structure and processes already established for the operation of inhabited air power assets.

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<sup>285</sup> *Strong, Secure, Engaged*, 73.

As it relates to the RCAF readiness to facilitate the RPA integration to operational service, this chapter offers venues for the required training and qualification of the initial RCAF RPA personnel cadre by leveraging the structure and experience of the USAF and RAF. Finally, using the future RCAF functional areas as a framework, the chapter demonstrates that RPA integration into the RCAF address capability requirements. The RCAF has limited experience in the operation of BLOS RPA both domestically and during expeditionary operations. It is therefore paramount to seek the expertise and leverage the experience of key allies, and particularly the USAF, in preparing for the integration of this new capability into the RCAF while preventing a strategic dependence.

### **Advantages and Challenges of RPA**

#### **RPA Advantages**

The integration of RPA will enhance RCAF current and future air power capabilities throughout the spectrum of operations, while it will also be able to address the casualty aversion considerations. As highlighted in Chapter 3, casualty aversion among the public constitutes a significant influencing factor in Western democracies way of waging war since the end of the Cold War.<sup>286</sup> The Canadian public is not immune.<sup>287</sup> As one academic has noted, “such are the high expectations that militaries fight a clean, human or antiseptic war that the public is increasingly expecting war without any

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<sup>286</sup> Niklas Schornig, and Alexander C. Lembcke. “The Vision of War without Casualties: On the Use of Casualty Aversion In Armament Advertisements.” *The Journal of Conflict Resolution* 50, no. 2 (2006): 204-227.

<sup>287</sup> For instance, studies indicate that most of Canada’s public perception of the Afghanistan intervention was influenced by casualties. Jean-Christophe, Boucher. “Evaluating the “Trenton Effect”: Canadian Public Opinion and Military Casualties in Afghanistan (2006-2010): [1]. “ *The American Review of Canadian Studies* 40, no. 2 (2010): 254.



casualties, friendly or otherwise: a war with zero human cost.”<sup>288</sup> RPA, however, have altered the risk calculation of air power.

Because there is no human pilot onboard, the risk of human casualty or capture by enemy forces in the event of RPA loss or shoot down by enemy forces, is reduced. An RPA employment in foreign airspace or for ISR missions also bears less risk of escalation in the event of a RPA shoot down considering that no human life is lost or aircrew stranded that would require a combat Search and Rescue.<sup>289</sup> That is unlikely the case for piloted air assets.<sup>290</sup> There are also other advantages of the absence of a pilot in the cockpit.

Unencumbered by human performance or physiological characteristics, RPA as previously discussed in Chapter 3 can achieve extreme persistence that far exceeds inhabited air assets, plus greater manoeuvrability.<sup>291</sup> The former advantage directly addresses the characteristic of persistence that has been traditionally a disadvantage of the air domain.<sup>292</sup> Therefore, RPA has proven to be of enormous value, delivering both ISR

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<sup>288</sup> Richard Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 118.

<sup>289</sup> André Haider, “Unmanned Aircraft System Threat Vectors,” Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems,” Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 47.

<sup>290</sup> As illustrated in the capture by the militant group Islamic State of Iraq and the Levant of a Royal Jordanian Air Force pilot after he ejected from the crashing of his F-16 fighter jet near Raqqa, Syria on 24 December 2014. The New York Times, “Jordanian Pilot’s Death, Shown in ISIS Video, Spurs Jordan to Execute Prisoners” 3 February 2015, Accessed 10 October 2021, <https://www.nytimes.com/2015/02/04/world/middleeast/isis-said-to-burn-captive-jordanian-pilot-to-death-in-new-video.html>. The failed prisoner exchange negotiations between Jordan and the militant group resulted in the Jordanian fighter pilot being burned alive by ISIL while Jordan executed two ISIL prisoners, thus further escalating the conflict. CNN, “Jordan executes Sajida al-Rishawi and Ziad Karboul,” Accessed 15 October 2021, <https://www.cnn.com/2105/02/03/world/isis-captive/index.html>

<sup>291</sup> Ministry of Defence, “Joint Doctrine Publication 0-30 UK Air and Space Power,” Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302> 51.

<sup>292</sup> *Royal Canadian Air Force Doctrine*, 17.

and attack effects which will not diminish in the future.<sup>293</sup> Indeed, these capabilities are highly sought after in multinational campaigns.

To avoid capability gap while contributing to future coalition operations, nations would be wise to include not only a capable RPA able to operate in the anticipated threat environment, but also one whose systems integrate seamlessly and provide valued capability. Persistent aerial surveillance is a capability highly desired by Joint Force Commanders anxious to keep pace with enemy movements and to track mobile targets, which has been reinforced in the conflicts of the post-Cold War era.<sup>294</sup> It will be essential to integrate RCAF ISR capabilities seamlessly into coalition networks “to allow the swift transfer and exploitation of information, rapid decision-making and timely delivery of effects.”<sup>295</sup>

As noted by Dr J. Boyle, RPA is becoming a disruptive technology due to the combination of distinguishing air power characteristics into a single package.<sup>296</sup> RPA possesses the speed associated with inhabited aircraft; observation characteristic associated with satellite; and the manoeuvrability associated with cruise missile. At the same time, it also alters the decision making in terms of risk calculation and low cost.<sup>297</sup>

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<sup>293</sup> Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 22.

<sup>294</sup> Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, [https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851\\_A1b.pdf](https://cradpdf.drdc-rddc.gc.ca/PDFS/unc287/p805851_A1b.pdf). 21-22.

<sup>295</sup> *Ibid.*, 12.

<sup>296</sup> Michael J. Boyle, “The Drone Age; How Drone Technology Will Change War and Peace” Accessed 15 December 2021, <https://oxford-universtypressscholarship-com.cfc.idm.oclc.org/view/10.1093/oso/9780190635862.001.0001>

<sup>297</sup> *Ibid.*

The significant lower unit cost of RPA compared to inhabited aircraft makes RPA expandable with some specific RPA designed with expendability in mind.<sup>298</sup>

It is also worthwhile re-visiting a direct benefit of the RSO concept discussed in Chapter 3. The ability to flex RPA assets between areas of responsibility means that only maintenance personnel and launch and recovery element are deployed into theatre. The forward footprint for RPA operations is reduced, hence allowing for expeditious deployment and redeployment while minimizing the overall in-theatre logistical support requirements. Furthermore, with the RPA operators, analysts and support personnel remaining in the rear, the force protection requirement is also minimized.<sup>299</sup> The RSO concept contributes to alter the risk calculation with fewer personnel deployed to theatre, which should also satisfy casualty aversion considerations.

Although still PY intensive (like inhabited platforms), the introduction of RPA favours increased reliance on synthetic training. It may be possible for initial qualification training of RPA operators to be accomplished via simulators almost entirely without launching an aircraft.<sup>300</sup> The RPA enhanced synthetic training would enable a higher percentage of aircraft to be available for other operations, while it should also allow increase in the overall numbers of trained RPA operators.<sup>301</sup> The resulting deployment

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<sup>298</sup> André Haider, “Unmanned Aircraft System Threat Vectors,” Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems,” Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 47.; Filippo Ruschi, “The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law.” *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 151.

<sup>299</sup> Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302> 31.

<sup>300</sup> United States, “Air Force Unmanned Aircraft Systems Flight Plan 2009-2047,” Accessed 26 February 2022, [https://irp.fas.org/program/collect/uas\\_2009.pdf](https://irp.fas.org/program/collect/uas_2009.pdf) 16.

<sup>301</sup> Brad W. Gladman, “The future of allied air power: The Royal Air Force,” Defence Research and Development Canada, November 2017, Accessed 24 January 2022, <https://cradpdf.drdc->

and employment efficiencies lend greater capability at the same or reduced expense when compared to inhabited aircraft.<sup>302</sup>

Finally, one of the most underappreciated aspects of RPA operation is that the “aircraft cockpit has been reinvented with the ability to port talent and expertise at any time.”<sup>303</sup> The ability to virtually place subject matter experts (SME) in the aircraft at will is a tremendous component of RPA operations.<sup>304</sup> The advantage of having SMEs “in the cockpit” needs to be balanced against a potential drawback stemming from the tactical generalship that could degrade the mission command capabilities of the RPA operators. As a potential safeguard, clear operational guidelines should be established to optimize RPA command and control infrastructure.<sup>305</sup>

### The Challenges of RPA

There are few challenges that RCAF could face while integrating RPA in the delivery of air power. Chief among them would be the public stigma surrounding RPA stemming from the intensive CIA and JSOC targeted killing covert operations and the associated heavy civilian casualties during the first drone age as previously discussed in Chapter 3.<sup>306</sup>

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rddc.gc.ca/PDFS/unc287/p805851\_A1b.pdf. 13; United States. “Air Force Unmanned Aircraft Systems Flight Plan 2009-2047,” Accessed 26 February 2022, [https://irp.fas.org/program/collect/uas\\_2009.pdf](https://irp.fas.org/program/collect/uas_2009.pdf). 16.

<sup>302</sup> United States Air Force Unmanned Aircraft Systems, “Flight Plan 2009-2047,” Accessed 26 February 2022, [https://irp.fas.org/program/collect/uas\\_2009.pdf](https://irp.fas.org/program/collect/uas_2009.pdf). 16.

<sup>303</sup> John D. Duray, “Remotely Piloted Aircraft Operations: Lessons Learned and Implications for Future Warfare”, *Mitchell Institute For Aerospace Studies*, no. 28 (2019): 11.

<sup>304</sup> *Ibid.*

<sup>305</sup> Richard Goette, “Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations,” (Trenton: Royal Canadian Air Force Warfare Center, 2020), 68-69.

<sup>306</sup> James Rogers, “Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), “A Comprehensive Approach to Countering Unmanned Aircraft Systems”, Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats-military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/> 483.

The perceived lack of transparency and accountability has been compounded by the disproportionate civilian casualties caused by RPA strikes to the relatively small number of suspected terrorist or insurgent leaders killed. This led to a difficulty by the public to ascertain whether RPA is more precise than traditional precision-guided munitions despite the assertions to the contrary by government officials.<sup>307</sup> The disinformation campaigns used by state and non-state actors who oppose Western nations or NATO to falsely attribute civilian casualties to military operations can have an effect on the public view of air power in general and RPA in particular.<sup>308</sup>

Furthermore, the reliance on RPA (due to not risking a pilot) heightened the concerns that the use of armed RPA has become a default strategy or the “easy button” for governments to be used almost anywhere in contradiction to the ethical just-war tradition of using force as a last resort.<sup>309</sup> The result could further lead to disproportionate civilian casualties caused by kinetic response from RPA.

The protection of civilians must therefore be a fundamental feature of any RCAF capability. For instance, in the 2000s, the Protection of Civilians mandate became central in UN peacekeeping.<sup>310</sup> With peace support operations taking place in volatile areas, RPA capabilities such as information collection and analysis along with intelligence and target acquisition, are paramount to enhance the resilience of UN operations.<sup>311</sup> The UN appointed Special Rapporteur on the promotion and protection of human rights stated that

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<sup>307</sup> Michael Byers and Kelsey Franks, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs,” *Canadian Foreign Policy* 20, no. 3 (2014): 283.

<sup>308</sup> James S. Corum, “NATO Airpower and the Strategic Communication Challenge: About the JAPCC’s Airpower and Disinformation Study,” *Joint Air Power Centre Journal*, no. 21 (2015): 44.

<sup>309</sup> Michael Byers and Kelsey Franks, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs,” *Canadian Foreign Policy* 20, no. 3 (2014): 282-283.

<sup>310</sup> Veronica W. Nzioki, “Technology as a Resilience factor in peace Operations,” *Connections: The Quarterly Journal* 19, no. 4 (2020): 69-85.

<sup>311</sup> *Ibid.*

“if used in strict compliance with the principles of international humanitarian law, RPA are capable of reducing the risk of civilian casualties in armed conflict by significantly improving the situational awareness of military commanders.”<sup>312</sup> Therefore, the RCAF must operate its RPA in strict compliance with domestic, international humanitarian and human rights law, Law of Armed Conflict, generally recognized ethical principles while complying with the same rules of engagement as its inhabited aircraft.<sup>313</sup>

It is also vital to address the matter of physical and cognitive distance of RPA operators previously discussed in Chapter 3. The concern is that an increase in physical and cognitive distance from the target potentially reduces the degree of responsibility and guilt of RPA operators making it easier to kill.<sup>314</sup> RPA operators literally commute to the battlefield daily and experience a dual war fighter/domestic lifestyle with a potentially thin demarcation line between operational and personal life.<sup>315</sup> The greater persistence of RPA over a target compared to inhabited aircraft, combined with the lower speed of RPA, means that RPA crews usually observe the target area for a significant period prior to and following an engagement.<sup>316</sup> This could lead to an internal conflict within RPA operators who feel remorse or guilt for killing an individual they have observed extensively.<sup>317</sup>

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<sup>312</sup> United Nations, “Report of the Special Rapporteur on the promotion of human rights and fundamental freedoms while countering terrorism, A/68/389, 18 September 2013”

<sup>313</sup> Michael Byers and Kelsey Franks. “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs,” *Canadian Foreign Policy* 20, no. 3 (2014): 286.

<sup>314</sup> *Ibid.*, 283.

<sup>315</sup> Mark Sandner, “The Mental Health Risks Associated with Remotely Piloted Aircraft Operations,” *Canadian Military Journal* 20, no.3 (2020): 49.

<sup>316</sup> Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302-48>.

<sup>317</sup> Mark Sandner, “The Mental Health Risks Associated with Remotely Piloted Aircraft Operations,” *Canadian Military Journal* 20, no.3 (2020): 49. The UK House of Commons Defence committee visited a RPA Squadron and noted that “Despite being remote from the battlespace [RPA operators] exhibited a strong sense of connection to the life and death decision that they are sometimes required to take. Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,”

Even more, the video record of RPA, provides incontrovertible evidence of wrongdoing and makes avoiding accountability more difficult.<sup>318</sup>

To believe that flying an RPA is like playing a video game demonstrates a lack of exposure to the operations of that platform.<sup>319</sup> This phenomenon is amplified by effective public relations of militant group such as al-Qaeda or the Taliban's combined with United States' reluctance to disclose information about its use of RPA.<sup>320</sup> Furthermore, several mental health studies that could be of interest to the RCAF related to RPA operators, indicate the existence of potential harmful combat stressors to mental health. Those related to an RPA operator stem from military operations by using weapons on enemy targets while witnessing disturbing or graphic scenes through the lens of an RPA's camera.<sup>321</sup> Combined with the physical and cognitive distance of RPA operators previously discussed, constant exposure to combat operations may increase the risk of clinical distress and post-traumatic stress disorder (PTSD).<sup>322</sup> Although, RPA operators are not at a higher risk of PTSD than deployed personnel, research indicates they are not immune to the traumas of war and require enhanced monitoring compared to personnel who are not involved into RPA operations.<sup>323</sup>

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Accessed 5 September 2021, <https://www.gov.uk/government/publications/unmanned-aircraft-systems-jdp-0-302> 49.

<sup>318</sup> Michael J. Boyle, "The Drone Age: How Drone Technology Will Change War And Peace," Oxford Scholarship Online, 2020: 277.

<sup>319</sup> Joseph O. Chapa, "Remotely Piloted Aircraft and War in the Public Relations Domain," *Air & Space Power Journal* 28, no.5 (2014): 29.

<sup>320</sup> *Ibid.*, 38.

<sup>321</sup> Mark Sandner, "The Mental Health Risks Associated with Remotely Piloted Aircraft Operations," *Canadian Military Journal* 20, no.3 (2020): 52.

<sup>322</sup> *Ibid.*, 48.

<sup>323</sup> *Ibid.*, 52.; Ministry of Defence, "Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems," Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 32.

Finally, there is the argument that RPA proliferation could lower threshold use of force by state and non-state actors. The use of force for national self-defence or the individual use of force in the conduct of military operations is governed by the principles of imminence, necessity and proportionality as discussed in Chapter 3.<sup>324</sup> The UN Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions raises the prospect of war being normalized on the grounds of necessity and not imminence. In addition, the law of self-defence under article 51 of the UN Charter could be reinterpreted by states as more government and non-state actors acquire armed RPA.<sup>325</sup> Therefore, CAF international military operation that uses armed force to include RPA will require the GoC authorization (through Memorandum to Cabinet or Crown Prerogative) which is also subject to parliamentary oversight.<sup>326</sup> The rule of law is a pillar of Canada's application of the instrument of National power and a fundamental belief of military service.<sup>327</sup> However, the political decision-making about who and where to strike is less constrained and rule-bound.<sup>328</sup> Learning from the CIA and JSOC targeted killing covert operations during the first drone age, the RCAF RPA force structure must therefore be transparent and accountable for its RPA operations.<sup>329</sup>

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<sup>324</sup> Boddens J.F.R. Hosang, "The Effects of Paradigm Shifts on the Rules on the use of Force in Military Operations," *Netherlands International Law Review* 64, no. 3 (2017): 353-373; Aiden Warren and Ingvald Bode, "Altering the Playing Field: The U.S. Redefinition of the use-of-Force," *Contemporary Security Policy* 36, no. 2 (2015):174.

<sup>325</sup> United Nations, "All drone strikes in self-defence should go before Security Council, argues independent rights expert," 9 July 2020, Accessed 7 November 2021, <https://news.un.org/en/story/2020/07/1068041>

<sup>326</sup> The line of authority from Parliament, Cabinet and the minister encompasses all matters relating to national defence including oversight of the conduct of CAF operations. *Canadian Military Doctrine*, 5-5.

<sup>327</sup> *Canadian Military Doctrine*, 4-4.

<sup>328</sup> Michael J. Boyle, "The Drone Age: How Drone Technology Will Change War And Peace." Oxford Scholarship Online, 2020: 277.

<sup>329</sup> James Rogers, "Future Threats: Military UAS, Terrorist Drones, and the Dangers of the Second Drone Age, Joint Air Power Competence Centre (JAPCC), "A Comprehensive Approach to Countering Unmanned Aircraft Systems", Accessed 20 January 2022, <https://www.japcc.org/c-uas-future-threats->



## RPA Force Structure

Considerations for the integration of RPA into the RCAF will also have to take into account of RCAF force structure organized around the 14 Wings located across Canada.<sup>330</sup> 2 Canadian Air Division as the Training Authority for the RCAF centrally controls 15, 16 and 17 Wings.<sup>331</sup> The remaining Wings are centrally controlled by 1 Canadian Air Division, responsible for the force generation (FG) and force employment (FE) of air power at home and abroad on behalf of the Commander RCAF, Commander NORAD and Commander Canadian Joint Operations Command.<sup>332</sup> Finally, the integration of space capability within the RCAF portfolio since 1 July 2016 means that the RCAF also has leadership responsibility of this domain.<sup>333</sup> Accordingly, 3 Canadian Space Division is expected to be stood up by summer 2022 as the command authority, likely responsible for FE and FG of space capabilities in support of military operations both at home and abroad.<sup>334</sup>

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military-uas-terrorist-drones-and-the-dangers-of-the-second-drone-age/ 483.; Michael Byers and Kelsey Franks, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs.” *Canadian Foreign Policy* 20, no. 3 (2014): 272.

<sup>330</sup> Government of Canada, “Wings and Squadrons,” Accessed 13 February 2022, <https://www.rcaf-arc.forces.gc.ca/en/wings-squadrons.page>

<sup>331</sup> Royal Canadian Air Force, “Welcome to 2 Canadian Air Division,” Accessed 13 February 2022, <http://rcaf.mil.ca/en/2-cad/home.page>

<sup>332</sup> Memorandum, Commander 1 Canadian Air Division, Canadian NORAD Region, Joint Force Air Component, Search and Rescue Region Trenton – Operational Direction and Guidance (D&G) – FY 21/22 dated 22 March 2021.

<sup>333</sup> *Royal Canadian Air Force Vectors*, iv.; Government of Canada, “RCAF leads Canadian Armed Forces space initiatives,” Accessed 29 January 2022, <https://rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=rcaf-leads-canadian-armed-forces-space-initiatives/jyk96x80.>; Government of Canada, “Royal Canadian Air Force and Space,” Accessed 10 March 2022, [www.rcaf-arc-forces.gc.ca/en/space/index.page](http://www.rcaf-arc.forces.gc.ca/en/space/index.page)

<sup>334</sup> Brigadier-General Michael Adamson assumed the role of RCAF Director General Space and the Joint Force Space Component Commander in June 2020 and oversees the administrative functions of the Space enterprise for the CAF. Government of Canada, “Director General Space and Joint Force Space Component Commander,” Accessed 13 February 2022, <https://www.rcaf-arc.forces.gc.ca/en/space/roles-leadership.page>

The RCAF wings vary in size and capabilities. 3 Wing Bagotville and 4 Wing Cold Lake are Canada's fighter bases with a fleet of CF-188 Hornet that provides general purpose, multi-role, combat capable forces in support of domestic and expeditionary operations. In addition, a fleet of CH-146 Griffon is dedicated primarily to on base Search and Rescue for the fighter squadrons.<sup>335</sup> 14 Wing Greenwood and 19 Wing Comox provide sovereignty and surveillance missions over respectively the Atlantic and Pacific Ocean using a fleet of CP-140 Aurora, while maintaining search and rescue capabilities using a mixed fleet of CH-149 Cormorant and legacy CC-130H Hercules that will soon be replaced with the CC-295 Kingfisher.<sup>336</sup> Nos. 3, 4, 14 and 19 Wings deliver the RCAF air power core capabilities of Control of the Air, Air Attack, ISR and the SAR role capabilities.

Based on the 'Family of systems' concept, it is also important to focus the approach on Wing delivery of core capabilities such as ISR, from a platform-centric view to one based on capabilities spread over multiple platforms. Key to the family of systems concept is interoperability, integration and sharing of information.<sup>337</sup> Therefore, 3, 4, 14 and 19 Wings are all doctrinally well positioned as potential Main Operating Base (MOB) for the integration of RPA into the RCAF.

Furthermore, as one study notes, long endurance RPA has the potential to complement crewed Maritime Patrol Aircraft in many aspects of maritime domain ISR.<sup>338</sup> As it relates to the Arctic transformation discussed in Chapter 2, the key threats to North

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<sup>335</sup> Government of Canada, "Wings and Squadrons," Accessed 13 February 2022, <https://www.rcaf-arc.forces.gc.ca/en/wings-squadrons.page>

<sup>336</sup> *Ibid.*

<sup>337</sup> Joint Air Power Competence Centre, "Enabling Maritime ISR through the 'Family of Systems,'" Accessed 10 March 2022, <https://www.japcc.org/enabling-maritime-isr-through-the-family-of-systems>

<sup>338</sup> *Canadian Forces UAV Campaign Plan*, 17.

America will be associated with great-power competition to include increased activity in the Arctic. MALE RPA positioned at 14 and 19 Wing as MOB will enhance Domain Awareness to Canada's air and maritime approaches with a multi-layered sensor system that enables threat detection and identification at its birth and track until its death.<sup>339</sup> Finally, as previously discussed in Chapter 4, the GoC is contemplating the replacement of the CP-140 Aurora with next generation multi-mission aircraft. To that end, establishing 14 and 19 Wings as the MOB for the RPA would position well the RCAF integration of crewed platform with uninhabited platform in the conduct of maritime domain awareness.<sup>340</sup>

The MOB deduction is consistent with the information available from the RFP released by the GoC on 11 February 2022 to the Qualified Suppliers, identifying 14 Wing and 19 Wing as the MOB for the Remotely Piloted Aircraft System (RPAS) project. The RFP also reveals that Yellowknife is identified as Forward Operating Base with the RPA main control centre located in the Ottawa area.<sup>341</sup> At this juncture of the procurement process, the total number of MALE RPA to be delivered to Canada by 2025 to 2030 has yet to be determined by the two Qualified Suppliers. However, the GoC also announced on 11 February 2022 that a total of 240 RCAF members will compose the RPA force with

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<sup>339</sup> FAOC, 14.

<sup>340</sup> Ross Freeman, "The Aurora Replacement: The Viability of Drones as Maritime Patrol Aircraft," JCSP 44 Exercise Solo Flight. 2018. 19. As demonstrated by the RAAF, its fleet of crewed P-8A Poseidons will be operating alongside its uninhabited MQ-4C Triton at RAAF Base Edinburgh with a forward base at RAAF Base Tindal in the conduct of maritime domain awareness by 2023. Royal Australian Air Force, "Air Force Capacity Guidebook 2020," Accessed 23 January 2022, <https://airpower.aiforce.gov.au/publications/air-force-capability-guide-2020>. 70.

<sup>341</sup> Vancouver Sun, "Ottawa launches long-awaited competition for armed military drones," 11 February 2022, Accessed 19 February 2022, <https://vancouver.sun.com/news/local-news/ottawa-launches-long-awaited-competition-for-armed-military-drones>

55 personnel stationed at 14 Wing, 25 personnel at 19 Wing and 160 personnel at the main control centre in the Ottawa area.<sup>342</sup>

The RCAF could consider standing up two separate squadrons respectively at 14 and 19 Wing to operate the RCAF RPA or incorporate the RPA within the existing 405 and 407 Long Range Patrol squadrons currently operating the CP-140 Aurora. The main benefit of standing up a separate RPA squadron is to facilitate the cultural transition challenges from a force comprised solely of inhabited platforms to a mix of inhabited and uninhabited remotely piloted platforms discussed in Chapter 4 with selected leaders that promote the new ways of fighting. This approach is also consistent with the approach taken by the RAF for example who stood up 39 Squadron in 2007 as the first RPA Squadron at RAF Waddington after it was disbanded back in 2006.<sup>343</sup>

At the time of writing, there is no indication or commitment by the GoC to acquire autonomous RPA like the Loyal Wingman currently under various phases of development for the USAF, RAF and RAAF as mentioned in Chapter 4. It is to be recognized the complexity associated with the introduction to service of a new aircraft in light of the replacement of the CF-188 Hornet with fifth-generation F-35 fighters.<sup>344</sup> Therefore, it is paramount to consider early-on in its Release to Service key considerations such as Master Implementation Plan, readiness to conduct operations and maintenance, infrastructure, logistic support for 3 and 4 Wings, the concept of teaming the F-35 fighter

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<sup>342</sup> *Ibid.*

<sup>343</sup> Royal Air Force, “39 Squadron,” Accessed 21 February 2022, <https://www.raf.mod.uk/our-organization/squadrons/39-squadron>

<sup>344</sup> *Strong, Secure, Engaged*, 38; Government of Canada, Public Works and Government Services Canada, “Canada moves closer to delivering 88 advanced fighter jets for the Royal Canadian Air Force as it begins negotiations with the top-ranked bidder, the United State government and Lockheed Martin, for the F-35,” Accessed 1 April 2022, <https://www.canada.ca/en/public-services-procurement/news/2022/03/canada-moves-closer-to-delivering-88-advanced-fighter-jets-for-the-royal-canadian-air-force-as-it-begins-negotiations-with-the-top-ranked-bidder-th.html>

with autonomous RPA like the Loyal Wingman.<sup>345</sup> Such approach would position well the RCAF for future integration of a balanced mix of air and space capabilities that includes inhabited, uninhabited remotely operated systems and autonomous aircraft.

### **RPA Concept of Operations**

The RCAF Concept of Operations (CONOPS) of RPA will also have to seamlessly integrate into key allies RPA CONOPS to optimize interoperability while capitalizing on their decades-long experience and lessons learned. The review of USAF and RAF concept of operations indicates the optimum crew composition of a typical MALE RPA requires a rated pilot and sensors or a system operator.<sup>346</sup> In addition, a ground control station (GCS) provides the means for a pilot/operator to control the flight of the RPA by transmitting signals to it and receiving position, condition and other telemetry.<sup>347</sup> The rated pilot performs aircraft ground movement, pre-programs routes into the RPA or manually flies the aircraft. The USAF created a new trade for the RPA rated pilot since it was assessed as not requiring a full-fledged Instrument Flight Rating (IFR). The sensors or a system operator, called payload officer in the USAF, controls the payload, to include electro-optics/infra-red camera and/or the radar. The Payload operator

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<sup>345</sup> Royal Canadian Air Force, AFO 8001-2 Release to Service – New and Modified Aircraft Fleets, Accessed 19 February 2022, <http://rcmf.mil/en/c-air-force-staff/afo-8001-2.page>

<sup>346</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 19 February 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf>. 13. ; Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf). 12.; Mark Sandner, “The Mental Health Risks Associated with Remotely Piloted Aircraft Operations.” *Canadian Military Journal* 20, no.3 (2020): 47.

<sup>347</sup> Institute for Defense Analyses, “Staffing for Unmanned Aircraft Systems (UAS) Operations,” Accessed 20 February 2022, [https://prhome.defense.gov/Portals/52/Documents/MRA\\_Docs/TFM/Reports/F2108340\\_TFMR-staffing%20for%20Unmanned%20Aircraft%20Systems%20\(UAS\)%20Operations-ForPiiWork-DM.pdf](https://prhome.defense.gov/Portals/52/Documents/MRA_Docs/TFM/Reports/F2108340_TFMR-staffing%20for%20Unmanned%20Aircraft%20Systems%20(UAS)%20Operations-ForPiiWork-DM.pdf)

directs onboard weapons through the use of a laser designator.<sup>348</sup> Finally, a squadron operations centre with its associated personnel and support systems along with satellite communication infrastructure performs RPA mission and intelligence integration.<sup>349</sup>

Although there are limited operational-level doctrine, tactics, techniques and procedures specific to RPA, the planning and execution of RPA missions should be in line with RCAF air power doctrine which presents an integrated, less platform-specific view of air power operations.<sup>350</sup> For example, MALE RPA should be included in the Air Tasking Order (ATO) while compliance with Air Control Order is critical if the RCAF RPA is not “see and avoid” capable like inhabited aircraft.<sup>351</sup> Moreover, the extreme persistence of RPA could lead to ATO coordination issues which was designed around

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<sup>348</sup> Mark Sandner, “The Mental Health Risks Associated with Remotely Piloted Aircraft Operations,” *Canadian Military Journal* 20, no.3 (2020): 47.

<sup>349</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 19 February 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf>. 13.; Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 12.; Mark Sandner, “The Mental Health Risks Associated with Remotely Piloted Aircraft Operations,” *Canadian Military Journal* 20, no.3 (2020): 47.

<sup>350</sup> Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 25.; NATO, “AJP-3.3 Allied Joint Doctrine for Air and Space Operations,” Accessed 19 February 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/624137/doctrine\\_nato\\_air\\_space\\_ops\\_ajp\\_3\\_3.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/624137/doctrine_nato_air_space_ops_ajp_3_3.pdf) 4-14; *Royal Canadian Air Force Doctrine*, ii.

<sup>351</sup> NATO, “AJP-3.3 Allied Joint Doctrine for Air and Space Operations,” Accessed 19 February 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/624137/doctrine\\_nato\\_air\\_space\\_ops\\_ajp\\_3\\_3.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/624137/doctrine_nato_air_space_ops_ajp_3_3.pdf) 4-14; Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 27.; Public Works and Government Services Canada, “Solicitation Amendment-Remotely Piloted Aircraft System (RPAS) – Information for Canadian Industry,” Accessed 6 March 2022, <https://buyandsell.gc.ca/cds/public/2020/06/22> 5. states as mandatory requirements to be able to sustain operations worldwide in appropriate classes of airspace, under adverse weather.

the operating cycle and flight times of inhabited aircraft.<sup>352</sup> In addition, the integration of RPA into all classes of Canadian Airspace must be coordinated with NAV Canada along with the Federal Aviation Administration to ensure optimized Continental North America FE including support to Civil Authorities and FG requirements in support of CAF and NORAD defence and non-defence missions.<sup>353</sup>

To fully exploit RPA capability, specialist advice from 1 Canadian Air Division ISR Division will be required to ensure all components of the intelligence cycle are planned or established.<sup>354</sup> In addition, RPA sensors generate very large amounts of data; hence, the pooling of analysts to optimize Processing, Exploitation and Dissemination process while complying with standardization agreement for data outputs will be key.<sup>355</sup> Therefore, to unleash the full potential of future RCAF RPA, the pan-domain interoperability with Five Eyes and NATO in terms of command and control, PED, weapons employment and airspace control must be considered before the introduction to operational service.<sup>356</sup>

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<sup>352</sup> Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 29.

<sup>353</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 18 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 27; Danny Garrett-Rempel, “Will JUSTAS Prevail? Procuring a UAS Capability for Canada.” *RCAF Journal*, no. 4 (2015): 25.

<sup>354</sup> Ministry of Defence, “Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems,” Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 28.

<sup>355</sup> *Ibid.*, 29; United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 18 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 22.

<sup>356</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 18 January 2022, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 34.

## RPA Initial Cadre Training

Considerations for the integration of RPA into the RCAF will also have to take into account initial cadre and FG training requirements. The CAF experience with MALE RPA is limited to the operation of the legacy CU-161 Sperwer from 2003 until 2009 and the CU-170 Heron from 2009 to 2012 during the Afghanistan mission. The operators controlled these RPA via a line-of-sight control. Since the end of the Afghanistan mission, the RCAF has not flown RPA operationally under the ownership of the Government of Canada.<sup>357</sup> The experience gained from the legacy CU-161 Sperwer and the CU-170 Heron, has a narrow potential to be transferable in the more complex aspects of MALE RPA operations as highlighted by the RAAF.<sup>358</sup>

Therefore, in preparation of the introduction to operational service of the RCAF MALE RPA, an Initial Cadre Training (ICT) should be provided to selected RCAF personnel to include rated pilot, systems or sensor operator, personnel assigned to a Combined Air Operation Centre (CAOC), intelligence and maintenance technicians. These members would be embedded at the earliest opportunity with allies operating MALE RPA to gain first-hand knowledge and experience in flying and maintaining these platforms like the steps taken by the RAAF by embedding personnel in the USAF to fly the MQ-9 Reaper.<sup>359</sup>

The RCAF should also capitalize on its alliance connections to enable a RPA capability. Consideration should be given, for the RCAF RPA initial cadre to be posted to

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<sup>357</sup> Mark Sandner, "The Mental Health Risks Associated with Remotely Piloted Aircraft Operations," *Canadian Military Journal* 20, no.3 (2020): 48.

<sup>358</sup> Australian Aviation, "RAAF Retires "Legacy" Heron UAV," 9 August 2017, Accessed 20 February 2022, <https://australiaaviation.com.au/2017/08/raaf-retires-legacy-heron/>

<sup>359</sup> *Ibid.*



Holloman Air Force Base in New Mexico, which has been the hub of USAF RPA operations as well as providing local training for operators for more than 20 years.<sup>360</sup> Another option would be a posting at RAF Waddington to acquire the skills to operate and maintain a modern MALE RPA such as the MQ-9 Reaper.<sup>361</sup> Furthermore, it is also critical to qualify an initial cadre of 434 Operational Test and Evaluation Squadron personnel with key allies operating the same RCAF RPA to acquire the skills and expertise required to manage and coordinates current and future RPA test and evaluation activities.<sup>362</sup>

### **RPA Pilot and Systems Operator Selection and Training**

The RCAF should consider creating a new RPA pilot trade in the officer corps like the USAF or RAF.<sup>363</sup> RPA candidate pilot selection should be conducted at the Canadian Forces Aircrew Selection Centre at 8 Wing similar to inhabited aircraft pilot selection. As it relates to RPA pilot training, there are few options available to the RCAF ranging from civilian contracted RPA pilot training such as CAE that proposes a turn-key MALE RPA pilot and operator training;<sup>364</sup> leverage the RPA pilot training program

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<sup>360</sup> Mark Sandner, "The Mental Health Risks Associated with Remotely Piloted Aircraft Operations," *Canadian Military Journal* 20, no.3 (2020): 49.; United States Air Force, "Holloman Air Force Base," Accessed 20 February 2022, <https://militarybase.net/holloman-air-force-base/>

<sup>361</sup> Ministry of Defence, "Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems," Accessed 23 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673940/doctrine\\_uk\\_uas\\_jdp\\_0\\_30\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf) 5.

<sup>362</sup> Government of Canada, "Organization of the Canadian Forces Aerospace Warfare Centre (CFAWC)," Accessed 20 February 2022, <https://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/organization.page>

<sup>363</sup> Royal Air Force, "Remotely Piloted Aircraft System (RPAS) Pilot," Accessed 20 February 2022, <https://www.raf.mod.uk/recruitment/roles/roles-finder/aircrew/remotely-piloted-aircraft-system-rpas-pilot>; U.S. Air Force, "Remotely Piloted Aircraft Pilot," Accessed 20 February 2022, <https://www.airforce.com/careers/detail/remotely-piloted-aircraft-pilot>.

<sup>364</sup> CAE, "RPA Training Solutions," Accessed 20 February 2022, <https://www.cae.com/defence-security/what-we-do/training-systems/rpa-training-solutions/>

established by the USAF or UK; develop an organic RPA pilot training under the hospice of 2 Canadian Air Division; or a combination of all the above.

As an example, the U.S. Air Force RPA rated pilot training begins for selected pilot candidate with the Initial Flight Training (IFT) on board the Diamond DA-20 Airplane for 20 months. The RCAF equivalent would be the Primary Pilot training delivered by 3 Canadian Forces Flying Training School on board the Grob 120-A. Upon completion of the IFT or Primary Pilot training, the RPA rated pilot candidate is introduced to rules and regulations that governs the skies through the RPA Instrument Qualification Course (IQC). The IQC training is delivered using the T-6A Texan II Flight Simulator where the pilot candidate flies approximately 30 missions during 10 weeks.<sup>365</sup>

Upon completion, RPA rated pilot candidate would move on to the RPA Aircraft Fundamentals Course (RFC) to be introduced to RPA combat operations on a specific RPA platforms (RQ-4 Global Hawk or MQ-9 Reaper) for five weeks. The RPA pilot candidate would then move on to the Formal Training Unit (FTU) which is a graduate level training for MQ-9 or RQ-4 Weapons System Employment for approximately six months. The FTU would be equivalent to the RCAF Operational Training Unit for inhabited aircraft to include the actual employment of the RPA such as conducting ISR.<sup>366</sup>

Regarding the systems or payload operator, the RCAF has multiple venues, ranging from contracted training, leverage the USAF or RAF established operator training or conduct an organic training like the 404 Long Range Patrol Airborne Electronic Sensor Operator. As an example, the USAF created a new RPA Sensor Operator trade for its

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<sup>365</sup> Department of National Defence, “3 Canadian Forces Flying Training School,” Accessed 20 February 2022, <http://rcaf.mil.ca/en/2-cad/home.page>

<sup>366</sup> U.S. Air Force, “Remotely Piloted Aircraft Pilot,” Accessed 20 February 2022, <https://www.airforce.com/careers/detail/remotely-piloted-aircraft-pilot>.

enlisted members who can be fully trained within four months.<sup>367</sup> It is to be noted that the RAF shared facilities, infrastructure and training with the USAF with their first two RPA squadrons based at Creech Air Force Base in Nevada until 2013. A new training pathway for RPA pilot candidate and systems or payload operators has been established with General Atomics Aeronautical Systems, Inc. Flight Test and Training Centre in Grand Forks North Dakota. Upon completion, students will then progress to Creech AFB where they join 39 Squadron to be taught UK specific aspects of rules of engagement and safety procedures.<sup>368</sup> This close strategic RPA partnership created significant dependence to the USAF as reported by a 2014 UK House of Commons Defence Committee report.<sup>369</sup> Based on the final number of RPA platforms and the required training throughput for RPA pilot, operator and maintenance technicians, consideration should then be given by the RCAF, whether to develop an organic training capability for the RCAF RPA community at large unless the training requirement has also been included in the Request for Proposal.

Finally, it is also paramount to consider sustained access to RPA pilot and operator simulator for not only initial and mission qualification training, but also proficiency training of RCAF RPA operators and sensors or system operator. The USAF MQ-1 and MQ-9 Predator Mission Aircrew Training System is a high-fidelity simulation system that models Predator and Reaper aircraft, sensors and weapons for initial and

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<sup>367</sup> U.S. Air Force, "Remotely Piloted Aircraft Sensor Operator," Accessed 21 February 2022, <https://www.airforce.com/careers/detail/remotely-piloted-aircraft-rpa-sensor-operator>; Mark Sandner, "The Mental Health Risks Associated with Remotely Piloted Aircraft Operations." *Canadian Military Journal* 20, no.3 (2020): 48.

<sup>368</sup> Royal Air Force, "New Training pathway paves way for Protector," Accessed 22 February 2022, <https://www.raf.mod.uk/news/articles/new-training-pathway-paves-way-for-protector/>

<sup>369</sup> Conrad E. Orr, "Can Unmanned Aircraft Systems meet Canadian Air Power Needs?" *Royal Canadian Air Force Journal* no. 3 (2016): 20.

mission qualification training.<sup>370</sup> Although it could be a boon to the Canadian aerospace industry, it may be cost prohibitive for Canada to procure and sustain its own high-fidelity simulation system.<sup>371</sup> Therefore, an agreement with key allies operating the same type of MALE RPA than Canada to use their simulator should be established.

### **RPA Maintenance Program**

In light of the looming global shortages of aviation maintenance technicians discussed in Chapter 4, the RCAF RPA maintenance concept should be articulated around the following three major principles for a successful introduction to service and sustainment of this new capability: 1) implementation of a hybrid maintenance format between contractor and RCAF technicians to optimize mentorship; 2) public servant positions to augment first and second line maintenance organization to retain expertise with longer tenure compared to the routine posting cycles; and 3) augmenting RCAF technicians with a contracted Technical Support Team to enhance first and second line maintenance at MOB and FOB including during expeditionary operations.<sup>372</sup> RPA ability to take advantage of remote split operations previously discussed at Chapter 2 enables sustained combat capability more efficiently with a reduced forward footprint to include the maintenance support requirements.

Regarding RCAF aviation technician force generation writ large, the integration of RPA into the RCAF presents a unique opportunity to leverage the use of augmented

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<sup>370</sup> General Atomics Aeronautical, “Predator Mission Aircrew Training System (PMATS),” Accessed 22 February 2022, <https://www.ga-asi.com/training-and-support-services/predator-mission-aircrew-training-system>

<sup>371</sup> CAE, “Predator Mission Aircrew Training System (PMATS),” Accessed 22 February 2022, <https://www.cae.com/defence-security/what-we-do/training-systems/predator-mission-aircrew-training-system-pmts-program/>

<sup>372</sup> Sylvestre Bishop, “Aircraft Maintenance Within the Twenty-First Century RCAF,” JCSP 45 Master of Defence Studies, 2019, 35.

reality to optimize maintenance operations and training. The Member Operations Training Analytics and Reports currently under development by the USAF illustrates the capability enhancement that augmented reality provides to modern aviation maintenance operations and training.<sup>373</sup> With capability enhancement in mind, let us consider how RPA integration into the RCAF address capability requirements.

### **How RPA Addresses Capability Requirements**

The RCAF Future Concepts Directive Part 2: Future Air Operating Concept, identifies 11 future RCAF functional areas, stemming from the examination of RCAF's core air power capabilities and government-mandated non-defence missions.<sup>374</sup> These 11 future RCAF functional areas will be used as the lens through which to evaluate how the RCAF integration of RPA will meet future capability requirements. Starting with Functional Area 1,<sup>375</sup> the RCAF integration of a multi-role RPA positioned at 14 and 19 Wings will contribute to air/maritime warning mission which entails a shared awareness and understanding of the activities conducted in US and Canadian maritime approaches, maritime areas, and inland waterways including ships passing through the Northwest Passage area in the Canadian Arctic as a result of the climate change discussed in Chapter 2.<sup>376</sup> Regarding Functional Areas 2 and 7,<sup>377</sup> the key threats to North America “will be associated with great-power competition, including increased activity in the Arctic specifically, the new generation of Russian nuclear and conventional military capabilities

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<sup>373</sup> Amy Hudson, “Augmented Reality Goes Mainstream,” Air Force Magazine, 19 January 2022, Accessed 9 April 2022, <https://www.airforcemag.com/article/augmented-reality-goes-mainstream/#:~:text=How%20a%20flight%20line%20superintendent,Air%20Force%20does%20aircraft%20maintenance>

<sup>374</sup> FAOC, 12.

<sup>375</sup> The Surveillance of Canadian Territory and Air/Maritime approaches. FAOC, 12.

<sup>376</sup> *Canadian Military Doctrine*, 3-5.

<sup>377</sup> The Aerospace Defence of Canada and North America. FAOC, 12.

pose the most pressing concerns to North American defence.<sup>378</sup> The RCAF integration of RPA will contribute to create an all Domain Awareness capabilities provided by a multi-layered sensor system in support of NORAD Modernization. It will enable threat detection and identification at its birth and track until its death while allowing greater standoff ranges and reducing impact of obscurants and adverse weather.<sup>379</sup>

RPA will also be essential to Functional Areas 3, 4, 8, 9.<sup>380</sup> ISR being the *raison d'être* of RPA, its integration into the RCAF enhances the overall contribution to Joint ISR specifically overland ISR capabilities and targeting for any future expeditions undertaken as demonstrated during the Allied and CAF experience in Afghanistan.<sup>381</sup> During the planning of Operation ATHENA in July 2003, the Army staff identified a lack of BLOS imagery capability and initiated an unforecasted operational requirement (UOR) which led to the quick “off-the-shelf” purchase of the SAGEM CU-161 Sperwer system to keep soldiers out of dangerous situations.<sup>382</sup> The Manley Report highlighted the immediacy in need for the RCAF to lease the Israeli Herons for use in Afghanistan following the 2009 retirement of the CU-161 Sperwer.<sup>383</sup> The urbanization trend

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<sup>378</sup> Andrea Charron and James Fergusson, “Beyond NORAD and Modernization to North American Defence Evolution”, Canadian Global Affairs Institute, May 2017, Accessed 11 December 2021, [https://www.cgai.ca/beyond\\_norad\\_and\\_modernization\\_to\\_north\\_american\\_defence\\_evolution](https://www.cgai.ca/beyond_norad_and_modernization_to_north_american_defence_evolution); Andrea Charron, “Beyond the North Warning System”, War on the Rocks, 7 September 2020, Accessed 11 January 2022, <https://warontherocks.com/2020/09/beyond-the-north-warning-system/>

<sup>379</sup> United States Air Force RPA VECTOR, “Vision and Enabling Concepts 2013-2038,” Accessed 23 October 2021, <https://www.af.mil/Portals/1/documents/news/USAFRPAVectorVisionandEnablingConcepts2013-2038.pdf> 35.

<sup>380</sup> Support to Maritime and Land Operations in Canada, RCAF support to Continental Operations and Low-Intensity Conflicts. FAOC, 12.

<sup>381</sup> *Canadian Forces UAV Campaign Plan*, 2; Michael Byers and Kelsey Franks, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs,” *Canadian Foreign Policy* 20, no. 3 (2014): 278.

<sup>382</sup> *Canadian Forces UAV Campaign Plan*, 15.

<sup>383</sup> Conrad, E. Orr, “Can Unmanned Aircraft Systems meet Canadian Air Power Needs?” *Royal Canadian Air Force Journal* no. 3 (2016): 17.; Michael Byers and Kelsey Franks, “Unmanned and Unnecessary: Canada’s Proposed Procurement of UAVs,” *Canadian Foreign Policy* 20, no. 3 (2014): 272.

discussed in Chapter 2, high-altitude RPA, precision strikes and special operation forces all recommend themselves for future urban warfare.

As it relates to Functional Areas 5, 6 and 11,<sup>384</sup> the extreme persistence of RPA is invaluable in providing increased awareness to decision makers. The RPA ability to produce “real-time infrared (IR), electro-optical, low light, fused IR and low light and synthetic aperture radar (can see through clouds) full motion video could be a boon to SAR, damage assessment, cordon placemen, and humanitarian efforts after a major disaster.<sup>385</sup> Furthermore, as demonstrated in Chapter 2, climate change is likely to increase demand for domestic SAR in the Canadian Arctic with the appropriate equipment and personnel largely located in the south.<sup>386</sup> The current SAR posture that produces the slowest response time in the Arctic where a fast response is needed most constitutes one of the greatest challenge of the current Canadian SAR system.<sup>387</sup> In addition, CAF deployments in future humanitarian assistance and disaster response operations will increase due to climate change.

Finally, regarding Functional area 10,<sup>388</sup> it is to be acknowledged the RCAF does not have the foundation needed to build and sustain a full ISR-capability enterprise similar to the USAF or acquire the full spectrum of ISR assets, platforms and capabilities

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<sup>384</sup> Search and Rescue, Support to the Civil Power and RCAF support to Non-Combat Military Operation Other Than War. FAOC, 12.

<sup>385</sup> Ross Freeman, “An Overview of Potential Non-Traditional Remotely Piloted Aircraft System (RPAS) Roles,” JCSP 44 Service Paper. 2018. 5.

<sup>386</sup> *Royal Canadian Air Force Doctrine*, 36; North America and Arctic Defence and Security Network (NAADSN), “Shielding North America: Canada’s Role in NORAD Modernization,” March 2021, Accessed 11 December 2021, <https://www.naadsn.ca/wp-content/uploads/2021/03/NAADSN-engaged4-NORAD-NT-RD-upload.pdf>

<sup>387</sup> Dany, Poitras. “Search and Rescue in the Arctic.” In *Canadian Arctic Operations, 1945-2015: Lessons Learned, Lost and Relearned*, edited by Whiteny Lackenbauer and Adam Lajeunesse, 387-425. 401 Fredericton: The Gregg Centre for War & Society, 2017; *Royal Canadian Air Force Vectors*, 13; FAOC, 17. Jean, Leroux, “Canadian Search and Rescue Puzzle: The Missing Pieces,” *Canadian Military Journal* 18, no. 2 (2018): 24-35.

<sup>388</sup> RCAF Operations in High Intensity, A2/AD Conflicts. FAOC, 12.

required to do it all.<sup>389</sup> Therefore, RPA integration into RCAF contributes to overall interoperability with key allies making Canada more relevant as a trusted partner in the age of network-centric warfare with enhanced ISR and attack capabilities as part of its contribution warfare.<sup>390</sup> However, given the legal and ethical uncertainties surrounding the employment of RPA discussed in Chapter 3, it is essential RCAF RPA be operated in strict compliance with international humanitarian law, international human rights law, law of armed conflict and generally recognized ethical principles.<sup>391</sup>

## Conclusion

The extreme RPA persistence compared to inhabited air assets has proven to be of enormous value in delivering ISR and attack effects, attributes that are expected to increase in the future air power capabilities. Furthermore, RPA has also altered the risk calculation by reducing the risk of human casualty. However, the RCAF could still face the public stigma surrounding RPA stemming from the intensive CIA and JSOC targeted killing covert operations.<sup>392</sup>

Regarding the potential RPA force structure within the RCAF, 3, 4, 14 and 19 Wings are all doctrinally well positioned as potential MOB for the integration of RPA. In addition, selecting 14 and 19 Wings as the MOB for the RPA, would position well the RCAF integration of RPA with crewed next generation multi-mission aircraft as the potential replacement of the CP-140 Aurora.

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<sup>389</sup> Richard Goette, "Preparing the RCAF for the Future: Defining Potential Niches for Expeditionary Operations," (Trenton: Royal Canadian Air Force Warfare Center, 2020), 139.; C.A. Mask, "ISR: You need to find it to hit it," *Royal Canadian Air Force Journal* no. 8 (2019): 26.

<sup>390</sup> Danny Garrett-Rempel, "Will JUSTAS Prevail? Procuring a UAS Capability for Canada," *RCAF Journal*, no. 4 (2015): 22; *Canadian Forces UAV Campaign Plan*, 15, 27.

<sup>391</sup> Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy* 20, no. 3 (2014): 286.

<sup>392</sup> *Ibid.*, 283.



In preparation of the introduction to operational service of the RCAF Medium Altitude Long Endurance RPA, an ICT of selected RCAF rated pilot, systems or sensor operator, personnel assigned to a CAOC, intelligence and maintenance technicians should be embedded at the earliest opportunity with allies operating MALE RPA to gain first-hand knowledge and experience in flying and maintaining these platforms.

Finally, RCAF integration of RPA evaluated through the lens of the 11 RCAF functional areas in support of domestic, continental and expeditionary operations demonstrated that RPA would enhance current and future delivery of air power to meet Canadian defence and non-defence missions in an increasingly complex security and defence environment.

## CHAPTER 6 – CONCLUSION

This paper has demonstrated that the RCAF integration of RPA will enhance current and future delivery of air power throughout the spectrum of operations to meet Canadian defence and non-defence missions in an increasingly complex security and defence environment. For the past few decades, Canada's Five eyes allies and NATO partners have increasingly relied on a balanced mix of air and space capabilities that includes inhabited and remotely piloted aircraft to facilitate their military operations.<sup>393</sup> The UK's Armed Forces Chief of Defence Staff estimates RPA will make up 80% of RAF fleet by 2030 while the Pentagon estimates RPA will make up 70% percent of USAF aircraft by 2035.<sup>394</sup> Moreover, the USAF is testing new development concept to expand RPA applications throughout the core air power capabilities. Understanding how other nations approach RPA implementation is instructive, for as Dr Brad W. Gladman shows, comprehensive understanding of the capability investment and concept development initiatives of Canada's key allies informs the understanding of the future directions in air warfare.<sup>395</sup> That approach would mitigate the uncertainty and

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<sup>393</sup> FAOC, 26.; Gary Schaub and Kristian Søby Kristensen, "But who is Flying the Plane? Integrating UAVs into the Canadian and Danish Armed Forces," *International Journal* 70, no. 2 (2015): 251.

<sup>394</sup> AIRFORCE TECHNOLOGY, "Future RAF will mix crewed fighters, UAVs and swarming drones: CDS," 14 April 2021, Accessed 14 February 2022, <https://www.airforce-technology.com/features/future-raf-will-mix-crewed-fighters-uavs-and-swarming-drones-cds/>; Filippo Ruschi, "The Rise of Drones and the Transformation of Warfare: A view from Philosophy of International Law," *Revista De Estudos Constitucionais, Hermeneutica e Teoria do Direito* 12, no. 1 (2020): 150.

<sup>395</sup> Brad W. Gladman, "The future of allied air power: The Royal Australian Air Force," Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 26.; Brad W. Gladman, "The future of allied air power: The United States Air Force," Defence Research and Development Canada, October 2014, Accessed 3 February 2022, [https://publications.gc.ca/collections/collection\\_2015/rddc-drddc/D68-2-82-2014-eng.pdf](https://publications.gc.ca/collections/collection_2015/rddc-drddc/D68-2-82-2014-eng.pdf). 54

unpredictability associated with an attempt to frame a complex and evolving future security environment.<sup>396</sup>

As Chapter 2 demonstrated, examining the future security environment provides insights on the most likely environments and battlespace in which CAF and subsequently RCAF operations are likely to occur.<sup>397</sup> Climate change is anticipated to pose a major threat to global economy, peace, and stability. Therefore, the UN Security Council and the NATO Secretary General have identified climate change as a threat multiplier for peace and accelerant of instability.<sup>398</sup> Climate change is likely to increase demand for CAF deployments in future HADR operations and imposes a wide range of strategic, operational, and tactical challenges. The most dramatic transformation due to human-induced climate change is experienced in the Arctic. The region is warming at least twice the global average. The Arctic is becoming an area of strategic international importance with both Arctic and non-Arctic states expressing a variety of economic and military interests in the region. The key threats to North America will be associated with great-power competition, including increased activity in the Arctic.

An analysis of the fundamental characteristics and challenges of RPA in Chapter 3 determined that RPA will provide the required enhanced capabilities in support of

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<sup>396</sup> Brad W. Gladman, "The future of allied air power: The Royal Australian Air Force," Defence Research and Development Canada, October 2015, Accessed 3 February 2022, [https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709\\_A1b.pdf](https://cradpdf.drdrddc.gc.ca/PDFS/unc203/p802709_A1b.pdf). 26.

<sup>397</sup> Department of National Defence, *Capability Based Planning Handbook*, Accessed 3 November 2021.

<sup>398</sup> Yasmeen, Samina, "Climate Change and Human Security: In Context of Global Economy, Culture and Conflict," *Journal of the Research Society of Pakistan* 58, no. 3 (09, 2021): 203 <https://www.proquest.com/scholarly-journals/climate-change-humans-security-context-global/docview/2580281552/se-2?accountid=9867>; RAND Europe, "Crisis Response in a Changing Climate," 4 May 2021, Accessed 6 January 2022, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/983194/RAND\\_RRA1024-1\\_1\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/983194/RAND_RRA1024-1_1_.pdf)

defence and non-defence-missions. The distinguishing characteristics of RPA have significantly impacted current and future warfare. Unencumbered by human performance or physiological characteristics, RPA can achieve extreme persistence that far exceeds inhabited air assets and manoeuvrability. The weaponization of RPA has provided a new tool for the delivery of air power and lethal force by both states and violent non-state actors in and outside the battlespace. Moreover, the increased computational power and software innovations are the first driver of the unprecedented developments in AI and machine learning, and ultimately to autonomous weapon systems. The rise of AI is expected to bring about the greatest potential change in how RPA operates.

Chapter 4 evaluated how RPA could enhance current and future RCAF capabilities. Canada's current air power doctrinal core capabilities of Control of the Air, Air Attack, Air Mobility and ISR closely aligned with the Five Eyes and NATO current air power core capabilities. Moreover, the analysis of the core capabilities of the Five Eyes partners and NATO has demonstrated consistency in the current application of RPA to the Control of the Air, Air Attack and ISR core capabilities using RCAF doctrinal terminology. In addition, the USAF has also demonstrated the enhanced capability provided by RPA in the conduct of HADR operations. With the advance in autonomous vehicles, USAF, RAF and RAAF allies are exploring the teaming of inhabited and uninhabited platforms capable of collaborative operations as a loyal wingman in a contested environment. That is consistent with RCAF Vectors and force development considerations, which already highlight the development of a balanced mix of air and

space capabilities that includes inhabited, remotely operated and autonomous assets to support operations in both contested and uncontested environments.<sup>399</sup>

As Chapter 4 demonstrates further, when projecting air power, because there is no human pilot onboard, RPA has also altered the risk calculation by reducing the risk of human casualty or captured by enemy forces in the event of RPA loss or shoot down by enemy forces. As the RCAF transitions from a force comprised solely of inhabited platforms to a mix of inhabited and uninhabited remotely piloted platforms, leadership will be key to address the anticipated significant cultural challenge. In addition, the RCAF and the CAF will need to transcend traditional organizational structures, concept of operations, training and embark on a similar RAAF Plan Jericho transformation. Such transformation is required to fully harness the capabilities of fifth-generation platforms into all aspects of how CAF fights, while also transitioning to a pan-domain force that can deliver air and space power in the information age.

Finally, an assessment of the RCAF force structure in Chapter 5 provides options for the integration of RPA into the RCAF to optimize the use of limited air power resources in support of defence and non-defence missions. Through the lens of RCAF core capabilities, this chapter identified that 3, 4, 14 and 19 Wings are all doctrinally well positioned as potential MOB for the integration of RPA into the RCAF. The above deduction is consistent with the information available from the RFP released by the GoC on 11 February 2022 to the Qualified Suppliers, identifying 14 Wing and 19 Wing as the MOB for the Remotely Piloted Aircraft System (RPAS) project. Despite the limited operational-level doctrine, tactics, techniques and procedures specific to RPA, the

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<sup>399</sup> FAOC, 26.

planning and execution of RPA missions should be in line with RCAF air power doctrine. In order to facilitate the RPA introduction to operational service, selected RCAF personnel to include rated pilot, systems or sensor operator, personnel assigned to a CAOC, intelligence and maintenance technicians, should be embedded at the earliest opportunity with allies operating MALE RPA to gain first-hand knowledge and experience in flying and maintaining these platforms. RCAF integration of RPA evaluated through the lens of the 11 RCAF functional areas in support of domestic, continental and expeditionary operations, demonstrated that RPA will enhance current and future delivery of air power to meet Canadian defence and non-defence missions in an increasingly complex security and defence environment.

Although this DRP focused on the RPA integration into the RCAF, the global proliferation of RPA by both state and non-state actors cause concerns for global peace and security. The rapid development of nanotechnologies and AI are likely to further heighten the security challenges caused by the use of RPA by violent non-state actors. Therefore, the exploration of physical counter-measures system against not only RPA, but also these emerging technologies should also be considered by the RCAF and military alliances such as NATO to optimize the need for layered protections in a dynamic and complex global peace and security environment.

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