National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

CONSIDERING AUTONOMOUS WEAPONS SYSTEM USAGE IN THE CANADIAN ARMED FORCES

Major D.A. Lee

JCSP 47

Service Paper

Disclaimer

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.

PCEMI 47

Étude militaire

Avertissement

Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.

Canada

CANADIAN FORCES COLLEGE - COLLÈGE DES FORCES CANADIENNES

JCSP 47 - PCEMI 47
2020 - 2021

SERVICE PAPER – ÉTUDE MILITAIRE

CONSIDERING AUTONOMOUS WEAPONS SYSTEM USAGE IN THE CANADIAN ARMED FORCES

By Major D.A. Lee

Word Count: 2,597

Nombre de mots : 2.597

CONSIDERING AUTONOMOUS WEAPONS SYSTEM USAGE IN THE CANADIAN ARMED FORCES

AIM

1. The aim of this service paper is to inform readers – including Director General Operations (DG Ops) at Canadian Joint Operations Command (CJOC) – about a range of factors that should be considered prior to the adoption of autonomous weapons systems (AWS) by the Canadian Armed Forces (CAF). The paper defines AWS and suggests technical, policy, and legal questions that need to be addressed before AWS are employed either directly or indirectly by the CAF. The paper aims to spark further discussion and deliberation amongst appropriate CAF authorities and stakeholders from across the Canadian government.

INTRODUCTION

2. This paper was prepared in response to an 'RCAF Operational Concepts' research question submitted to the Canadian Forces College for contemplation by students enrolled in serial 47 (2020-2021) of the Joint Command and Staff Programme (JCSP). It has been constructed using open sources and excludes any classified considerations. However, the unclassified nature of the paper should facilitate wider distribution as required.

3. To ground further discussions, the paper first provides a suggested definition for AWS. Second, it briefly addresses the research question's contention that such systems represent the future of warfare. Next, the paper examines the state of current Canadian and international policy efforts addressing AWS, and briefly assesses the risk of technological developments outpacing regulation. For the penultimate section a selection of moral, ethical, and legal dimensions of AWS development are presented for consideration. Finally, the paper concludes with the provision of a short list of recommendations for further deliberation and action.

DISCUSSION

4. Before proceeding further, it is useful to define what is meant by AWS. As quoted in the research question, the US Department of Defense defines an AWS as a "weapons system that, once activated, can select and engage targets without further intervention by a human operator."[1] According to the 'Campaign to Stop Killer Robots', a coalition of non-governmental organizations (NGOs) formed in late 2012, fully autonomous weapons "are weapons systems that would select and engage targets on the basis of sensor inputs, that is, systems where the object to be attacked is determined by sensor processing, not by humans."[2]

5. A key distinction is that no human input is required prior to target engagement once an AWS is activated, whether such engagement is kinetic or non-kinetic. This is an important difference from semi-autonomous systems which include a human actor 'in the loop' prior to

[1] Michael T. Klare, "Autonomous Weapons Systems and the Laws of War," *Arms Control Today*, 2019, https://www.armscontrol.org/act/2019-03/features/autonomous-weapons-systems-laws-war.

[2] "Campaign to Stop Killer Robots," 2021, https://www.stopkillerrobots.org/.

engagement. Indeed, according to the United Nations Institute for Disarmament Research (UNIDIR), the phrase 'human control' is used by agencies like the US Department of Defence as a demarcation between AWS and semi-autonomous weapon systems.[3]

6. It is also worth noting what is *not* considered an AWS by this paper. While a landmine could be seen as possessing autonomy – since once emplaced and armed, it may be triggered and explode without further human input – it is instead useful "to think about lethal autonomous operations as situated on a spectrum, with, for instance, antipersonnel mines… at one end, and human beings or (theoretical) strong artificial intelligence at the other."[4] Thus, this paper does not consider AWS as akin to landmines, since doing so diminishes their potential impact and sidesteps important questions about their use.

7. Since AWS require no human input to perform lethal actions, the concept of asserting 'meaningful human control' (MHC) over otherwise independent AWS looms large in current debates about AWS usage. However, a universal definition of MHC does not yet exist – which is unsurprising since the terms 'meaningful' and 'human control' can be subjective. Nevertheless, UNIDIR asserts that "the idea of Meaningful Human Control is intuitively appealing even if the concept is not precisely defined."[5] Despite the lack of agreement on what MHC means, three factors can be broadly implied by the term – keeping humans in the targeting 'loop' as a failsafe, maintaining human accountability in AWS actions, and a guarantee that considerations of morality will be made by humans, not an automated system.[6]

AWS as the future of warfare

8. The research question that sparked this paper also asserts that AWS represent the future of warfare. Amongst much of the AWS literature, this consideration is taken as a given – it is less a question of 'if' and more a question of 'when' or 'how'. Indeed, as author P.W. Singer points out in his 2009 book *Wired for War*, "All the rhetoric ignores the reality that man started moving out of 'the loop' of war a long time before robots made their way onto battlefields."[7] Singer cites present-day examples such as air defense systems whereby operators retain only veto power, which they are typically reticent to use given the "quicker (and… better) judgment of a computer."[8] Thus, for the sake of argument, this paper concurs with the research question's claim that AWS are indeed 'the future' since they are already very much 'the present.' However,

[3] United Nations Institute for Disarmament Research, "The Weaponization of Increasingly Autonomous Technologies: Considering How Meaningful Human Control Might Move Discussion Forward," *UNIDIR Resources*, no. 2 (2014): 1, http://www.unidir.org/files/publications/pdfs/considering-how-meaningful-human-control-might-move-the-discussion-forward-en-615.pdf.

[4] Robert Sparrow, "Robots and Respect: Assessing the Case Against Autonomous Weapon Systems," *Ethics and International Affairs* 30, no. 1 (2016): 94, doi:10.1017/S0892679415000647.

[5] United Nations Institute for Disarmament Research, "The Weaponization of Increasingly Autonomous Technologies: Considering How Meaningful Human Control Might Move Discussion Forward," 2.

[6] Daniele Amoroso and Guglielmo Tamburrini, "Autonomous Weapons Systems and Meaningful Human Control: Ethical and Legal Issues," *Current Robotics Reports* 1, no. 4 (2020): 189, doi:10.1007/s43154-020-00024-3.

[7] P.W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century*, OverDrive (New York: Penguin, 2009), chap. 6.

[8] Ibid.

future iterations of AWS will be far more advanced than the automated systems of today.

Current Canadian and international policy

9. The RCAF Operational Concepts research question then suggests that "public policies and international norms do not as yet exist and may not be able to keep pace with autonomous systems…" This statement is not entirely accurate. For example, Canada's 2017 defence policy – *Strong, Secure, Engaged* (*SSE*) – notes that "The [CAF] is committed to maintaining appropriate human involvement in the use of military capabilities that can exert lethal force."[9] Similarly, *SSE* priority #93 states the Canadian defence team will "Promote the development of international norms for the appropriate responsible and lawful use of remotely piloted systems, in support of Global Affairs Canada."[10] Such language at the very least suggests CAF endorsement of MHC for AWS as well as support for more robust guidelines for semi-autonomous systems.

10. Perhaps most forcefully, the Canadian Minister of Foreign Affair's Mandate Letter notes direction from the Prime Minister in December 2019 to "Advance international efforts to ban the development and use of fully autonomous weapons systems…"[11] This represents a marked increase in the clarity of the Government of Canada's position on AWS between 2017 and 2019.

11. While such direction from the highest level of government could create the impression that the CAF will not employ AWS, according to the Campaign to Stop Killer Robots, Canada has yet make a national statement calling for a prohibition on AWS.[12] Furthermore, based on similar tracking efforts, Canada has yet to formally support the creation of "a new international treaty to prohibit and restrict lethal [AWS]."[13] Such inconsistences suggest some level of dissonance at the national level, perhaps explaining why specific policy is lacking at present.

12. *SSE* also considers the present-day usage of remotely piloted systems. While current tasks for remotely piloted systems include ordnance disposal, acoustic surveillance, and countering naval mines, *SSE*'s initiative #91 directs the Canadian defence team to "Invest in a range of remotely piloted systems, including an armed aerial system capable of conducting surveillance and precision strikes."[14] Usage of the term 'remotely piloted' implies such systems will not be fully autonomous. No matter the degree of system autonomy, *SSE* pledges that "Operations will be conducted in strict accordance with all the controls, procedures, and rules of engagement that govern the use of force with any other weapon."[15] These statements suggest the CAF will not employ AWS for lethal action, relying instead on semi-autonomous systems for such strikes.

[9] Canada. Department of National Defence, "Strong, Secure, Engaged - Canada's Defence Policy," 2017, 73.
[10] Ibid., 112.
[11] Government of Canada, "Minister of National Defence Mandate Letter," 2019, https://pm.gc.ca/en/mandate-letters/2019/12/13/minister-national-defence-mandate-letter.
[12] Campaign to Stop Killer Robots, "States Calling for a Treaty to Ban and Restrict Killer Robots," 2020, 1.
[13] Ibid., 3.
[14] Canada. Department of National Defence, "Strong, Secure, Engaged - Canada's Defence Policy," 73.
[15] Ibid.

13. Much of the international debate about AWS since 2014 has been carried out within an arms control framework by parties to the UN's Convention on Certain Conventional Weapons (CCW)[16]. Nevertheless, as of this paper's writing no international law or agreement exists specifically addressing AWS. In fact, some countries – including Australia, Russia, and the United States – oppose the creation of an international pact, saying such an effort would be "premature."[17]

Risk of technology outpacing regulation

14. *SSE* also addresses the difficulty of policy or legislation keeping pace with technology. According to its introductory text, *SSE* reflects Canadian values when addressing "the uncharted legal territory surrounding the use of autonomous vehicles and cyber threats."[18] *SSE* notes that advanced technologies such as AWS represent an increased pace of change that "will also require that domestic and international legal and governance systems adapt in an effective and timely manner."[19] No such adaptation has occurred to date, lending credence to concerns that the development of AWS technology is outpacing regulation.

Moral, ethical, and legal dimensions of AWS development

15. This paper's research question also points to the 'significant moral and ethical issues' that surround AWS development and employment. Put simply, "many people have the intuition that there is something morally problematic about robots killing people."[20] Though this paper lacks the space to consider either particular scenarios or the full range of debate amongst academics, governments, and militaries, key themes that emerge around AWS focus on responsibility, accountability, and moral judgment.

16. One concern that is frequently raised is referred to as the 'responsibility gap argument.' Such a gap could exist "when an AWS harms someone, but no [human] is responsible."[21] According to critics, such a responsibility gap complicates just war theory since humans are no longer involved in the application of force. [22] However, others submit that the retention of some level of control over the AWS avoids any such gap – even if that control occurs much earlier and hinges on decisions about AWS programming and deployment. [23]

17. A similar ethical concern for AWS usage exists regarding accountability. Should an AWS malfunction or "commit war crimes, there is no single person to hold accountable the way

[16] United Nations Institute for Disarmament Research, "The Weaponization of Increasingly Autonomous Technologies: Autonomous Weapon Systems and Cyber Operations," *UNIDIR Resources, No. 7,* no. 7 (2017): 1.

[17] Campaign to Stop Killer Robots, "States Calling for a Treaty to Ban and Restrict Killer Robots."

[18] Canada. Department of National Defence, "Strong, Secure, Engaged - Canada's Defence Policy," 8.

[19] Ibid., 55.

[20] Sparrow, "Robots and Respect: Assessing the Case Against Autonomous Weapon Systems," 95.

[21] Johannes Himmelreich, "Responsibility for Killer Robots," *Ethical Theory and Moral Practice* 22, no. 3 (2019): 731, doi:10.1007/s10677-019-10007-9.

[22] Ibid.

[23] Ibid., 745.

a drone operator, pilot in the cockpit, or ground team would be accountable today."[24] A related anxiety is that AWS usage "will allow leaders and soldiers not to feel ethically responsible for using military force because they do not understand how the machine makes decisions and they are not accountable for what the machine does."[25]

18. Despite a range of fears surrounding AWS employment, others point to potential benefits of their usage. For example, an autonomous system's lack of emotion could allow it to carry out tasks more stringently within agreed-upon international humanitarian law (IHL).[26] Once again, though, the other side of this particular debate would contend that developments in artificial intelligence do not yet suggest that AWS will possess "a better-than-human application of the IHL principles."[27]

19. Despite this paper's genesis as a response to an RCAF query, the future use of AWS will not be constrained to the aerospace environment. While the usage of semi-autonomous weapons in the land and air domains over the last two decades is well documented, the potential for AWS usage in the maritime domain remains relatively unexamined.[28] The use of AWS as unmanned underwater vehicles (UUV) will present unique ethical and legal questions given the maritime environment. These include whether UUVs will be understood as 'vessels' or 'weapons', what sort of UUV tasks or missions would be viewed as legitimate in international (vice territorial) waters, and whether UUVs would be subject to customary maritime laws such as Safety of Life at Sea (SOLAS).[29]

20. In order to facilitate the independent targeting operations that would be undertaken by AWS, it will likely be necessary to connect such systems to a broader 'battle network' or 'combat cloud.' Forging such a connection could lead to further moral and legal concerns. For example, if "one nation's forces engage a civilian target because the data provided to the combat cloud by another country's sensors was in error…"[30] it is unclear which nation would be responsible. Thus, while Canada may not directly employ its own AWS, the very real possibility of Canadian sensing data being shared with an allied AWS across a battle network exists. Such a scenario could subject the CAF to the types of legal and ethical questions raised above, albeit at arm's length.

21. While no nation has yet fielded a fully autonomous unmanned aerial vehicle (UAV), the use of remotely-piloted UAVs over the past two decades has produced its own series of unintended consequences. For example, while the combination of advanced UAVs and precision

[24] Michael C. Horowitz, "The Ethics & Morality of Robotic Warfare: Assessing the Debate over Autonomous Weapons," *Daedalus* 145, no. 4 (2016): 30, doi:10.1162/DAED_a_00409.

[25] Ibid.

[26] Amoroso and Tamburrini, "Autonomous Weapons Systems and Meaningful Human Control: Ethical and Legal Issues," 188.

[27] Ibid.

[28] Robert Sparrow and George Lucas, "When Robots Rule the Waves?," *Naval War College Review* 69, no. 4 (2016): 49–50, https://www.usnwc.edu/getattachment/a08fae16-a0d4-481c-9b1c-7090d3d738a2/When-Robots-Rule-the-Waves-.aspx.

[29] Ibid., 50.

[30] Peter Layton, "Fifth-Generation Air Warfare," *Australian Defence Force Journal* 204 (2018): 28, http://www.defence.gov.au/ADC/ADFJ/Documents/issue_204/ADFJournal204_Fifth_generation_air_warfare.pdf.

munitions may effectively limit collateral damage, Prof. Mark Clodfelter points out that 700 Pakistani civilians were killed along with 2,300 militants during American UAV strikes in Pakistan from mid-2004 to mid-2012.[31] The net effect was that a full 74% of Pakistan's population considered America to be an enemy by 2014.[32] If such a backlash is experienced based on the usage of a system that maintains MHC, it is likely the negative perceptions resulting from AWS strikes will be more severe.

The short-term future in Canada

22. Canada may be able to sidestep particularly difficult moral, ethical, and legal issues in the short term by focusing Canadian AWS usage toward particular operational functions. Much of what has been discussed above focuses on kinetic strikes within the 'Act' operational function. However, if Canadian usage of automated systems – note the exclusion of the term 'weapon' in this case – was instead focused toward the 'Sense' or 'Sustain' functions, many of the negative implications of using AWS might be avoided. Using AWS under the 'Shield' function to counter enemy AWS, or to destroy enemy landmines or sea mines, may also be acceptable.

23. Published in late 2020, the Canadian Army's *Advancing with Purpose* modernization strategy speaks to such a possible direction and provides the most up-to-date statement on potential CAF usage of AWS. While recognizing that autonomous systems "can already perform many dull, dirty, and dangerous tasks…"[33] the strategy suggests that "The requirement for a human in or on 'the loop' will remain for any application of lethal force but their utility to assist with sensing and sustaining are already apparent."[34] Such a statement offers alignment with government intent in the absence of more rigorous policy.

CONCLUSION

24. Having considered all aspects of the initiating research question, this paper concurs that AWS that are markedly different from current semi-autonomous systems will be present in the battlespaces of the near future. The Canadian government has signalled its desire for a ban on AWS development and employment, and various CAF strategic documents have thus been careful to delineate between semi-autonomous systems and AWS, as well as AWS and automated systems more broadly. This delicate balance suggests that the CAF wishes to 'reserve the right' to use automated systems in some way in the near future.

25. Specific national and international policy on AWS is lacking and may remain outpaced by technological progress. Nevertheless, it is clear that the philosophical debate about AWS use is ongoing, suggesting the need for ongoing CAF engagement in this realm. By participating in this arena and fully articulating its own position, the CAF will be better able to rationalize what it

[31] Mark Clodfelter, "Theory, Implementation, and the Future of Airpower*," *Air & Space Power Journal*, no. September-October (2014): 121.

[32] Ibid.

[33] Canadian Army HQ, *Advancing with Purpose: The Canadian Army Modernization Strategy*, 4th Edition (Ottawa, ON: Canada. Department of National Defence, 2020), 52.

[34] Ibid.

considers as permissible usage of automated systems across its various operational functions.

RECOMMENDATIONS

26. Given the considerations outlined above, the following recommendations are provided for the consideration of DG Ops at CJOC. These are primarily intended to spur broader engagement with relevant CAF stakeholders as appropriate:

a. Recommend the establishment of a CAF, Defence Research and Development Canada (DRDC), and Canadian Defence Academy (CDA) working group to examine future use cases for AWS, including tasks that may involve the use of explosives or other kinetic responses against enemy AWS, munitions, or static defenses.

b. Recommend high-level CJOC and CAF engagement with Global Affairs Canada (GAC) to reconcile Government of Canada (GoC) direction to work toward a ban of AWS against CAF desire to employ automated systems for a range of tasks.

c. Recommend CJOC engagement with CAF legal experts from the Legal Branch to fully consider the possible moral, ethical, and legal ramifications of AWS usage linked to the CJOC Joint Targeting Cycle. In the event that GoC direction to work toward banning AWS remains unchanged, recommend that this consideration include scrutinization of usage of CAF sensor data within allied battle networks.

BIBLIOGRAPHY

Amoroso, Daniele, and Guglielmo Tamburrini. "Autonomous Weapons Systems and Meaningful Human Control: Ethical and Legal Issues." *Current Robotics Reports* 1, no. 4 (2020): 187–94. doi:10.1007/s43154-020-00024-3.

"Campaign to Stop Killer Robots," 2021. https://www.stopkillerrobots.org/.

Campaign to Stop Killer Robots. "States Calling for a Treaty to Ban and Restrict Killer Robots," 2020.

Canada. Department of National Defence. "Strong, Secure, Engaged - Canada's Defence Policy," 2017.

Canadian Army HQ. *Advancing with Purpose: The Canadian Army Modernization Strategy*. 4th Edition. Ottawa, ON: Canada. Department of National Defence, 2020.

Clodfelter, Mark. "Theory, Implementation, and the Future of Airpower*." *Air & Space Power Journal*, no. September-October (2014): 118–28.

Government of Canada. "Minister of National Defence Mandate Letter," 2019. https://pm.gc.ca/en/mandate-letters/2019/12/13/minister-national-defence-mandate-letter.

Himmelreich, Johannes. "Responsibility for Killer Robots." *Ethical Theory and Moral Practice* 22, no. 3 (2019): 731–47. doi:10.1007/s10677-019-10007-9.

Horowitz, Michael C. "The Ethics & Morality of Robotic Warfare: Assessing the Debate over Autonomous Weapons." *Daedalus* 145, no. 4 (2016): 25–36. doi:10.1162/DAED_a_00409.

Klare, Michael T. "Autonomous Weapons Systems and the Laws of War." *Arms Control Today*, 2019. https://www.armscontrol.org/act/2019-03/features/autonomous-weapons-systems-laws-war.

Layton, Peter. "Fifth-Generation Air Warfare." *Australian Defence Force Journal* 204 (2018): 23–31. http://www.defence.gov.au/ADC/ADFJ/Documents/issue_204/ADFJournal204_Fifth_generation_air_warfare.pdf.

Singer, P.W. *Wired for War: The Robotics Revolution and Conflict in the 21st Century*. OverDrive. New York: Penguin, 2009.

Sparrow, Robert. "Robots and Respect: Assessing the Case Against Autonomous Weapon Systems." *Ethics and International Affairs* 30, no. 1 (2016): 93–116. doi:10.1017/S0892679415000647.

Sparrow, Robert, and George Lucas. “When Robots Rule the Waves?” *Naval War College Review* 69, no. 4 (2016): 49–78. https://www.usnwc.edu/getattachment/a08fae16-a0d4-481c-9b1c-7090d3d738a2/When-Robots-Rule-the-Waves-.aspx.

United Nations Institute for Disarmament Research. “The Weaponization of Increasingly Autonomous Technologies: Autonomous Weapon Systems and Cyber Operations.” *UNIDIR Resources, No. 7*, no. 7 (2017): 1–16. www.unidir.org.

———. “The Weaponization of Increasingly Autonomous Technologies: Considering How Meaningful Human Control Might Move Discussion Forward.” *UNIDIR Resources*, no. 2 (2014). http://www.unidir.org/files/publications/pdfs/considering-how-meaningful-human-control-might-move-the-discussion-forward-en-615.pdf.