National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

FUTURE BATTLESPACE: IS THERE A PLACE FOR AUTONOMOUS WEAPONS?

LCdr C.J. Forsberg

JCSP 42

Exercise *Solo Flight*

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 42

Exercice *Solo Flight*

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 42 – PCEMI 42
2015 – 2016

EXERCISE *SOLO FLIGHT* – EXERCICE *SOLO FLIGHT*

FUTURE BATTLESPACE: IS THERE A PLACE FOR AUTONOMOUS WEAPONS?

LCdr C.J. Forsberg

Word Count: 4779

Compte de mots: 4779

Technology is rapidly advancing to the point where unmanned systems can be deployed to a battle space without the control or intervention of a human being. The prospect of machines being able to make the choice of how and when to apply violence as an instrument of national power is unsettling to many but a necessity to others. There are three primary reasons why the military is interested in developing autonomous weapon systems (AWS). Firstly, unmanned vehicles can actually save lives, they remove the stress of combat and allow operators to make critical decisions without the stress of losing one's life, and also they can remain on station much longer than a manned vehicle[1]. Secondly, AWS can perform dull, dirty and dangerous missions that human combatants would prefer to avoid[2]. Thirdly and in the fullness of time, AWS could compress a targeting cycle and provide rapid support to troops, with the ability to find and engage a target within assigned targeting framework that meets targeting policy, and associated rules of engagement[3]. AWS has the ability to save lives in future conflict and passing on the development of AWS would be irresponsible of our government with respect to sparing lives of its soldiers and also from a national security perspective[4]. There is nothing prohibiting nations or non-state actors from developing and deploying AWS to seek a technological advantage. The convention on the development of conventional weapons does not prohibit the development of AWS but individual nations at the forefront of the development are taking a self-imposed measured approach[5]. The law of armed conflict (LOAC) does not ban the development of any

[1] Gregory P. Noone and Diana C. Noone. "The Debate Over Autonomous Weapons Systems." *Case Western Reserve Journal of International Law no. 47*(Spring 2015): 25. http://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1005&context=jil

[2] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal Singularity". *University of Illinois Journal of Law, Technology and Policy Vol No. 1* (2013):54.

[3] Ibid, 54.

[4] Gregory P. Noone and Diana C. Noone. "The Debate Over Autonomous..., 25.

[5] Ronald C. Arkin, Lethal Autonomous Weapons Systems and the Plight of the Noncombatant of the Mobile Robot Laboratory Georgia Institute of Technology. Presentation at the United Nations Informal Meeting of Experts at the Convention on Conventional Weapons, 14 May 2014, Geneva, Switzerland accessed 29 April 2016, available at:

weapons, including AWS, as long as its functionality can fall within the principles of distinction, proportionality, unnecessary suffering (humanity) and military necessity.

When discussing AWS there are some key terms to clarify in order to avoid confusion, firstly and most importantly, AWS is not artificial intelligence – AWS carry out pre-programmed sequence of operations in a structured environment[6]. It is also important to compare the definition of AWS from an international human rights group and from a department of defence to capture their approach to the topic. The International Committee of the Red Cross (ICRC) define AWS as "weapons that can independently select and attack targets, i.e. with autonomy in the "critical functions" of acquiring, tracking, selecting and attacking targets"[7]. The United States (US) Department of Defense (DoD) defines AWS as "a weapon system that, once activated, can select and engage targets without further intervention by a human operator"[8]. The DoD definition includes human-supervised autonomous weapon system that are designed to allow human operators to override operation of the weapon system, but can select and engage targets without further human input after activation[9]. It is interesting to note that although these two organizations have vastly different views towards AWS, their definitions are extremely similar. The three categories of AWS are human in the loop which requires a human to actively engage a target, human on the loop which can engage autonomously but can be stopped by an operator and human out of the loop which can act completely without human input[10]. This paper will focus on the discussion revolving around human out of the loop technology, which though

---

http://www.unog.ch/80256EDD006B8954/(httpAssets)/FD01CB0025020DDFC1257CD70060EA38/$file/Arkin_LAWS_technical_2014.pdf

[6] Gregory P. Noone and Diana C. Noone. "The Debate Over Autonomous…, 28.

[7] Ibid, 27.

[8] Ibid.

[9] Ibid.

[10] Allyson Hauptman. "Autonomous Weapons and the Law of Armed Conflict". *Military Law Review Vol 218* (Winter, 2013): 170. http://heinonline.org/HOL/LandingPage?handle=hein.journals/milrv218&div=6&id=&page=

still under development has some far reaching implications with respect to international law and the just war concept.

Through an examination of the principles of LOAC (distinction, proportionality, military necessity and unnecessary suffering), aspects of the accountability, ethical and moral issues surrounding AWS this paper will argue that AWS should be developed and employed in accordance with LOAC. The principles of LOAC will be examined in a manner to evaluate their applicability to AWS in terms of ability to meet the spirit of LOAC principles or control measures required to the reduce risk of non-compliance. Also, a brief examination of the accountability and ethical/moral issues surrounding AWS, specifically the means to ensure accountability for the application of violence in accordance with international law and the ethical/moral considerations for the application of violence without a human in the decision cycle.

Distinction

The first principle to be examined is distinction, the obligation of parties in an armed conflict to distinguish between combatants and non-combatants while also ensuring that attacks are only directed at combatants[11]. This principle is especially difficult to adhere to in the modern era of warfare, which seldom provides solid front lines and often includes combatants in civilian attire, or not identifiable as an armed belligerent, which creates doubt about whether a person is either a combatant in disguise or a civilian taking a direct part in hostilities[12]. The challenge in identifying a combatant can be difficult for a human combatant but can an AWS rise to challenge. The current capabilities of autonomous weapon systems improve upon human distinction capabilities in terms of target acquisition through the use of sensors, however this

[11] Canada. Canadian Defence Academy. Course Reader for the Intermediate Law of Armed Conflict Course (Kingston, Canada): 40.
[12] Allyson Hauptman. "Autonomous Weapons and the Law…, 195.

improvement can only be utilized when a target can be predetermined prior to weapon deployment[13]. When faced with the ambiguity of the complex operating environment an AWS lacks reasoning capabilities equal to those of a human being. The potential resolution for this problem could be to allow the programming to err on the side of caution but this could mean acquiescing a number of opportunities to achieve military victory that a commander and state are unwilling to forego[14]. Until technology can achieve a fully autonomous end state, humans will need to stay on the loop for engagements to maintain credibility and legitimacy for engagements by unmanned vehicles.

In order to meet the distinction requirements, an AWS must be able to consistently recognize the enemy. To facilitate this requirement the systems would have to be programmed to recognize who the enemy is, and what objects belong to that enemy, which can be accomplished through the use of modern software in conjunction with an advanced sensor suite[15]. AWS must be able to determine whether a particular target is civilian or military to meet the jus in bello requirement of distinction[16]. The AWS must have a function that can override an engagement when there is doubt over whether a person or object is a lawful target, until such a time the target is presumed to be a civilian[17]. An additional challenge factor for distinction in AWS is the ability to determine when a civilian is directly participating in hostilities (DPH). In this case an AWS could be programmed to sacrifice themselves to "reveal the presence of a combatant" since they

---

[13] Ibid, 192.
[14] Ibid.
[15] Markus Wagner. "The Dehumanization of International Humanitarian Law: Legal, Ethical, and Political Implications of Autonomous Weapon Systems". V*anderbilt Journal of Transnational Law vol. 47* (2014): 21. http://robots.law.miami.edu/wp-content/uploads/2012/01/Wagner_Dehumanization_of_international_humanitarian_law.pdf
[16] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully Autonomous Weapons". *Joint Force Quarterly issue 63, 4th quarter* (2011): 80. http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-67/JFQ-67_77-84_Thurnher.pdf
[17] Markus Wagner. "The Dehumanization of International Humanitarian Law: Legal…, 21.

are constrained by the notion of self-preservation[18]. This tactic would be similar to a show of force conducted by the Air Force and could provide accurate positional information to other AWS for their subsequent engagement and allow them to meet the requirements of distinction.

Until such a time that programming and sensor systems for AWS can be fully automated to adequately determine between a civilian or legitimate military target their employment must be limited through the use of control measures. In the case of current weapons, human on the loop and human in the loop will continue due to complexity of the operating environment. However, if there were ever a battlefield where no civilians were reasonably thought to be present, then a commander may be able to legally unleash an AWS in that area, even if it were not capable of distinguishing between combatant and civilian[19]. This instance would apply to a traditional state on state conflict that cannot be ruled out as an unlikely future conflict given current global uncertainty. This means of employment for a fully automated AWS, with the ability to distinguish enemy from friendly forces, and the AWS has the ability to be aimed or aim itself at a target, then it could be utilized in a conventional conflict in an area wholly occupied by the enemy without contravening the distinction principle of LOAC.

There can be no doubt that largest hurdle to overcome for fully AWS to enter the battle space and conduct missions without any human interaction is the ability to distinguish combatants from civilians. The main counter to the AWS problem of distinction is that there is not an adequate definition of a civilian that can be translated into computer code[20]. The LOAC does not provide a definition that could give a

[18] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 80.
[19] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…, 61.
[20] Noel E. Sharkey. "The Evitability of Autonomous Robot Warfare". *International Review of the Red Cross, 94* (2012): 789. doi:10.1017/S1816383112000732.

machine the necessary information to make a decision to conduct or abort an engagement[21]. Machines are not yet capable of processing information necessary for distinction, war is not black and white. As a balance to this argument, nations developing this technology to employ AWS must ensure that prior to weapon deployment the system possesses the ability to be aimed, or aim itself, at an acceptable legal level of discrimination[22]. To ensure the acceptability of fully automated AWS in the future battlespace, rigorous testing of technology must occur in a public manner, to demonstrate their ability to distinguish combatant and civilian targets.

Proportionality

The second principle of LOAC to examine is proportionality which establishes a link between the concepts of military necessity and humanity[23]. This principle implies that collateral damage to civilian objects arising from military operations must not be excessive in relation to the direct military advantage anticipated from such operations[24]. To achieve this principle there must be a rational balance between the legitimate destructive effect and undesirable collateral effects[25]. In order to enable the use of AWS without human interaction prior to engagement, an AWS would require some sort of artificial intelligence, or computer program, which can appropriately judge proportionality. However, it remains unclear if technology could create an AWS that could consistently make a satisfactory determination of excessiveness at the level of a reasonable person, or a reasonable commander, in any given situation[26]. An operational commander can designate control measures as a means to achieve proportionality through the use of AWS in areas of low risk of collateral damage, circumstances where there is a declared

---

[21] Ibid, 789.
[22] Kenneth Anderson and Andrew Waxman. "Law and Ethics for Robot Soldiers". *Policy Review,* (2012): 9. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2046375
[23] Canada. Canadian Defence Academy. Course Reader for the Intermediate Law of Armed…, 40.
[24] Canada. Canadian Defence Academy. Course Reader for the Intermediate Law of Armed …, 41.
[25] Ibid.
[26] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 81.

enemy or high value target in an area of high intensity conflict[27]. AWS do not need to be limited for use in full spectrum combat[28]. The control measures set by the operational commander can offset proportionality concerns of AWS, until such a time when computer programming can bridge the gap between assessment of acceptable collateral damage, and military advantage.

Opponents of AWS foresee a similar limiting factor for proportionality as they have for distinction. In their view, attempting to translate highly indeterminate rules into software, for the time being, has so far proven to be illusory, and there is currently no realistic solution to replicate the fundamentally qualitative assessments in a proportionality analysis of military action[29]. It is acknowledged that proportionality is largely a qualitative, subjective decision, and there is ample reason to keep a human in or on the loop for these assessments, but technology can accelerate the targeting process up to the point where a human is required for an engagement decision[30]. In this scenario the commander or his delegate can assess the situation and authorize (or not authorize) the release of a given class of weapon on the proposed target, using assessments from the AWS sensors, programs such as Bugsplat, and other available intelligence tools to make their decision[31]. The use of AWS in future battle can still be assured to facilitate the selection and localization of targets, but in order to adhere LOAC requirements, a human will remain in the decision cycle when applying lethal force.

Military Necessity and Unnecessary Suffering (Humanity)

The principles of military necessity and unnecessary suffering (humanity) are combined for their examination in the context of AWS due to their close relationship with the principles of distinction and proportionality. Military necessity has three presuppositions which describe how

[27] Ibid, 81.
[28] Ibid, 81.
[29] Markus Wagner. "The Dehumanization of International Humanitarian Law: Legal…, 52.
[30] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…, 62.
[31] Ibid, 62.

force is applied, and to what end the force used must be controlled. The use of force is required to achieve submission of the enemy and the amount of force used is needed to achieve prompt submission for the realization of the purpose of armed conflict[32]. Unnecessary suffering, also known as humanity, provides the immunity of civilians and civilian objects from attack in an armed conflict[33]. This principle also acknowledges the fact that there may be civilian causalities when legitimate targets are engaged in armed conflict, but those incidental casualties must fall within the principle of proportionality[34]. Generally when the first two principles of distinction and proportionality are met, then military necessity and unnecessary suffering are generally satisfied, as well through the use of a legal weapon, and application of an appropriate level of force. As long as the types of targets and missions assigned to AWS are valid military objectives and meet the threshold of military advantage, which is a universal consideration in all conflicts, then AWS would be in compliance with the principle of necessity when engaging those targets[35]. When considering the design of AWS itself it is clear that the intent of the machine is not to cause unnecessary suffering and meets the requirements of LOAC[36]. However, to ensure legality once armed conventional weapons must be used, and without some addition like impermissible fragmentation weapons, the principle of unnecessary suffering, may be the least problematic[37].

Law of Armed Conflict Conclusion

As eluded to in the section previous sections, LOAC is not designed to impede the conduct of war, but is instead intended to ensure combatants appropriately direct violence toward the enemy's war efforts[38]. The arguments used against the development of AWS or their

[32] Canada. Canadian Defence Academy. Course Reader for the Intermediate Law of Armed…, 38.
[33] Ibid, 39.
[34] Ibid, 39.
[35] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 80.
[36] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…,62.
[37] Ibid, 62.
[38] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 80.

legitimacy as a weapon of war, or their legitimate use in conflict can be traced back to the very first debates concerning laws and ethics of war. The legitimacy debate has occurred for the introduction of many new weapons that were considered as unlawful from their first use or creation, for example, poison, the cross-bow, submarines, aerial bombardment, antipersonnel landmines, chemical and biological weapons, and nuclear weapons[39]. In this respect, given historical context, there is nothing novel in the debate against AWS and the conditions of their lawfulness as weapons, and the conditions of their lawful use[40]. In some cases, the legal prohibitions against the aforementioned weapons eroded over time, such as with airplanes and submarines, as their use became increasingly common place, the rules governing the use of those weapons adapted[41]. Just as development and employment of aircraft and submarines gained acceptance and changed over time, so too will that of autonomous weapon systems. The introduction of AWS through such vehicles as unmanned aerial vehicles (UAVs) has been incremental, so too will development of norms regarding acceptable systems and uses be incremental[42]. From these arguments it is assessed AWS can meet the criteria in the LOAC through the use of control mechanisms and, until technology can meet the principles of LOAC, a human will remain in the decision cycle for the application of violence. It also demonstrates the adaptability of international law as new technology becomes the new normal.

Accountability

Another segment of the equation for LOAC is accountability, and the greatest question from opponents AWS is who will be accountable when an AWS strikes the wrong target due to a failure of its machinery, sensors or programming. It is viewed that any breach of LOAC

[39] Kenneth Anderson and Andrew Waxman. "Law and Ethics for Robot Soldiers". *Policy…,* 6.
[40] Ibid, 6.
[41] Ibid, 7.
[42] Ibid, 5.

committed by an AWS will not be accountable to a human being[43]. While the need to hold someone accountable is a visceral reaction, it is not definitively required by international law, rather international law demands that states not absolve themselves of liability with respect to a grave breach of the laws of war[44]. LOAC does not require that a human be held personally accountable for any mistakes or violations that may occur on the battlefield[45]. In this regard, it is the state itself that assumes responsibility for the violence it utilizes to pursue its national interest, and the states responsibility to determine accountability of an individual. This is evidenced by the recent case of the accidental targeting of the Medecins Sans Frontier Hospital in Kunduz, Afghanistan where the US assumed responsibility and punished those involved in the targeting chain of errors with administrative measures[46]. This accident was attributed to human error, and highlights the fact that humans are not infallible in terms of engagements in times of conflict, and that AWS would likely have similar faults. This also denotes the difficulty applying a standard to accountability for AWS. It will be difficult to ascertain when AWS are developed sufficiently to operate in a fully autonomous mode, a standard of "no worse than humans" would be difficult to assess considering the questionable accuracy of civilian casualty rates in conflict[47]. A testing model cannot be developed if it is unknown how good humans are at following LOAC principles[48]. Until such a time when fully automated AWS can meet the standards set forth in LOAC and a more nuanced approach to accountability will continue with a human remaining on or in the loop[49]. The problem of accountability is therefore not exclusive to AWS and although

[43] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 82.
[44] Jeffrey Thurnher. "No One at the Controls: Legal Implications of Fully…, 82.
[45] Ibid, 82.
[46] Barbara Starr and Ryan Browne. "Pentagon: U.S. bombing of Afghanistan hospital not a 'war crime'". Last accessed on 4 May 2016 at: http://www.cnn.com/2016/04/29/politics/u-s-airstrike-hospital-afghanistan-investigation/
[47] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…, 64.
[48] Ibid, 64.
[49] Ibid.

LOAC has to the capacity to accept human error, can it adapt to accept machine error (or programming error which is undoubtedly attributable to a human).

The accountability problem is not limited to errors in judgement with respect to the targeting cycle, when under pressure humans can ignore information which indicates their thought process is flawed. This is highlighted by the USS VINCENNES incident where it perceived a threat from an Iranian fighter but it was actually a civilian airliner flying in well-established air lanes squawking appropriate IFF[50]. The US government has not assumed accountability for this incident but has expressed regret that the tragedy occurred and has settled out of court with the government of Iran. The question remains whether or not LOAC is able to prosecute any wrong doing, let alone holding a nation accountable. In this respect LOAC has not been able to provide accountability for even gross negligence on behalf of human error due to its focus on the nation state rather than individual action. When considering the employment of AWS without human operators, a change in emphasis on existing law towards command responsibility will need a renewed focus[51]. This would not require a change in the law but its interpretation for the employment of weaponry to account for the way in which AWS receive orders from a higher command authority, rather than from tactical level commanders on ships, as in the example above. In this instance the commander who ordered the deployment would be the last point of contact for the AWS and would therefore be responsible for its actions[52]. However, when considering fairness to the commander, the programmer is the last physical point of contact and could introduce inadvertent errors, which means that human error will continue to play a role despite the automation of war. When bearing in mind the future weapons of war, AWS will

[50] Ibid, 65.
[51] Ibid, 66.
[52] Eric T. Jensen. "The Future of the Law of Armed Conflict: Ostriches, Butterflies, and Nanobots". *Michigan Journal International Law Vol. 35:253* (2014): 296.
http://repository.law.umich.edu/mjil/vol35/iss2/3

continue to develop as a means to answer the needs of the military, but restrained by LOAC[53]. Accountability will continue to fall within purview of states when the deployment of fully automated AWS does occur ine future conflict.

Ethical and Moral Considerations

The crux of the moral and ethical considerations for the future employment of fully automated AWS is the dehumanization of the battlefield and the fact the machine will be able to make the "choice" to kill a human being. The moral and ethical distinction in this argument is unique when viewed through the lens of one's feeling of right and wrong (moral perspective), and the study of the principles of right conduct (ethics). Detractors of AWS often ground their arguments in the moral camp, and protractors view this capability from the ethical camp. Both sides will be examined concurrently since their arguments weave together in the fractious issue of AWS in combat. The moral argument against AWS that bears the most consideration is that many consider it profoundly disrespectful to utilize AWS against an adversary[54]. The value of human life demands that a minimal level of interpersonal relationship exists between belligerents, but because AWS are not moral agents, that relationship will not ever exist between attacker and target[55]. The killing by AWS, where no human being has any involvement on the targeting decision, does not uphold the dignity of the person being killed[56]. The ethical view point approaches the AWS problem from a vastly different perspective, AWS has the ability to save lives, and is a means to mitigate human error through the removal of emotions from engagements[57]. The elimination of the need for an AWS to claim self-defence as a means to

[53] Eric T. Jensen. "The Future of the Law of Armed Conflict: Ostriches, Butterflies…, 296.
[54] Heather M. Roff. "The Strategic Robot Problem: Lethal Autonomous Weapons in War". *Journal of Military Ethics, 13:3* (2014): 214. http://dx.doi.org/10.1080/15027570.2014.975010
[55] Ibid, 214.
[56] Ibid, 214.
[57] Ronald Arkin. "Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture". *Georgia Institute of Technology, Atlanta, Mobile Robot Lab, Technical Report* (2007): 11.

justify the use of violence would reduce incidents of collateral damage which is a common cause of civilian casualties by human soldiers[58]. AWS systems can be seen as equipment and need not make the appeal of self-defence or feel the need for self-preservation by focusing engagements on legitimate military targets. AWS can be programmed to place civilian lives above their own existence which would position the machine to take the moral high ground in an ambiguous operating environment[59]. The challenging task will then be to determine sufficient criteria through a combination of programming and sensors to enable an AWS's decision making process when determining belligerents from civilians.

The difficult task of establishing standards to determine functionality of AWS and their ability to act in a manner consistent with LOAC principles will be the focus of the main powers who are undertaking development of AWS. As presented previously, this can be accomplished by determining a standard that can be assessed as no worse than a reasonable human or commander. The manner to determine that standard is achievable through the use of thorough testing to determine data points between expected and actual results in engagements through observing the AWS ability to utilize various programmed level of rules of engagement in conjunction with the accuracy of sensors to correctly classify various objects[60]. The US Department of Defense (DoD) is taking a measured approach to AWS and has a directive providing guidance for the development of AWS. The directive states that targeting decisions will ultimately be supervised or made with a human in the decision cycle, even if this 'supervision' is considered to be the moment a human creates the software architecture, and so the appropriate way to look at AWS is that they should be considered 'in terms of human-system

---

http://www.cc.gatech.edu/ai/robot-lab/online-publications/formalizationv35.pdf
[58] Ibid, 11.
[59] Ibid.
[60] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…, 65.

collaboration'[61]. This enables an ethical approach to the use of autonomous systems by maintaining a human in the loop through the engagement decision in order to be able to trace back to a human decision. The DoD directive further states that autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force.[62] This addresses the issue of accountability and moral argument counter to AWS by ensuring that a human will continue to be a moral agent, though detached from combat itself and not affected by the emotional need for self-preservation. The limiting factor to AWS as part of human system collaboration is that it must be able to interact with all relevant human forces in the battlespace to ensure its affect are not redundant or harmful to their operations[63]. This can be countered through continued use of the targeting cycle and the joint action of combatant components within the battlespace.

An additional moral hurdle to struggle with is the strategic robot problem. This refers to how much authority is programmed into AWS[64]. Any AWS (semi or fully autonomous) would have to be able to determine the nature, location, purpose, use and contribution of any given object, as well as possess a means for assessing that target and how it affects one's military advantage[65]. This basic requirement would demand a type of artificial intelligence strong enough to incorporate situational awareness or a significant human system collaboration that could exercise prospective judgment to determine the best course of action to pursue an objective[66]. In effect, the internal targeting system or human collaboration of that weapon, becomes de facto

[61] Heather M. Roff. "The Strategic Robot Problem: Lethal Autonomous Weapons…, 214.
[62] United States. Department of Defense. Directive: Autonomy in Weapon Systems NUMBER 3000.09. (Washington D.C.: Joint Chiefs of Staff, 2012): 2. http://www.dtic.mil/whs/directives/corres/pdf/300009p.pdf
[63] Heather M. Roff. "The Strategic Robot Problem: Lethal Autonomous Weapons…, 219.
[64] Ibid, 219.
[65] Ibid.
[66] Ibid.

commander and a strategic actor[67]. This concern for the strategic robot problem should not be considered a new idea, the issue of the strategic corporal has been present in modern combat since the introduction of instant telecommunications. The strategic corporal is a soldier placed in a situation where his/her judgement alone can have strategic and political consequences that can affect the outcome of a given mission[68]. The awareness of this problem has given rise to increased training on LOAC to soldiers prior to going into combat. To relate to the AWS strategic robot, the measured approach taken by DoD to maintain a human system collaboration in the development of AWS must be taken into account.

As a counter argument to the morality of AWS, critics point out that the use of anthropomorphisms to imply that robots can be more humane than humans and that robots will humanize the battlefield when they can only dehumanize it further[69]. Anthropomorphic terms such as 'ethical' and 'humane', when applied to AWS, lead us to making further inaccurate attributions about AWS in the future[70]. Those arguing against AWS are implying that associating humanistic terms to refer to AWS will make their use easier to consider in future conflict. What has not been considered is the measured approach that these weapons will not be fully automated until it can be reasonably assured that the spirit of LOAC will be met. Also, those rallying against AWS adhere to a series of partially coherent reasons distilled to the "human element" as being essential for providing judgment, restraint, and ultimately responsibility for decisions by AWS[71]. AWS are merely one segment of what the future of warfare will resemble, and what must be considered carefully prior to entering any conflict is must we fight, If the response is

---

[67] Ibid.
[68] Lynnda Liddy. "The Strategic Corporal Some Requirements in Training and Education". *Australian Army Journal Volume II, Number 140* (2004): 140. http://smallwarsjournal.com/documents/liddy.pdf
[69] Noel E. Sharkey. "The Evitability of Autonomous Robot Warfare". *International…,* 793.
[70] Ibid, 793.
[71] Eric T. Jensen. "The Future of the Law of Armed Conflict: Ostriches, Butterflies…, 295.

fight, then all available means within LOAC should be utilized to accomplish the aim quickly with the least amount of force[72]. The advantage of AWS is that they can be easily reviewed, scrutinized, accountable, and morally justified than other means of warfare[73].

Many nations can see the advantages of AWS development as is evidenced by the introduction of other new technologies, it is the rules of war that will have to adapt.

Conclusion

The future of AWS is uncertain, will their development continue, certainly, but will there ever come a time where a machine will be able to decide to use force against a human without human intervention is unknown. Although there are moral dilemmas, the pursuit of AWS will continue, since the development of these weapons is not incongruent with LOAC principles. It is how they are employed which rings true of all weapons in conflict. Technology is on the cusp of fully autonomous weapons, no weapon will be deliberately designed to not adhere to LOAC principles, and must be thoroughly tested prior to use in combat, the technology should not be rushed to be utilized in a fully autonomous manner to prove it can respect LOAC[74]. The history of conflict is filled with examples in which new weapon, propulsion, communication, and transportation technologies provide a basis for strategic advantage, that enable the state to avoid attritional battles, and instead pursue a form of "decisive" warfare[75]. It would also be a risk to national security to not invest in this technology, since it is the next generation of war, in fact Clausewitz most eloquently defined the changing nature of war with this statement: "Each era had its own kind of war, its open limiting conditions, it's own biases. Each would therefore have

---

[72] Amitai Etzioni. "The Great Drone Debate". *Military Review* (March-April 2013): 12. http://usacac.army.mil/CAC2/MilitaryReview/Archives/English/MilitaryReview_20130430_art004.pdf
[73] Ibid.
[74] Benjamin Kastan. "Autonomous Weapons Systems: A Coming Legal…, 47.
[75] John Arquilla and David Ronfeldt. "Cyberwar is Coming!" In *Athena's Camp: Preparing for Conflict in the Information Age* (Santa Monica: RAND, 1997): 24.

had its own theory of war"[76]. Further study regarding the use autonomous weapons is required in order to develop a standard of what a reasonable commander or human would look like when applying a model of machine logic. It would be most helpful if a scholarly pursuit of this topic occurred concurrently with military sponsored studies to provide balance to that bias. Also, most academic works proposing to ban AWS outright are sponsored by international human rights organizations. This requires a balanced academic approach as well to determine if dehumanizing the battlefield could in fact be more humane. The future development of AWS will not be without controversy, but until such a time that technology improves, there will continue to be a human in or on the loop to maintain accountability for decisions in the application of violence, commanders in the field and society in general is not ready for anything more detached.

[76] Echevarria, Antulio J. *Clausewitz and Contemporary War*. Oxford: Oxford University Press (2007): 61.

Bibliography

Anderson, Kenneth and Andrew Waxman. "Law and Ethics for Robot Soldiers". *Policy Review,* (2012): 1-20. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2046375

Arkin, Ronald. "Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture". *Georgia Institute of Technology, Atlanta, Mobile Robot Lab, Technical Report* (2007): 1-117. http://www.cc.gatech.edu/ai/robot-lab/online-publications/formalizationv35.pdf

Arkin, Ronald. "Lethal Autonomous Weapons Systems and the Plight of the Non-combatant". Paper presented at the United Nations Informal Meeting of Experts at the Convention on Conventional Weapons, 14 May 2014, Geneva, Switzerland, accessed 29 April 2016, available at: http://www.unog.ch/80256EDD006B8954/(httpAssets)/FD01CB0025020DDFC1257CD70060EA38/$file/Arkin_LAWS_technical_2014.pdf

Arkin, Ronald C., Patrick Ulam, and Brittany Duncan. "An Ethical Governor for Constraining Lethal Action in an Autonomous System". *Georgia Institute of Technology, Atlanta, Mobile Robot Lab, Technical Report* (2009): 1-9 http://www.cc.gatech.edu/ai/robot-lab/online-publications/GIT-GVU-09-02.pdf

Arqilla, John, and David Ronfeldt. "Cyberwar is Coming!" In *Athena's Camp: Preparing for Conflict in the Information Age*, edited by John Arquilla and David Ronfeldt, 23-60. Santa Monica: RAND, 1997.

Canada. Canadian Defence Academy. Course Reader for the Intermediate Law of Armed Conflict. Kingston, Canada 1-190.

Echevarria, Antulio J. *Clausewitz and Contemporary War*. Oxford: Oxford University Press (2007):1-197

Etzioni, Amitai. "The Great Drone Debate". *Military Review* (March-April 2013): 1-13. http://usacac.army.mil/CAC2/MilitaryReview/Archives/English/MilitaryReview_20130430_art004.pdf

Hauptman, Allyson. "Autonomous Weapons and the Law of Armed Conflict". *Military Law Review Vol 218* (Winter, 2013): 177-195. http://heinonline.org/HOL/LandingPage?handle=hein.journals/milrv218&div=6&id=&page=

Jensen, Eric T. "The Future of the Law of Armed Conflict: Ostriches, Butterflies, and Nanobots". *Michigan Journal International Law Vol. 35:253* (2014): 255-317. http://repository.law.umich.edu/mjil/vol35/iss2/3

Kastan, Benjamin. “Autonomous Weapons Systems: A Coming Legal Singularity”. *University of Illinois Journal of Law, Technology and Policy Vol No. 1* (2013):45-82.

Klincewicz, Michał. “Autonomous Weapons Systems, the Frame Problem and Computer Security”. *Journal of Military Ethics, 14:2* (2015): 162-176. http://dx.doi.org/10.1080/15027570.2015.1069013

Liddy, Lynnda. “The Strategic Corporal Some Requirements in Training and Education”. *Australian Army Journal Volume II, Number 140* (2004): 139-148. http://smallwarsjournal.com/documents/liddy.pdf

Lin, Patrick, George Bekey and Keith Abney. “Autonomous Military Robotics: Risk, Ethics, and Design”. *Report prepared for US Department of the Navy, Office of Naval Research by Ethics + Emerging Sciences Group at California Polytechnic State University, San Luis Obispo* (December 2008): 1-112 http://digitalcommons.calpoly.edu/phil_fac/2/

Noone, Gregory P;Noone, Diana C. “The Debate Over Autonomous Weapons Systems”. *Case Western Reserve Journal of International Law No. 47* (Spring 2015): 25-35. http://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=1005&context=jil

Roff, Heather M. “The Strategic Robot Problem: Lethal Autonomous Weapons in War”. *Journal of Military Ethics, 13:3* (2014): 211-227. http://dx.doi.org/10.1080/15027570.2014.975010

Sharkey, Noel E. “The Evitability of Autonomous Robot Warfare”. *International Review of the Red Cross, 94* (2012): 787-799. doi:10.1017/S1816383112000732.

Thurnher, Jeffrey S. “No One at the Controls: Legal Implications of Fully Autonomous Weapons”. *Joint Force Quarterly issue 63, 4th quarter* (2011): 77-84. http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-67/JFQ-67_77-84_Thurnher.pdf

United States. Department of Defense. *Directive: Autonomy in Weapon Systems NUMBER 3000.09.* Washington D.C.: Joint Chiefs of Staff, 2012. http://www.dtic.mil/whs/directives/corres/pdf/300009p.pdf

Wagner, Markus. “The Dehumanization of International Humanitarian Law: Legal, Ethical, and Political Implications of Autonomous Weapon Systems”. V*anderbilt Journal of Transnational Law vol. 47* (2014): 1-54. http://robots.law.miami.edu/wp-content/uploads/2012/01/Wagner_Dehumanization_of_international_humanitarian_law.pdf