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THE RISE OF ROBOTS:
THE MILITARY'S USE OF AUTONOMOUS LETHAL FORCE

by

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Biography

Lieutenant Colonel Christopher J. Spinelli is currently an Air War College student and was the former Commander of the 445th Flight Test Squadron at Edwards Air Force Base (AFB) California where he led a diverse organization of both Active Duty, Reserve and Civilian personnel as the primary flying test support squadron for all the associated test units on Edwards. The squadron flew four types of aircraft: F-16, T-38, KC-135 and the C-12. During his tenure as Commander, Colonel Spinelli had the unique opportunity to qualify in the KC-135 aircraft while still maintaining his F-16 qualification. He flew test and test support missions in the KC-135, including sorties supporting the aerial refueling qualification of the F-35 Lightning II.

He received his commission from the United States Air Force Academy in 1996. After graduation, he attended pilot training at Vance AFB, Oklahoma, and was subsequently assigned the F-16 Fighting Falcon as his primary aircraft. Following F-16 training, his first operational assignment was at Moody AFB, Georgia, in the 69th Fighter Squadron. While at Moody, he upgraded to flight lead and deployed to Kuwait in support of Operation SOUTHERN WATCH. He was then transferred to Hill AFB, Utah, into the 421st Fighter Squadron. It was at Hill where he upgraded to F-16 Instructor Pilot and led a six-ship deployment to Qatar for Operation IRAQI FREEDOM.

In 2004, he was competitively selected to attend the United States Air Force Test Pilot School (TPS) at Edwards AFB, California. Prior to attending the formal flying school, Colonel Spinelli completed his Masters of Science degree in Computer Science at the Air Force Institute of Technology (AFIT) on Wright-Patterson AFB, Ohio. This was a joint program (AFIT-TPS) where his Master's thesis research was part of the TPS capstone exercise, which

included ground-breaking flight test of autonomous station keeping between two aircraft for aerial refueling purposes.

Following TPS, Colonel Spinelli was assigned to the 416th Flight Test Squadron where he tested and evaluated numerous upgrades to the F-16 including multiple targeting pod and mission system software upgrades. He was also privileged to participate in the first-ever Air Force Materiel Command unit deployment to Red Flag in 2009. After two years in the 416th, he was selected to be the Executive Officer for the Air Force Flight Test Center Commander, a 2-star position. He then spent a short year at the Pentagon working on the F-22 and F-35 programs as a Program Element Monitor in the Secretary of the Air Force for Acquisition branch of the Air Staff. Once again, he returned to Edwards AFB to be the Director of Operations for the 416th Flight Test Squadron where he led the second-ever Air Force Materiel Command unit deployment to Red Flag in 2012, and then moved to the 445th Flight Test Squadron as Commander.

Lieutenant Colonel Spinelli is a Command Pilot with over 2000 flight hours in multiple aircraft, primarily the F-16 (all blocks), KC-135 and C-12, as well as 30 other types.

Abstract

Humanity's quest to find innovative ways to deal with difficult, monotonous and dangerous activities has been an ever evolving and unending endeavor. The current proliferation of robotic technology is just the next step in this evolutionary sequence. Both civilian and military agencies alike are vying for this new round of technology. Most civilian applications of robots are innocuous and generally perform menial tasks. The same cannot be said for the military. Currently there are numerous systems in each branch of the military that have some autonomous lethal engagement ability. As military professionals, we have a duty to ensure the legal framework, proper policy, moral and ethical considerations, as well as proper tactics and doctrine are in place to ensure compliance with the Rule of Engagement (ROE) and the Laws of Armed Conflict (LOAC) before embarking down a path to fully automated autonomous lethal force. This paper will investigate some of the more pressing issues and present recommendations for potential paths forward. To facilitate the discussion, the paper is divided into three major areas: the legal implications, ethical implications and professional implications of use of robots in warfare.

Introduction

The quest for automation in the human experience is as old as time itself. Although the technology has changed through the ages, the concept that man can take previously dangerous or tedious tasks and transform them by use of the information and resources at his disposal is an unending quest. Astonishingly, the initial discovery of what would become semiconductors dates as far back as 1833, when the now famous physicist Michael Faraday stumbled upon a unique observation.¹ Faraday discovered that electrical conduction increases with temperature in silver sulfide crystals, which is the opposite of that observed in copper and other metals.² However, it was not until the 1960s and 70s with the introduction of the integrated circuit, made of the silicates first discovered by Faraday, that brought the revolution in computer technology which has fundamentally transformed the human experience.³ In 1965, a man by the name of Gordon Moore, then Fairchild Semiconductor's Director of Research and Development and future Intel co-founder, postulated the number of transistors per chip would double every two years.⁴ This concept was subsequently termed "Moore's Law" and has been amazingly accurate over the past 50 years, in large part because chip manufacturers build their future development roadmaps based on this theory.⁵ Now in 2015, computer technology has become so advanced that recently a savvy 16 year-old put the Windows 95 operating system on an Android smartwatch!⁶

The giant leaps in technology during the past decade have also led to some very sophisticated robot technology. In fact, the 2013 Defense Advanced Research Projects Agency (DARPA) Robotics Challenge showcased some of the most advanced robots seen to date.⁷ The winning robot, SCHAFT, developed by Japanese company SHAFT Inc., attained an impressive 27 of 32 possible points during the challenge.⁸ The challenge consisted of eight distinct tasks:

driving a vehicle, maneuvering the robot over rough terrain, going up an industrial ladder, removing debris from a pathway, opening different types of doors, cutting through a wall in a certain pattern, closing different types of valves, and finally, unwinding and connecting a hose to a spigot.⁹ While the DARPA robots are intended for peaceful and innocuous purposes, there are other robots being developed for uses that are more threatening.

There are many governments and associated defense contractors working on various robots for use in combat situations. Some of these machines have the ability to autonomously target and engage adversaries. Recently, Rear Admiral Matthew L. Klunder, Chief of United States Naval Research, debuted a new swarming boat technology where as many as 20-30 autonomous boats can be designated to surround a single target.¹⁰ The boats can carry a number of different payload options including spotlights, high powers speakers, or even offensive weapons.¹¹ Of course, the U.S. Navy is not the only service researching autonomous weapon systems. The U.S. Air Force and Army also have active programs. The Air Force developed the MQ-9 Reaper and deployed it successfully to both Iraq and Afghanistan.¹² Additionally, the U.S. Army has numerous systems in development including the unmanned robocopter sniper system, Autonomous Rotorcraft Sniper System (ARSS),¹³ and other ground-based systems that do everything from deliver foodstuffs¹⁴ to QinetiQ's Modular Advanced Armed Robotic System (MAARS) which can carry multiple combat loads including a 40mm grenade launcher and 7.62mm machine gun.¹⁵ The emergence of these systems, especially those capable of autonomous lethal engagement, bring with them many questions: how should we test and verify such systems, how should they be employed, who is responsible if the autonomous systems malfunction and harms an innocent human, and ultimately should we even develop and use autonomous lethal force?

Although the technology to produce robots similar to Terminator or I, Robot are still decades away, it is undeniable that future autonomous lethal systems will be used in armed conflict. In fact, the first iteration of such systems are already in use in combat today as discussed previously. As military professionals, we have a duty to address carefully the questions posed above and ensure the legal framework, proper policy, moral and ethical considerations, as well as proper tactics and doctrine are in place to ensure compliance with the Rule of Engagement (ROE) and previously mentioned concepts before embarking down a path to fully automated autonomous lethal force. This paper will investigate some of the more pressing issues and present recommendations for potential paths forward. To facilitate the discussion, the paper is divided into two major areas: the legal and ethical implications of use of robots in warfare.

Definitions

Before delving into the details of the discussion, a basic sense of the technologies and ideas we are discussing are in order. There are many different types of robots or automated machines. Consequently, although some specific technologies will be described, they are primarily for illustrative purposes and should not be construed to represent the totality of the robotic family under question. Additionally, for the purposes of this paper, I will use the definition of a robot set forth by Lin, Bekey and Abney in their paper for the Office of Naval Research titled, *Autonomous Military Robotics: Risk, Ethics, and Design*:

Robot: A powered machine that (1) senses, (2) thinks (in a deliberative, non-mechanical sense), and (3) acts.¹⁶

This definition will exclude lethal weapons such as land mines, missiles and grenades, although all of them have some autonomy or ability to interact with the environment. The key

distinction being the second part of the definition dealing with the required deliberative and logical decision process. In other words, we are primarily concerned with machines that can autonomously operate and interact with the world around them and make decisions to use lethal force.

The robots described in this paper may or may not be fully mobile, but can maneuver in some fashion. In addition, many autonomous machines involve a spectrum of man-in-the-loop (MIL) interaction and this paper is not meant to exclude such technology. In other words, most robots require at least some human interaction, even if it is to give the initial orders.

Legal Implications

Most discussions on the use of robots in war begin with legal implications of their use during combat. The preferred and most appropriate framework utilized is Just War Theory or more broadly understood as the Laws of Armed Conflict (LOAC).¹⁷ These laws have evolved over time and are concerned with the conduct before, during and after war; known more commonly as *Jus ad Bellum*, *Jus in Bello* and *Jus post Bellum*.

Jus ad Bellum

Jus ad Bellum are laws to prevent the start of war.¹⁸ They describe the conditions under which war can be legally and morally justified, a legitimate war.¹⁹ Although there is no universally accepted list of conditions for *Jus ad Bellum*, they are generally split into seven areas: a just cause, proportionality, a legitimate authority to declare war, a reasonable chance of success, right intention, war declared as a last resort and the goal of a just peace.²⁰ Some of the current literature dealing with autonomous lethal force assumes the *Jus ad Bellum* conditions will be met and thus do not focus much on this section of LOAC.²¹ However, there are potential issues when dealing with autonomous lethal force.

In his Air War College paper on this same subject, Colonel Michael Contratto aptly pointed out the potential for autonomous systems to circumvent the LOAC rules given our reliance on systems-of-systems and thus illegitimately begin a war.²² He further states that even if the system followed the Rules of Engagement (ROE) and LOAC, there is potential for an autonomous system to act without the authority of the legitimate owner, once again leading to potentially disastrous consequences.²³ This argument is especially compelling given the incredibly complex nature of the autonomous systems we are discussing, the insurmountable task of completely testing all possible input and outputs of the system and finally the dire consequences of system failure, notably the potential loss of life and destruction of property.

Contratto is not alone in his misgivings of autonomous lethal force and the *Jus ad Bellum* argument. Peter M. Asaro, a well-known philosopher and computer scientist in the robotics community, has written extensively on the use of autonomous lethal force in combat. One of his arguments against the use of robots includes lowering the barriers to entry into war.²⁴ By using them there could be a dramatic reduction in the cost of human capital on the side deploying the robots, a significant barrier to entry into war and potentially cutting at the proportionality, right intention and war declared as a last resort aspects of *Jus ad Bellum*.²⁵ Others, namely Patrick Lin, George Bekey and Keith Abney, do not find this argument compelling, citing the fact that robots themselves do not necessarily change the calculus of the individual *Jus ad Bellum* requirements.²⁶ Additionally, they fittingly point out this argument could be used to prevent the advancement of any military technology, a point not completely lost on Asaro.^{27, 28} Finally, they argue that a country could develop a deterrence strategy with an army of robots, similar to nuclear weapons, where the mere possession of such weapons significantly deters attack.²⁹ Regardless of one's particular point of view on the preceding arguments, the mere fact that they

are debated should be evidence enough of the need to thoroughly investigate the *Jus ad Bellum* requirements relative to autonomous lethal force. It is this author's opinion the use of a robot army for autonomous lethal force is a revolution in military affairs and would transform the basic fabric of warfare.

Interestingly, with this transformation on the horizon, one would expect to find a wealth of professional articles or other literature from the military and governmental organizations. Unfortunately, this is not the case. Although there are certainly papers from the professional military education institutions, the dearth of them is surprising. Of more concern is the lack of ethical considerations in the few official government documents currently available dealing specifically with autonomous machines. In his book, *Wired for War*, Singer laments the lack of serious contemplation of these ethical considerations at a 2006 conference, "Rethinking the US Military Revolution," and a 2007 conference including 100 international law experts discussing "New Battlefields, Old Laws."³⁰ Additionally, in the 2007 Unmanned Systems Safety Guide for DoD Acquisition (most current version), there is not a single reference to ethics in this document, where one would certainly expect to find at least a cursory discussion.³¹ Finally, in a recent update to the Air Force's remotely piloted aircraft roadmap, *USAF RPA Vector: Vision and Enabling Concepts 2013-2038*, there are only two references to ethics in the 100-page document.³² The first states the following:

With appropriate CONOPS and doctrinal considerations, the future potential for autonomous systems to independently select and attack targets with lethal effects exists from a technology perspective. To achieve this, **the Air Force and DoD must first address the legal, moral, and ethical concerns that autonomous lethal effects present as well as consider minimum safeguards.** Future RPA may continue on mission using a combination of autonomous behaviors and assured position, navigation, and timing (PNT) if communications are lost or degraded in an A2/AD scenario.³³ (emphasis added)

It is encouraging to see the Air Force acknowledge the need to address the “legal, moral, and ethical concerns” with autonomous lethal force, but it is unclear what exactly is being pursued. The second reference, innocuously inserted into the nuclear strike section states, “Ethical discussions and policy decisions must take place in the near term to guide the development of future UAS capabilities, rather than allowing the development to take its own path apart from this critical guidance.”³⁴ It is not explicitly clear whether this statement is directed specifically at nuclear RPA operations or more broadly dealing with general RPA operations, and one would certainly hope that weapons as destructive as a nuclear bomb might never be armed on an autonomous vehicle.³⁵ Either way, it is ironic given the current state of RPA development and the lack of credible and substantive guidance on the ethical use of autonomous lethal force throughout the Department of Defense. These references provide an indication that the United States military and policy makers have much more work to do for a true *Jus ad Bellum* case for the use of autonomous lethal force.

Jus in Bello

Jus in Bello refers to the proper conduct in or during war.³⁶ It applies legal and moral restraints to the conduct of war, and although no complete set of agreed upon principles exist, they are generally divided into two main areas: discrimination and proportionality.³⁷ Most of the literature surrounding autonomous lethal force deals with issues surrounding these principles.

Discrimination obligates the belligerents of a conflict to discriminate between military combatants and the civilian population.³⁸ Force can then only be applied to the military combatants.³⁹ In theory, one could argue that advancements in robotic technology could someday allow an autonomous machine to distinguish properly between legitimate and illegitimate targets.^{40, 41} However, in the fog and friction of a wartime environment, this will be

a daunting task, and many believe it is almost insurmountable due to the very nature of war, especially in the case of insurgencies where the enemy combatant is virtually indistinguishable from the surrounding populace.⁴² Laying aside the technical difficulties and assuming that an autonomous robot could make this distinction based upon proper coding of the LOAC and the ROEs, it is then reasonable to assume an autonomous robot could adequately discriminate between targets.

Perhaps the more important question is whether an autonomous robot could discriminate better than a human could. In his Naval War College paper, Michael A. Guetlein aptly points out that discrimination would ultimately come down to an adjustable probability calculation based on the ROEs and presence of civilians.⁴³ On an autonomic level, this is how humans engage their own decision process; that is one of probabilities. Additionally, Dr. Ronald C. Arkin, a roboticist, roboethicist and Regents' Professor at Georgia Tech, argues that eventually robots will be able to "perform more ethically than human soldiers are capable of."⁴⁴ However, given the sheer complexity of the task and limits of current technology as well as systems integration, this capability is still decades away, if it ever becomes possible to have a machine truly able to autonomously make such moral decisions.

Proportionality seeks to avoid killing civilians or damaging their property unless military necessity dictates otherwise and only if the proportional military gain exceeds the cost of the civilian casualties.⁴⁵ At first glance, it appears the proportionality principle might be easier for autonomous robot compliance. In fact, Guetlien offers only one passing sentence on the issue, "Due to AW [autonomous weapon] logic constraints, **it can be easily argued** that autonomous weapons will be more proportional."⁴⁶ (emphasis added) Additionally, in the study sponsored by the Office of Naval Research they make the following statement, "After testing, **it is easy to**

imagine that robots could perform at least as well as humans in deploying no greater violent force than needed, and thereby passing the ‘military Turing test’ for moral deployment.”⁴⁷

(emphasis added) In Arkin’s 100-page foundational essay on robotic ethics, he goes much further in-depth on the issue and spends numerous pages describing how a robot could be programmed via set theory to ensure both discrimination and proportionality.⁴⁸ However, it is not clear that the proper discriminating sensor inputs are currently, or would ever be available to feed such algorithms. This argument is precisely what Sharkey sets forth and further underscores the idea that there are no objective measures to determine proportionality.⁴⁹

Although not specifically delineated in either discrimination or proportionality, many have fittingly argued that if an ethical autonomous robot were possible, it has some unique characteristics that make it especially suited for the battlefield. For instance, robots do not get tired, angry, have feelings of revenge, succumb to boredom, or a host of other undesirable human traits, which can lead to egregious violations of the ROEs and/or LOAC. Admittedly, the instances of such occurrences are low in present conflicts especially given the number of fielded soldiers and the length of the conflicts. However, when they do occur they receive very widespread attention across the globe and cause deleterious effects to the prestige and political standing of the United States, as well as feed the enemy’s cause, which aims to undermine the United States intentions and legitimacy in the war effort. The Abu Ghraib prison scandal in Iraq and the Maywand District murders in Afghanistan are examples of such unfortunate events.

Similarly, by deploying autonomous robots we could effectively reduce the number of required human troops thus saving many from the horrors of war. Some argue we actually have a moral obligation to do such and even point to United States Code, Title 10, Sections 3583, 5947 and 8583, which charges commanding officers from the four major branches of military

service “to promote and safeguard the morale, the physical well being, and the general welfare of the officers and the enlisted persons under their command or charge.”⁵⁰ Of course, the military is specifically organized, trained and equipped to fight the nation’s wars and thus expected to be placed in harm’s way. It seems injudicious to use the Title 10 code as justification for autonomous lethal force.

Jus post Bellum

Jus post Bellum refers to the proper conduct after war.⁵¹ It is concerned with items such as ceasefire terms, surrender terms and the disposition of prisoners of war after conflict has officially ceased.⁵² As a recent Office of Naval Research report points out, many of the same issues in *jus post bellum* are covered in *jus in bello*.⁵³ However, there are a couple unique circumstances which could arise in light of the use of autonomous lethal robots. The first concerns the ceasefire terms. In this case, consider two belligerents who go to war each solely with its own autonomous robot army. It is reasonable to assume each side would fight to the last robot, something not normally done with a conventional human army (i.e. no rational nation fights to their last soldier).⁵⁴ Next, at the conclusion of the hostilities, would the losing side feel compelled to abandon hope for victory or further launch human soldiers into the war effort against the remaining robots?⁵⁵ Additionally, Asaro makes the point that a war with solely a robotic army on each side could appear as little more than a violent sporting event and some political concession such as territory would need to occur to consider the hostilities profitable.⁵⁶

The second area of concern is post-war stabilization, which may include a counterinsurgency. As recent events in Iraq and Afghanistan depict, winning the war may be the easy part, but winning the peace is a considerably different matter. Some argue that the use of robots in a post-war environment may be very beneficial, especially in preventing such things as

raping, pillaging, taunting, etc.⁵⁷ Others point out that ensuring peace, especially in an insurgency, requires “winning the hearts and minds of the people,” which a robot army is certainly not well equipped to perform.⁵⁸ It appears cultural sensitivities would have the greatest impact on the use of autonomous robots during a post-war occupation.

Ethical Implications

Assuming the barriers to the legal implications could satisfactorily be overcome, there are still ethical implications for the use of autonomous lethal force. I will investigate two areas in this section: moral agency and chivalry.

Moral Agency

The first ethical issue arising from the use of autonomous lethal force comes in the form of moral agency. As human beings, we are held accountable for our own actions barring some legal claim to temporary insanity or the like. During warfare this concept is generally assumed away. In other words, it is assumed that the application of lethal force carries with it an assumed morally accountable agent or someone who can accept responsibility if civilian deaths should occur.⁵⁹ The advent of fully autonomous robots would challenge this assumption.

In modern warfare, there exists technology which significantly removes the human from the physical source of the lethal force (e.g. weaponized RPAs). However, there is still a MIL and moral agency is attributable directly to the human controlling the machine. With a truly autonomous robot, the question arises, who is ultimately responsible for the actions of such a machine? Is it the individual programmer, the company who developed the robot, the military commander under whose charge the robot falls, the military service that requested the development of the technology or even the United States government at large for authorizing the use of such autonomous lethal force in the first place? There does not seem to be an easy answer

to this question. Dr. Robert Sparrow, a Professor in the School of Philosophy and Bioethics at Monash University in Australia, is quick to point out that holding the programmer responsible for a truly autonomous robot is equivalent to holding parents responsible for their grown children's behavior, which obviously militates against conventional legal thought.⁶⁰ However, generally speaking, in military organizations the military commander is held accountable for the actions of his subordinates even if he or she may not have had the ability to directly influence the subordinate's behavior. Although some find this answer satisfying, the next obvious question is, *should* a military commander be held responsible for the acts of an autonomous robot for which he had no ability to control the coding or command influence on its behavior? As a former military commander, I find this logic troubling especially considering the fact I would have almost no ability to influence an autonomous robot's actions and yet be held accountable for them. At least in the case of a human being, you can legitimately argue a commander had the ability to directly influence the personnel assigned to him or her, especially at the squadron level.

Supposing one could argue a robot did achieve moral autonomy in a Kantian sense and would thus be held responsible for its own actions, how would punishment be administered to such a machine? The machine does not have feelings like a human. No amount of time in prison would alter the robot's behavior. Would recoding be an option? If recoding were an option, what about the rest of the autonomous robots? Would they be recoded as well? Last, would recoding be a *de facto* admission the robot was not truly a Kantian moral agent to begin with? Additionally, the current American legal framework serves as the means through which society conducts itself and provides a certain deterrent to would-be criminals in the form of punitive punishment. Would other autonomous robots be dissuaded from committing a crime by

witnessing one of their own punished? All of these questions raise considerable misgivings about assigning moral agency to an autonomous robot.

Chivalry

Another concept that raises ethical concerns is the idea of chivalry. Chivalry includes waging war in accordance with well-recognized formalities and courtesies and is occasionally listed as one of the *Jus in Bello* principles.⁶¹ I believe the concept of chivalry transcends as only a *Jus in Bello* concept. It drives at the very heart and nature of warfare. Asaro gives one of the most compelling arguments when he states:

This approach to war could be deemed unjust by traditional conventions of war because those doing the killing are not themselves willing to die. This principle is fundamental because it powerfully influences our sense of fairness in battle, and concerns the nature of war as a social convention for the settling of disputes.⁶²

Ironically, the advent of most military technologies, including autonomous robots, is to further remove humans from the horrors of war. This is especially true in our current age of almost instant media and the low tolerance for casualties (civilian or military) in democratic societies. However, to our enemies, the use of such technology shows a sign of weakness and may even further exacerbate asymmetrical attacks such as terrorism. When viewed from a purely realist or political perspective, one could argue an autonomous robot can achieve the same goals as a human soldier, thus there would be no qualms with using such technology and, in fact, would be desirable given the reduction in the potential loss of human capital. On the other hand, from the perspective of the international community or opposing belligerent, it could be viewed as cowardly and raise questions as to the legitimacy of the war effort as well as the state's intentions. Next, as Guetlein points out, "[m]achines do not have the capacity for the military ethos of chivalry (courage, justice, mercy, generosity, faith, nobility, and hope)."⁶³

Contratto's thesis rests on this basic idea of chivalry.⁶⁴ He ultimately contends the military ethos requires professional soldiers to do the bidding of their nation's wars.⁶⁵ He persuasively argues autonomous lethal force may ultimately degrade the status of the military from a profession to that of basic contract management.⁶⁶ He concludes with, "[t]herefore the offensive use of ALE should always keep a human in the loop of the kill chain."⁶⁷ One could counter argue, what is the real difference if someone is playing a "video game" war with the robots or the robots are doing it themselves? How is the soldier any more fulfilling honor or the warrior ethos by commanding the robot via datalink? The truth is, we are already at a point where some soldiers are far removed from the battlefield (e.g. Air Force RPAs), and whose life is more in danger on the car ride to work than at any time during military operations. Aside from the overwhelming technological challenges to creating a truly Kantian morally autonomous robot, chivalry represents one of the most vexing issues to the use of autonomous lethal force.

Recommendations

Tactical / Objective

1. Encourage professional studies papers at the various military professional education institutions on the subject of autonomous lethal force.
2. Encourage the military legal community to engage in an in-depth historical review of LOAC and ROEs, and then determine recommendations for potential laws governing the use of autonomous lethal force.
3. Encourage military headquarters staffs to require ethical/moral sections in documents governing procurement and vector documents dealing with systems that could be used for autonomous lethal force.

4. Encourage military participation in robotic ethics conferences such as We Robot, International Conference on Artificial Intelligence and Law, Computer Ethics Philosophical Enquiry, etc.

Even with all of the tactical/objective recommendations above, more must be done at the strategic level to effect lasting change, especially since the concepts surrounding the use of autonomous lethal force deal primarily with states in the international arena.

Strategic

1. A concerted effort on the part of the United States government to increase dialogue on the subject of autonomous lethal weapons needs to occur.
2. Recognized, legitimate international governing bodies such as the United Nations, North Atlantic Treaty Organization, International Monetary Fund, World Bank, etc. should be engaged to come up with international norms for the use of autonomous lethal force and potential ramifications of their misuse.

Ultimately, enforceable decisions on the legitimate use of autonomous lethal force will be made at the strategic level, having been informed by the items listed in the tactical/objective section.

Conclusion

The age of autonomous lethal weapons is presently upon us. It is not inconceivable to imagine fully autonomous robots similar to those currently depicted in science fiction movies by the end of the 21st Century. Although they still may not be considered free moral agents, the social implications of such machines raises a host of important legal, ethical and professional questions. On the civil side, police departments will face similar questions in the coming years as cities look to use these technologies in law enforcement capacities. This paper has addressed

some of those questions dealing specifically with the military application of autonomous lethal force.

We investigated some legal implications of autonomous lethal force in the framework of the Law of Armed Conflict principles as provided in Just War Theory: *Jus ad Bellum*, *Jus in Bello* and *Jus post Bellum*. Some of the more pressing issues raised were the potential for autonomous robots to lower the barriers for entry into war, robots accidentally starting wars (sovereignty), the ability for autonomous lethal machines to properly discriminate between combatants and non-combatants, objective measures for a proportionality algorithm, and the potential difficulties in terminating a robot vs. robot army war. Currently, many of these concerns are assumed away inferring that eventually the technology will exist for autonomous robots to perform such actions at a level equal to or greater than a human soldier.

We also discussed some overriding ethical implications of the use of autonomous lethal force. These included moral agency and chivalry. Although the previous legal areas of concern may someday be overcome by technical advancement, it is not clear there will ever be a day where the moral agency and chivalry issues could adequately be addressed. Perhaps the international norms will change allowing for the use of such technologies, similar to how the norms of high seas survivor rescue changed with the advent of submarine warfare. Ultimately, the question under the ethical implications section is, should we utilize these technologies just because they are available? Are we going to create something akin to the nuclear weapon, where it is considered mass suicide to employ such a weapon, yet countries have stockpiles of these weapons, which we then have to regulate closely and protect them from falling into the wrong hands?

Finally, I provided recommendations on how to move forward responsibly with the development and deployment of such weapons. Many industrialized states are well down the road to autonomous lethal force and some (United States, South Korea) have already employed such technology. As military professionals, we have a responsibility to inform policy makers of the implications of the use of such force and look for ways to legitimize the use of autonomous lethal force on an international level with the proper legal, ethical and policy measures in place.



Notes

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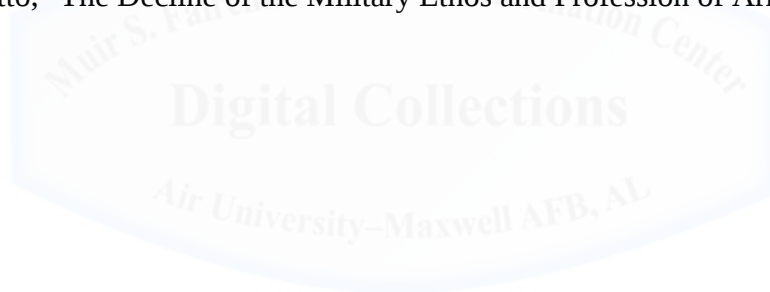
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