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Lethal autonomous weapons systems (LAWS) can safely and effectively integrate with military architecture to cover a range of conventional military options. They can operate in accordance with the Law of Armed Conflict (LOAC) despite the numerous ethical issues surrounding their use. The US should pursue LAWS that will operate with time and geographic constraints and not target humans in order to avoid potential war atrocities.

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MASTER OF MILITARY STUDIES

TITLE: The Ethics Surrounding Lethal Autonomous Weapons Systems in Future Conflict

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EXECUTIVE SUMMARY

Title: The Ethics Surrounding Lethal Autonomous Weapons Systems in Future Conflict

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Thesis: Lethal autonomous weapons systems (LAWS) can safely and effectively integrate with military architecture to cover a range of conventional military options. They can operate in accordance with the Law of Armed Conflict (LOAC) despite the numerous ethical issues surrounding their use.

Discussion: Continuing improvement in computer technology has made LAWS the next logical step in the evolution of weapons systems. At this time, the combination of system limitations and legal restrictions has kept most systems semi-autonomous with a human making or supervising the decision to fire, rather than truly autonomous. The major debates surrounding the use of LAWS in combat focus around the ethics of employing a weapon that can select and fire on targets without human interaction. Some critics fear that LAWS will operate outside the LOAC framework, making decisions to enter war easier.

This paper answers two major research questions regarding LAWS' ethics and considers two ideas that may defeat the necessity of ethical decisions by LAWS. The first question is First, 'what ethical issues currently surround the use of LAWS in combat operations' and the second question is 'will LAWS lower the threshold decision at which a country enters conflict?' The first idea is that LAWS should be constrained within a geographical area and a time limit and the second idea is that LAWS should only target enemy vehicles. Neither of these ideas would require making a distinction between human combatant and non-combatant.

Conclusion: U.S. Department of Defense Directive 3000.09 makes the intent to ensure that LAWS operations conform to the principles of LOAC through deliberate development restrictions. Within that framework and accordance to the proposed United Nations moratorium, the United States should pursue LAWS to target enemy aircraft, vehicles and maritime vessels.

DISCLAIMER

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PREFACE

Lethal autonomous weapons systems (LAWS) are potentially the next evolution of weapons. Throughout history we have seen technology increase the ability for a country to combat their enemy with fewer casualties and less civilian infrastructure damage. This paper's conclusions emerged from through analysis of many documents ranging from scientific magazine articles and scholarly articles involving algorithms of how to modulate a computer's decision all the way to United Nations documents for countries' open plans regarding LAWS. Scientists, roboticists, philosophers, academics, defense and military professional all have a stake in this subject and I suspect – and hope – the topic will garner more attention as technology progresses.

I must thank several individuals for their assistance: Dr. Bill Powers from the Potomac Institute for Policy Studies who provided mentorship, editing, and provoking thoughts; Dr. Streusand from the Marine Corps University for his editing assistance and inspiring me to think and write at a higher level; Dr. Lynn Tesser from the Marine Corps University for motivation to complete this project and editing. Thank you to my peers who provided their time reviewing my work and a special thank you to my family for their enduring patience and encouragement.

"Given the rapid pace of development of military robotics and the pressing dangers that these pose to peace and international security and to civilians in war, we call upon the international community to urgently commence a discussion about an arms control regime to reduce the threat posed by these systems. We propose that this discussion should consider the following: The prohibition of the development, deployment and use of armed autonomous unmanned systems; machines should not be allowed to make the decision to kill people." –International Committee for Robot Arms Control Mission Statement[1]

1. INTRODUCTION

Lethal Autonomous Weapons Systems (LAWS) are robots – machines powered by computers – that carry a lethal arsenal, require no human interaction during the assigned mission, and can function in any of the four physical domains of space, air, land and maritime. LAWS seem to be incredibly practical; they can fly, swim, or traverse distances under a set of pre-programmed rules and kill the enemy with no concern for self-survival. However, just because they are practical does not mean they are ethical.[*]

Research is underway to develop LAWS but no completely lethal autonomous weapons currently exist. Research is only a conceptualization because the technology necessary to target human beings in an ethical manner is not a reality. Targeting enemy vehicles, aircraft, and maritime vessels may be the largest target for the future because the targeting process would require a minor, if any, ethical decision. Not every government, corporation, or company is supportive of developing LAWS. Clearpath Robotics published a press release in August 2014 from the company president describing why they will not produce LAWS: "This technology has the potential to kill indiscriminately and to proliferate rapidly; early prototypes already exist. Despite our continued involvement with Canadian and international military research and

[*] Ethics are social principles that guide behavior and failure to abide by ethical principles carries legal repercussions.

development, Clearpath Robotics believes that the development of killer robots is unwise, unethical, and should be banned on an international scale."[2]

Japan and Cuba released public statements in April 2015 regarding LAWS development and prohibition. Japan's statement specifically states they have "no plan to develop robots with humans out of the loop, which may be capable of committing murder."[3] Cuba "supports the adoption of a legally binding international instrument which ordains a total prohibition of lethal autonomous weapons, especially those used against people."[4]

The United Kingdom issued guidance in June 2013 that the country does not have LAWS or an intention to develop them. "Whilst technological advances will likely increase the level of automation in some systems, just as in non-military equipment, the MoD currently has no intention to develop systems that operate without human intervention in the weapon command and control chain."[5] Since 2013, approximately 50 nations have joined the discussion on issues surrounding the use of LAWS in combat operations but not all of them have entered an agreement not to pursue LAWS.[6] If the ban fails, a secondary plan needs to be established.

Although critics call for a ban on LAWS, current literature indicates they can safely and effectively integrate with the military architecture to cover a range of conventional military options. The technology for immediate implementation of LAWS is deficient in two key areas: the vast number of programming variables to ensure that LAWS will abide by ethical codes, and constraining LAWS to comply with International Humanitarian Law, The Geneva Conventions, and rules of engagement set forth by military commanders.

This paper will introduce the reader to the key ethical debates concerning the use of LAWS in combat operations. Guiding the analysis will be two research questions. First, what

ethical issues currently surround the use of LAWS in combat operations? Second, will having LAWS as a combat tool lower the threshold decision at which a country enters conflict? Two ideas that depart mainstream literature for employing LAWS while potentially defeating the ethical decision making conundrum are proposed. The first idea is LAWS should attack enemy vehicles, aircraft, and maritime vessels. Targeting these classes would prevent direct human targeting which removes the need to understand the difference between combatant and non-combatant status or make ethical decisions during the targeting process. The second idea is that LAWS can operate effectively in a time and geographically constrained zone. A review and analysis of current literature and the developing situation throughout the world will answer the two research questions and two ideas.

First, several assumptions to prevent ambiguity must be clarified. Uninhabited military systems[†] (UMS) encompass the four physical domains of space, air, ground, and maritime. Underwater mines, guided missiles, and precision guided munitions such as the smart bomb will not be included because they are considered 'set and forget' weapons. Artificial intelligence will not be discussed due to the limited scope of this paper. Close-in Weapons (CIW) systems are not fully autonomous. Finally, the reader must set aside unrealistic Hollywood derived portrayals of robots such as RoboCop©, Terminator©, and scenes from other movies of 'killer humanoid robots' that hunt down a person with no regard for human life.

Before addressing the ethics of LAWS, autonomy must be defined as a term of reference. In accordance with Department of Defense Directive (DoDD) 3000.09, autonomy is "a weapon system that, once activated, can select and engage targets without further intervention by a human operator."[7] The Department of Defense (DoD), academic, engineering, and philosophical

[†] Uninhabited military system is a gender-neutral term used in lieu of unmanned military vehicle.

communities have not agreed on an authoritative definition of autonomy.[8] The undefined term is problematic because some organizations, critics, and activists have been calling for a ban of LAWS but there is vagueness as to what they are specifically trying to ban.

The definition of autonomy is such a key component for the context of this paper because the entire understanding is premised on the DoDD definition. One could argue that lethal autonomous robots have been in use for decades if a different definition is used or autonomy is not internationally agreed on. Influence mines, which are triggered by a ship or submarine and are controlled by sensors rather than direct contact, have been around since World War I and are operated off of microprocessors and acoustic sensors.[‡]

One simple way to imagine autonomy on a broad scale is through a tiered pyramid. The bottom tier is a 'human in the loop,' what is commonly referred to a semi-autonomous robot. In this instance, a human controls the robot and authorizes permission to fire a weapon at an identified target. The middle represents a 'human on the loop,' known as a human supervised, semi-autonomous robot. The robot identifies a target and automatically fires its weapon but the human operator monitors the robot and can intervene to stop the firing weapon if necessary. The top and final tier is a 'human out of the loop,' signifying an autonomous robot. This top tier represents "a weapon system that, once activated, can select and engage targets without further intervention by a human operator."[9]

From a roboticist perspective, autonomy means that a robot can complete a task when assigned by a human being much as if a soldier accomplishes a goal when a commander gives an

[‡] Influence mines can be bottom or moored weapons and can have sophisticated sensors and firing mechanisms that do not require contact with targets. They are fitted with combinations of magnetic, acoustic, seismic, underwater-electrical potential, pressure, and video sensors. Modern sensors use microcomputers that can sense a target's approach, determine whether the sensed sig nature is a ship or a sweep, and estimate the optimum time to detonate as the target passes.

order. From a philosophical standpoint, autonomy means being sentient and understanding through sensory feelings such as sight, touch, and sound.

Autonomy is not the same as automated and thus they will not be used interchangeably. Automation is a structured process that emphasizes quality, reliability, and productivity without direct control. Autonomy is the ability of a system to independently select a course of action based on sensory inputs from the surrounding situation and perform an act.[10]

2. EXISTING ARGUMENTS ON THE ETHICS OF LAWS

An overview of the existing arguments on the ethics of LAWS goes far in answering the question of the ethical issues surrounding their use in combat operations. The overview will shed light on how my argument diverges from existing claims in advocating for the use of LAWS in a range of conventional military operations, though with certain limitations.

LAWS has garnered international attention as many questions – ethical, moral, technological, and legal – remain unanswered. Answering these questions is imperative and according to some pundits, LAWS have the potential to change the course of warfare. BJ Strawser, an Assistant Professor of Philosophy in the Defense Analysis Department at the Naval Postgraduate School in Monterey, CA, emphasizes two types of questions that must be understood: the moral questions surrounding the use of drone warfare (use in principle or theory) and the moral question regarding current implementation (use in practice).[11] Despite Strawser's definitions applying to drones, the word 'drone' may encompass LAWS. Drone warfare is synonymous with semi-autonomous weapons systems and the word drone is enough to encompass unmanned systems with either lethal or non-lethal capability. The majority of this paper will be use in principle because LAWS are not available for combat operations.

2.1 Debate: Robots do not have the capability to make ethical decisions.

Ethics are the single most contested point when discussing LAWS. The University of Massachusetts at Amherst published a 2013 survey revealing approximately 55% of the 1,000 US citizens polled oppose LAWS and approximately 30% of the respondents needed more information to make a decision.[12] Of the polled citizens who chose to identify demographic data, "active and former military are among those most opposed to autonomous weaponry."[13]

Noel Sharkey, a Professor of Artificial Intelligence and Robotics and Professor of Public Engagement at the University of Sheffield, is a founding member of the International Community for Robot Arms Control (ICRAC). Dr. Sharkey is adamantly opposed to allowing LAWS on the battlefield because he asserts that robots – physical machines controlled by computers – cannot make the required ethical decisions necessary to kill a human.[14] While LAWS can receive information from sensory inputs such as infrared or optical cameras, radars, and other sensors, that processed information still does not make LAWS capable of accurately identifying targets from all aspects, whether targeting individuals or equipment, much less make them capable of ethical decision-making.

Rob Sparrow is an Associate Professor of Philosophy of Monash University, Melbourne, and a co-founder of ICRAC. Mr. Sparrow shares similar thoughts to Sharkey regarding LAWS being incapable of sentient behavior. His beliefs are that peace in the world should be carried out in the form of swift court justice and not the threat of armed conflict. Furthermore, he states that the money used for LAWS research could be spent developing stronger judicial institutions.[15] However, Sparrow desires that if LAWS become reality, they have a set of parameters guided by ethical considerations that allow a list of 'what-if' scenarios from which the computer must choose.

Ron Arkin is the Regents' Professor and Associate Dean for Research and Space Planning in the School of Interactive Computing at the Georgia Institute of Technology. Arkin believes that by installing an "ethical governor," a sort of artificial moral agent, LAWS can be programmed to be ethical on the battlefield. He professes that humans have a moral imperative to utilize LAWS in clearly defined scenarios if they can make ethical decisions superior to humans.[16]

Jurgen Altmann is a professor of experimental physics at the University of Dortmund, Germany who believes that "killing humans by machine decision raises a fundamental ethical problem" and "even more problematic would be autonomous decisions by armed uninhabited vehicles about when and whom or what to attack."[17]

2.2 Debate: A complete ban or time delay in LAWS development.

Sparrow, Sharkey, and other critics lobby for preventing LAWS development before they ever reach a point of introduction for combat operations. For example, Altmann's recommendation is that LAWS should be banned outright but in the event that a ban is not attained, the IHL "should be augmented by a specific rule prohibiting autonomous machine decisions on whom or what to attack, absolutely demanding a human in the decision chain."[18] This option may be more attainable than an outright ban.

Arkin supports a delay in the implementation of LAWS that would allow the international community time to develop appropriate questions and answers about the use of this technology but he does not believe that imposing an outright ban.[19] Arkin's assertion is that LAWS can function well through advanced technology and the fitment of an ethical governor that would support ethical decision-making.

Peter Asaro is an Assistant Professor and Director of Graduate Programs for the School of Media Studies at the New School for Public Engagement in New York City. Asaro does not call for a delay but he does state that an "international treaty will necessarily be determined through a process of negotiations, the centrepiece of such a treaty should be the establishment of the principle that human lives cannot be taken without an informed and considered human decision regarding those lives in each and every use of force, and any automated system that fails to meet that principle by removing humans from lethal decision processes is therefore prohibited."[20]

The 2012 Directive 3000.09 provides a time delay does not explicitly ban LAWS production. Instead, the directive states that any such production will be under scrutiny and supervision of Pentagon leadership.[21] In 2013, multiple organizations and experts recommended a proposed United Nations moratorium against LAWS.[22] The highlights of the early April 2015 UN conference was discussing meaningful human control – similar to the tiered system of a human on, in, or out of the loop – and another call for action on the LAWS moratorium. As of late April 2015, the United Nations Convention on Certain Conventional Weapons (UNCCW) has not imposed an international ban or moratorium on LAWS production.

2.3 Debate: LAWS could provide a method of targeted killing or assassination.

Noel Sharkey asserts "attacking with a remote piloted vehicle is no different under the Laws of War than attacking with a manned helicopter gunship or even with a rifle."[23] Semi-autonomous weapons systems already conduct targeted killing except their use is under the supervision of a human. Every UAV strike is a targeted killing based on the best available intelligence at the time; if the killing were not targeted, the strikes would be regarded as indiscriminate war crimes and the country that launched the attack would be held liable.

Targeted killing discussion quickly becomes a quagmire of ethical, legal, and technological arguments mainly regarding the right to legal due process. First, assassination and targeted killing are not synonymous. Targeted killings are "premeditated acts of lethal force employed by states in times of peace or during armed conflict to eliminate specific individuals outside their custody."[24] Additionally, targeted killings are not an internationally defined term and they are do not fit neatly within any legal context.[25] Secondly, experts are keenly aware that distinction must be practiced in order to identify who is a combatant and who is a non-combatant. A human may then engage the target with a full understanding of the risk involved once the target or targets has been identified. Understanding the repercussions of attacking the target and ensuring that the action complies with one's own social morality is a burden that must be at the forefront of the human's decision to act. LAWS may be capable of making faster decisions but that does not necessarily mean LAWS can understand the social dynamics that a human must interpret in order to make a valid and justifiable decision when targeting another human being. DARPA's Robotics Challenge has demonstrated that the technology necessary for a robot to understand the dynamics of combat operations is not ready for real world use and that most robots can only perform under controlled conditions in controlled exercises.[26]

2.4 Debate: LAWS may possibly lower the threshold decision at which a country enters conflict.

LAWS as a tool may make the decision to go to war easier due to lower financial costs and less risk for materiel and work force. Sparrow argues that robots can accomplish the same actions as a human but without additional endangerment to humans that could lead to lowering the threshold decision.[27] Additionally, a commander may be willing to deploy LAWS over soldiers for many reasons including fearing the loss of loved ones, being killed, or having to kill another human being.[28] Further contextual analysis of this issue will be discussed later in section

3.4.Existing LAWS literature primarily focuses around the ethics of employment. Some key points concerning LAWS development and use for combat operations include their inability to make ethical decisions; a complete ban or temporary delay in LAWS development; LAWS usage for targeted killing; and whether LAWS may lower the threshold decision at which a country enters conflict to avoid having humans do dull, dirty, or dangerous work.[29] The four outlined debates build the foundation for answering the two ideas and two research questions this paper seeks to explore and answer.

3. FURTHER DEVELOPMENT OF THE ARGUMENT ALLOWING LAWS IN COMBAT OPERATIONS

This paper moves the debate a step further in justifying the ethical basis for the use of LAWS in combat operations, with certain limitations. The first part considers LAWS in the context of the Law of Armed Conflict (LOAC) while the second part discusses why LAWS should attack enemy vehicles, aircraft, and maritime vessels before moving on to consider geographical and time constraints. A final section considers whether the use of LAWS in combat operations will lower the threshold for a country to embark on conflict.

3.1 LAWS and LOAC.

Attention to multiple issues arises when discussing how LAWS will perform if they are built. The issues can only be discussed in a theory context because the technology is unavailable and may never be available. LAWS published literature raises two common themes: moral and legal responsibility for their actions and their inability to perform equal to or superior to a human when making an ethical decision.[30]

The first theme is easy to answer but difficult to impose. If LAWS are equipped with an ethical governor, as Arkin suggests, and programmed to function based on near infinite variables, they cannot be responsible because they are not moral beings. The same question of responsibility does not apply to weapons already in use because a human being must release a weapon. In theory, LAWS cannot be held responsible because there are no repercussions to a machine or robot. In practice on the closely related semi-autonomous weapons systems, the commander is the responsible moral agent of the operation. A human operator in the command hierarchy must be held responsible.

The second theme is LAWS inability to perform equal or superior to a human ethical decision. The first point is nested within the Law of Armed Conflict, a set of laws that govern combat conduct. The three tenets of the Law of Armed Conflict (LOAC) nested under the International Humanitarian Laws (IHL) are military necessity, distinction, and proportionality. These principles are used to regulate the conduct of armed conflict, protect civilians, and ensure the rules apply to all forces engaged in combat. IHL encompass the LOAC and the Geneva Conventions as a commonality.

The first LOAC tenet is military necessity. A US Marine Corps publication offers the following definition: "military necessity prohibits combatants from killing or harming noncombatants or destroying or seizing civilian property, unless such destruction or seizure is demanded by the necessities of war."[31] Unfortunately, there is no clear-cut matrix displaying what action to take based upon a given scenario so the individual war fighter should exercise strong war acumen. Thus, we cannot expect LAWS to understand military necessity with ease if a human struggles with the same concept.

The second tenet of LOAC is distinction that implies a human can distinguish enemy combatants from non-combatants, surrendering enemy combatants, child soldiers, civilians protecting their homes, and civilians conducting daily business.[32] The ability to understand these nuances reflects a major point of why LAWS will not be battlefield ready for the foreseeable future. The wide-ranging variables that must be programmed into a non-sentient machine to understand distinction are too vast. Hence why LAWS would work best attacking enemy equipment rather than humans, a point of departure that differs from what most key leaders have suggested. The argument that humans are in the vehicles is typically factual; but if LAWS attack an enemy vehicle, the safe assumption is that an enemy is also operating the vehicles and

distinction between combatant and non-combatant is irrelevant. During the fog of war, generally defined as a period of uncertainty, LAWS must determine the differences between non-combatants and combatants who blend in with the local population during an asymmetric conflict.[33] The distinction necessary must be as good as or superior to a human's distinction. Properly programmed LAWS will be essentially rendered ineffective if they cannot make the proper distinction because the weapon will no longer fire on viable targets. If LAWS are programmed to make these distinctions, the ethically based rules for distinction would have to be both finite and exact, which would be extremely difficult based on the myriad variables inherent in war. The potential effects from the wrong decision could be catastrophic.

Proportionality is the final tenet of LOAC and requires the anticipated loss of life and damage to property that may result from attacks. It must not be excessive in relation to the direct military advantage gained.[34] Proportionality is subjective and must take into account an appreciation of the larger battlefield picture or cognizance of parallel operations. Proportionality requires some analysis and clarification from use in practice. Professional journals do not reveal an authoritative source of collateral damage from semi-autonomous weapons systems already in use but several private organizations are attempting to categorize drone strikes with sub-categories including collateral damage to civilians and infrastructure.[35] In a report published by Reprieve, the methodology section indicates the difficulty of accounting for all the incidental deaths with the antithesis being that the US drone strikes have kept casualties to a minimum.[36]

A simple scenario to illustrate the three tenets of LOAC runs as follows: when a platoon receives effective sniper fire from a building, they must identify the target (distinction), take into account any surrounding noncombatants (distinction), determine how to eliminate the threat

(military necessity), and perform a military action to render the threat impotent without excess damage to noncombatants or civilian property (proportionality).

LAWS proponents insist LAWS can satisfy military necessity and proportionality requirements for use of force much faster than a human can. Using acoustic sensors and advanced ballistics algorithms, LAWS can identify the direction and general location of where the sniper is hiding. Using infrared cameras in conjunction with radio detection and ranging (RADAR) and light detection and ranging (LIDAR), the system can identify the exact position where the sniper is located. The technologies in this example are tools that infantry can employ in combat and quickly neutralize threats.

The final note regarding the three LOAC tenets of military necessity, distinction, and proportionality is that the explicit understanding that they are all subjective and necessary for making an independent decision and taking an independent action that may adversely affect the outcome of an operation. If machines interpret the LOAC, the rules may need amending with unequivocal words that a computer can interpret.

Understanding the tangled relationship between the LOAC, nested under the IHL, and the permissible use of LAWS is necessary for the future of LAWS. The IHL provides legal rules by which belligerents must abide or the belligerent who commits an unlawful act can go on trial in the International Criminal Court. Currently, the technology does not exist to program LAWS with the understanding of the IHL. If LAWS can be adequately programmed in the future, the IHL may need to be revised to prevent any ambiguity in the specific words. Peter Asaro asks, “is current IHL … sufficient to deal with autonomous lethal technologies, or are they in need of minor extensions, or major revisions?”[37] Additionally, Asara states, “automating the rules of IHL would likely undermine the role they play in regulating ethical human conduct.”[38] International

panels should answered answer this question – starting with the UN Convention on Certain Conventional Weapons – in a timely manner.

If LAWS can perform as well as or incrementally better than a human, the US would be amiss for not exploiting them to assist in battlefield operations.[39] However, LAWS use for saving lives is wholly depending on the type of warfare being conducted; referencing the examples used, urban asymmetric combat is not the place to use LAWS. Conventional warfare would seem to be the most logical case to use LAWSs because the chance of excess civilian casualties and collateral damage is far less. When asymmetric warfare is conducted, insurgents use terrorist tactics in populated areas, which provides difficult conditions for well-trained humans to operate within LOAC guidelines of distinction.

If the UN does not impose the moratorium, Russia is an example of a state that can probably attain LAWS and use them within the LOAC. Due to declining birthrates, Russia would be wise to use their strong industrial base to support technology growth such as LAWS. The machines would then be employed to compensate for Russia's smaller work force pool for military recruitment.

3.2 LAWS should attack enemy vehicles, aircraft, and maritime vessels.

Most analysts agree that LAWS would not do well in densely populated urban environments because they would be required to make too many distinctions. The enemy would assuredly use guerilla tactics to blend in with the civilian population, fade away, and wait for a more opportune time to attack. To expect a robot, even a non-lethal robot, to determine who is friendly and who is an enemy in such a densely populated environment is a difficult task, even for a human being. The variances between combatants and non-combatants are nearly

indistinguishable. While such variances may eventually be apparent to a human, it takes time and intensive training to develop these skills and even then, they are not always perfect. For robotic programming, this presents a challenge that may produce undesired results. Presently, the technology does not exist to identify key indicators in the 'gray area' that constitute the landscape of ethical decision-making.

Conversely, LAWS could perform well in a conventional conflict targeting enemy vehicles instead of humans. The process or targeting vehicles, aircraft, and maritime vessels would occur through automatic target recognition. Automatic target recognition software analyzes objects and matches the data to an information database. In the theory of LAWS, the sensory information can be received through various sensors, rapidly processed, and used to identify the target as either friendly or enemy. Once the targeting process is complete, the engagement phase of the kill chain will occur.[§]

If LAWS are used in a conventional conflict targeting enemy vehicles, the potential for a war atrocity dramatically drops. Distinction between combatant and non-combatant will no longer be necessary because LAWS will only target vehicles based on a pre-programmed database of enemy vehicles. This methodology also circumvents the majority of the ethical argument about how LAWS will be operated.

3.3 LAWS can operate effectively in geographical and time constrained box.

If LAWS are given a well-defined operating area and time constraints, they must be capable of responsible ethical decisions and programmed to avoid committing a war atrocity. Arkin asserts that "atrocities are a human trait that does not need to be replicated in a robot."[40]

[§] The kill chain is a term used to describe the cycle used when targeting an enemy. The process is comprised of five steps: find, fix, track, target, and engage.

LAWS operations could be restricted to a time and geographically restricted box to comply with the LOAC and avoid potential unjustified collateral damage.[41] If intelligence determines where enemy vehicles are operating, establishment of an operating polygon or polyline could allow LAWS to 'free-range' within or along the boundary. LAWS passive sensors can detect enemy vehicles and then enter an active mode to begin destroying the enemy equipment while maintaining the LOAC tenets. Restricting LAWS to constrained operations could work best on a mountain pass, roadblock, or other specific scenario where the enemy can be canalized and have no operating space to disperse its forces.

US military scholars have written numerous articles on how to defeat the anti-access/area denial (A2/AD) threat in the event of a military conflict.[42] The enemy A2/AD threat involves weapons systems, such as anti-ship cruise missiles, that can destroy friendly assets such as a US aircraft carrier, estimated at 12.9 billion dollars. If LAWS were used in the maritime domain with both geographic and time constraints, they could function on the surface and subsurface with specific parameters of operation. Any parameter could be used including an operating window of three hours before the main body starts the attack (time restraint) and only within a 15-kilometer buffer on either side of the shoreline, extending approximately 30 kilometers on either side of the primary landing (geographical constraint). Within this area, LAWS would defeat the A2/AD threat and allow the main body of forces unfettered access to the objective.

LAWS operating in any of the four physical domains (space, air, land and maritime) may need to be used in conjunction with human conducted ISR missions in order to achieve the greatest chance of success with the fewest amount of civilian casualties or collateral damage. This will lower the threshold requirement for LAWS to understand proportionality because ISR operators can either narrow or enlarge the LAWS operating area based on changing factors

during war. If ground LAWS are operating in an open desert where only enemy forces are present, human operated ISR will not be as necessary as LAWS operating near urban areas. In the latter example, the ISR analyst can immediately change the geographical boundaries based on civilian responses to combat occurring around them.

3.4 Will LAWS lower the threshold decision at which a country enters conflict?

Using LAWS as a weapon for combat operations has the potential to lower the threshold of conflict in which a country enters against an enemy. This debate is important because having LAWS available for combat operations may lead senior policymakers to lower the decision threshold to commit military forces, believing that throw-away machines should be used opposed to citizens dying on the battlefield. The concern is not only how to use LAWS in combat operations but to what extent the senior policymakers would be willing to go in order to extend their politics.

As Dr. Arkin has suggested "the threshold of entry into warfare may be lowered as we will now be risking machines and fewer human soldiers."[43] LAWS may be able to advance the US political agenda based on the Clausewitzian premise that war is an extension of politics by other means but the negative comes from a political viewpoint that elected officials want to remain in office and may take measures believing that LAWS present that opportunity.[44] When debating a lowered conflict threshold, multiple problems exist. The first problem is stated in a UN Report: "due to the low or lowered human costs of armed conflict to States with LARs [LAWS] in their arsenals, the national public may over time become increasingly disengaged and leave the decision to use force as a largely financial or diplomatic question for the State, leading to the "normalization" of armed conflict."[45] The second problem is that airborne LAWS have the capability to fly low and undetected by enemy radar. Because airborne LAWS would be

unmanned, there would be no concern for imprisonment or loss of a pilot's life, making the decision to use LAWS easier.[46] A third problem is that lowering the threshold could lead to a knee-jerk reaction in case of a surprise conventional attack on the homeland or our military forces. This reaction could lead to a counter-offensive deemed necessary to maintain the safety and security of the public, regardless of the repercussions and negating the concept of a 'last resort' for military action.[47]

The idea of lowering the conflict decision threshold could lead to more common conflict. If LAWS become prolific through common technology, nearly any country will be able to afford a fleet of LAWS. Future warfare could be wholly dependent on LAWS attacking each other. In history, no other combat tool is similar to LAWS so no examples are available. The idea of states owning LAWS is not far-fetched; building them will require no sensitive materials, no special storage facilities, no special handling, nor any international treaties requiring inspection. This scenario highlights a potential path that LAWS could take except the issue would be far more pervasive and prolific than nuclear weapons.

The United States and other nations have historically relied on mechanical means and technological advances in all forms of warfare for waging a war in which fewer humans were required but the autonomous weapon capability has never existed. When the opportunity to use advanced weapons arises, we must wrestle with the ethical codes by which our society lives, the cost of waging a war with regards to work force, materiel, and cost, and destabilizing fragile international relations before, during, and after conflict. LAWS could potentially assist with numerous tasks of war including saving friendly lives, lowering the cost of war, and force protection when the necessary technology to assure IHL compliance is available and assured.

The issue of cost effectiveness presents a broader ethical discussion regarding integrity and trust of the public as the cost can be misleading. For example, the most expensive part of any organization is personnel; they require clothing, feeding, and retirement benefits to name a few. If military personnel are the example, veteran's affairs cost is also included. Thus, if we substitute one LAWS for ten soldiers, a potential cost savings may be realized over time. However, the cost savings could be falsified if many personnel are required to work abroad to support LAWS maintenance, rearmament, etc. The positive aspect of LAWS cost is that airborne platforms do not require a minimum number of flight hours per month to maintain currency which leads to lower man hours required for maintenance.[48] Even if a cost savings is feasible and realized, the ultimate ethical question remains justifying the use of LAWS in conducting combat operations.

4. CONCLUSION

I submit that LAWS can be ethical in combat operations but only under two constrained measures: the first constraint is that LAWS must not engage humans and secondly, LAWS must be constrained in a geographic area and specific time. Combining these two actions would help to obviate the majority of ethical debates that currently surround the use of LAWS in combat.

Experts criticize allowing LAWS in combat because of their inability to make ethical decisions. Distinction is one of the key tenets of the LOAC that LAWS would need to abide by but the technology is unavailable and may never be available. Other debates include the need to implement an immediate prohibition of LAWS and the idea that LAWS will lower the conflict decision threshold.

Several actions should be taken when discussing the ethical use of LAWS in combat operations. The first recommended action is to place a moratorium on LAWS, an action that has been accomplished in the US DoD Directive 3000.09 preventing LAWS use until 2022. The proposed 2013 UN moratorium would prohibit LAWS production if imposed.[49]

Following the moratorium, the second recommendation is to internationally define autonomy and link that definition with weapons systems. In conjunction with the moratorium, the international community will have the opportunity to discuss all of the issues surrounding LAWS and decide if this advanced tool of warfare that should be considered for combat and to what extent it should be used.

The third recommendation is for states to create international rules and guidelines before LAWS application. The technological leap is potentially volatile enough that it can change warfighting. The challenge remains that we should not develop rules after putting the weapons system in place. Some of the rules and guidelines include the decision threshold that a country would enter into combat. The desired outcome from this recommendation is a practical international treaty to serve as the basis for LAWS proliferation and use in combat.

Other research areas need further exploration: the cost of LAWS including modularity; LAWS and ISR synchronization; whether LAWS are best suited for offensive, defensive, or a combination of both during combat operations; and autonomous target recognition software.

The permissive use of robots on the battlefield as a tool that serves humans will become a reality when the requisite technology is available. Once the technology requirement is satisfied, LAWS use will probably be inevitable. Until then, the US should pursue LAWS that will operate with time and geographic constraints and not target humans.

[1] "2014 Mission Statement," *ICRAC*, http://icrac.net/statements/.

[2] "Clearpath Robotics Takes Stance Against 'Killer Robots'," Ryan Gariepy, *Clearpath Robotics*, last modified August 30, 2014, http://www.clearpathrobotics.com/press_release/clearpath-takes-stance-against-killer-robots/.

[3] "Japan's views on issues relating to LAWS," 2015, http://www.unog.ch/80256EDD006B8954/(httpAssets)/0B240327184B83A0C1257E1800543142/$file/LAWS(JAPAN'S+POSITION+PAPER+2015).pdf.

[4] "Cuba´s National Document on Lethal Autonomous Weapons," 2015, http://www.unog.ch/80256EDD006B8954/(httpAssets)/57B666986B91682EC1257E1A0038EF99/$file/Documento+Nacional+de+Cuba+Armas+Aut%C3%B3nomas+GE+2015+Rev+RBV.pdf.

[5] Kate Allen, *UK Foreign and Commonwealth response on LAWS*, (London, 2013).

[6] "Country Statements on Killer Robots," *Campaign to Stop Killer Robots*, last modified March 2013, http://www.stopkillerrobots.org/wp-content/uploads/2013/03/KRC_CountryStatus_14Mar2014.pdf.

[7] U.S. Department of Defense, *Autonomy in Weapons Systems*, Directive 3000.09, November 21, 2012.

[8] United Nations Institute for Disarmament Research, *Framing Discussions on the Weaponization of Increasingly Autonomous Technologies* (Geneva, Switzerland: UNIDIR, 2014).

[9] U.S. Department of Defense, Autonomy in Weapons Systems, Directive 3000.09, November 21, 2012; Noel Sharkey, "Saying 'no!' to Lethal Autonomous Targeting." *Journal of Military Ethics* 9, no. 4 (2010): 369-383. https://search.ebscohost.com/; Human Rights Watch, "Losing Humanity: The Case Against Killer Robots," *International Human Rights Clinic.* Accessed 13 April 2015, http://www.hrw.org/sites/default/files/reports/arms1112ForUpload_0_0.pdf.

[10] "Definitions: intelligent system, autonomy, automation, robots, and agents," *Florida Institute for Human and Machine Cognition*, accessed 13 April 2015, http://www.ihmc.us/groups/datkinson/wiki/fcb0e/intelligent_system_autonomy_automation_robots_and_agents.html.

[11] Jay Strawser, ed., *Killing Without Heart: The Ethics of an Unmanned Military* (New York, Oxford University Press 2013), 7.

[12] Charli Carpenter, "How Do Americans Feel About Fully Autonomous Weapons?" *Duck of Minerva* (blog), June 19, 2013, http://duckofminerva.com/2013/06/how-do-americans-feel-about-fully-autonomous-weapons.html.

[13] University of Massachusetts Amherst, "New Survey Shows Widespread Opposition to 'Killer Robots,' Support for New Ban Campaign," *Newswire*, June 19, 2013, http://www.newswise.com/articles/new-survey-shows-widespread-opposition-to-killer-robots-support-for-new-ban-campaign.

[14] Noel E Sharkey, "The Evitability of Autonomous Robot Warfare," *International Review of the Red Cross* 94, no. 886 (2012): 787-799. https://search.ebscohost.com/.

[15] "TechDebate: Lethal Autonomous ("Killer") Robots," video, 18:50, posted by the Georgia Tech Center for Ethics and Technology, Nov 21, 2013, https://www.youtube.com/watch?v=nO1oFKc_-4A.

[16] "TechDebate: Lethal Autonomous ("Killer") Robots," video, 2:15, posted by the Georgia Tech Center for Ethics and Technology, Nov 21, 2013, https://www.youtube.com/watch?v=nO1oFKc_-4A; Ron Arkin, "The Case for Ethical Autonomy in Unmanned Systems." *Journal of Military Ethics* 9, no. 4 (2010): 332-341.

[17] Jurgen Altmann, *Preventive Arms Control for Uninhabited Military Vehicles*, (Heidelberg, 2009).

[18] Ibid.

[19] Ron Arkin, "Lethal Autonomous Systems and the Plight of the Non-combatant," *Ethics and Armed Forces - Controversies in Military Ethics and Security Policy* 1, (2014): 3-10.

[20] Peter Asaro, "On banning autonomous weapon systems: human rights, automation, and the dehumanization of lethal decision-making," *International Review of the Red Cross* 886 (2012): 696.

[21] "Essay: The Legal and Moral Problems of Autonomous Strike Aircraft," Dave Majumdar, *USNI.com*, accessed 14 April 2015, http://news.usni.org/2014/08/21/essay-legal-moral-problems-autonomous-strike-aircraft.

[22] United Nations General Assembly, *Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns*, (2013).

[23] Noel Sharkey, "Saying 'no!' to Lethal Autonomous Targeting," *Journal of Military Ethics* 9, no. 4 (2010): 369-383, https://search.ebscohost.com/.
[24] "Targeted Killings," Jonathon Masters, *Council of Foreign Relations Backgrounders*, accessed 26 April 2015, http://www.cfr.org/counterterrorism/targeted-killings/p9627; United Nations General Assembly, Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston, (20101).
[25] United Nations General Assembly, Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston, (20101).
[26] "DRC: About the Challenge," *Darpa Robotics Challenge*, last modified 2015, http://www.theroboticschallenge.org/overview.
[27] Rob Sparrow, "'Just say no' to drones," *IEEE Technology and Society*, Spring 2012, 56, http://profiles.arts.monash.edu.au/rob-sparrow/download/Just-say-no-to-dronesForWeb.pdf.
[28] United Nations General Assembly, *Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns*, (2013).
[29] Peter W. Singer, "Military Robots and the Laws of War," *The New Atlantis* (Winter 2009): 29, http://www.thenewatlantis.com/publications/military-robots-and-the-laws-of-war.
[30] Noel E Sharkey, "The Evitability of Autonomous Robot Warfare," *International Review of the Red Cross* 94, no. 886 (2012): 787-799. https://search.ebscohost.com/.
[31] Lejeune Leadership Institute, *Discussion Material for Small Unit Leaders: Battlefield Ethics and Leadership* (Quantico, Virginia: Marine Corps University, 2008), 8, http://www.mcu.usmc.mil/lleadership/LLI%20site%20documents/Ethics/Issues%20of%20Battlefield%20Ethics%20and%20Leadership.pdf.
[32] Ibid, 9.
[33] Carl von Clausewitz, *On War*, ed. Michael Howard and Peter Paret, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1984), 101.
[34] Lejeune Leadership Institute, Discussion Material for Small Unit Leaders: Battlefield Ethics and Leadership (Quantico, Virginia: Marine Corps University, 2008), 8, http://www.mcu.usmc.mil/lleadership/LLI%20site%20documents/Ethics/Issues%20of%20Battlefield%20Ethics%20and%20Leadership.pdf.
[35] "Reprieve, *You Never Die Twice: Multiple Kills in the US Drone Program*, (2014); "Get the Data: What the Drone Strikes," Alex Ross and Jack Serle, *The Bureau of Investigative Journalism,* last modified May 23, 2014, http://www.thebureauinvestigates.com/2014/05/23/get-the-data-what-the-drones-strike/.
[36] Reprieve, *You Never Die Twice: Multiple Kills in the US Drone Program*, (2014).
[37] Peter Asaro, "On banning autonomous weapon systems: human rights, automation, and the dehumanization of lethal decision-making," *International Review of the Red Cross* 886 (2012): 693.
[38] Ibid, 699.
[39] "TechDebate: Lethal Autonomous ("Killer") Robots," video, 19:05, posted by the Georgia Tech Center for Ethics and Technology, Nov 21, 2013, https://www.youtube.com/watch?v=nO1oFKc_-4A; Ron Arkin, "The Case for Ethical Autonomy in Unmanned Systems." *Journal of Military Ethics* 9, no. 4 (2010): 332-341. http://search.ebscohost.com/.
[40] "TechDebate: Lethal Autonomous ("Killer") Robots," video, 10:35, posted by the Georgia Tech Center for Ethics and Technology, Nov 21, 2013, https://www.youtube.com/watch?v=nO1oFKc_-4A; Ron Arkin, *Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture*, (Georgia: Georgia Institute of Technology, 2007).
[41] Maya Brehm, "Meaningful Human Control," accessed 16 April 2015, http://www.unog.ch/80256EDD006B8954/(httpAssets)/897D1C5358C307BDC1257E280028024B/$file/BREHM_Presentation+on+MHC_14.04.2015.pdf.
[42] McCarthy, Christopher. "Chinese Anti-Access/Area Denial: The Evolution of Warfare in the Western Pacific." (master's thesis, Naval War College, 2010), http://www.dtic.mil/dtic/tr/fulltext/u2/a525078.pdf.
[43] Ron Arkin, "Ethical Robots in Warfare," *IEEE Technology & Society Magazine* 28, no. 1 (2009): 30-33. http://search.ebscohost.com/.

[44] Rob Sparrow, "'Just say no' to drones," (working paper, http://profiles.arts.monash.edu.au/rob-sparrow/download/Just-say-no-to-dronesForWeb.pdf).
[45] United Nations General Assembly, *Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns*, (2013).
[46] Jurgen Altmann, *Preventive Arms Control for Uninhabited Military Vehicles*, (Heidelberg, 2009).
[47] United Nations General Assembly, *Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns*, (2013).
[48] "Essay: The Legal and Moral Problems of Autonomous Strike Aircraft," Dave Majumdar, *USNI.com*, accessed 14 April 2015, http://news.usni.org/2014/08/21/essay-legal-moral-problems-autonomous-strike-aircraft.
[49] Human Rights Watch, "Shaking the Foundations: The Human Rights Implications of Killer Robots," *International Human Rights Clinic*, (2014).

BIBLIOGRAPHY

Allen, Kate. *UK Foreign and Commonwealth response on LAWS*, (London, 2013). www.article36.org/wp-content/uploads/2013/06/50240-Signed-Final.pdf.

Altmann, Jurgen. *Preventive Arms Control for Uninhabited Military Vehicles*, (Hiedelburg, 2009).

Antal, John. "I Fight the Body Electric!" *Military Technology* 33, no. 7 (2009): 22-30. https://search.ebscohost.com.

Arkin, Ronald C. *Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture*. Georgia: Georgia Institute of Technology, 2007.

Arkin, Ronald C. "Ethical Robots in Warfare." *IEEE Technology & Society Magazine* 28, no. 1 (2009): 30-33. http://search.ebscohost.com/.

Arkin, Ronald C. "The Case for Ethical Autonomy in Unmanned Systems." *Journal of Military Ethics* 9, no. 4 (2010): 332-341. http://search.ebscohost.com/.

Arkin, Ronald C. "Lethal Autonomous Systems and the Plight of the Non-combatant." *Ethics and Armed Forces - Controversies in Military Ethics and Security Policy* 1, (2014): 3-10.

Asaro, Peter. "On banning autonomous weapon systems: human rights, automation, and the dehumanization of lethal decision-making." *International Review of the Red Cross 886* (2012).

Brehm, Maya. "Meaningful Human Control." Accessed 16 April 2015. http://www.unog.ch/80256EDD006B8954/(httpAssets)/897D1C5358C307BDC1257E280028024B/$file/BREHM_Presentation+on+MHC_14.04.2015.pdf

Clausewitz, Carl von. *On War*. Edited by Michael Howard and Peter Paret. Translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1984.

"Convention on Conventional Weapons." YouTube video. Posted by "Campaign to Stop Killer Robots," March 12, 2014. https://www.youtube.com/watch?v=tCGidyqwHWk.

Davies, Sean. "It's War - but Not as we Know it." *The Institute of Technology and Engineering* 4, no. 9 (2009): 40-43.

Grayling, Anthony C. "Act Now before Armed Robots Get Out of Control." *New Scientist* 201, no. 2698 (2009): 23-23. https://search.ebscohost.com/.

Human Rights Watch. "Shaking the Foundations: The Human Rights Implications of Killer Robots." *International Human Rights Clinic* (2012): http://www.hrw.org/sites/default/files/reports/arms0514_ForUpload_0.pdf

Hambling, David. "Russia Wants Autonomous Fighting Robots, and Lots of them." Popular Mechanics, accessed Feb 15, 2015, http://www.popularmechanics.com/military/a10511/russia-wants-autonomous-fighting-robots-and-lots-of-them-16787165/.

Harris, Mark. "The Unknown Start-Up that Built Google's Self-Drive Car." IEEE Spectrum, accessed February, 2015, http://spectrum.ieee.org/robotics/artificial-intelligence/the-unknown-startup-that-built-googles-first-selfdriving-car.

Headquarters, US Air Force. "United States Air Force Unmanned Aircraft Systems Flight Plan 2009-2047." Washington, D.C.: US Air Force, Headquarters, 2009.

Human Rights Watch. "Losing Humanity: The Case Against Killer Robots." *International Human Rights Clinic*. Accessed 13 April 2015, http://www.hrw.org/sites/default/files/reports/arms1112ForUpload_0_0.pdf.

Johnson, Aaron M. and Sidney Axinn. "The Morality of Autonomous Robots." *Journal of Military Ethics* 12, no. 2 (2013): 129-141.http://search.ebscohost.com/.

Lejeune Leadership Institute. *Discussion Material for Small Unit Leaders: Battlefield Ethics and Leadership*. Quantico, Virginia: Marine Corps University, 2008. http://www.mcu.usmc.mil/lleadership/LLI%20site%20documents/Ethics/Issues%20of%20Battlefield%20Ethics%20and%20Leadership.pdf.

McCarthy, Christopher. "Chinese Anti-Access/Area Denial: The Evolution of Warfare in the Western Pacific." Master's thesis, Naval War College, 2010. http://www.dtic.mil/dtic/tr/fulltext/u2/a525078.pdf.

Minton, Eric. "Robots' Rules in Order." *Officer* 85, no. 2 (2009): 38-40. https://search.ebscohost.com/.

Purdy, Ellen M. "The Increasing Role of Robots in National Security." *Defense AT&L* 37, no. 3 (2008): 26-29. https://search.ebscohost.com.

Rafael Industries. *Iron Dome*. Vol. UNK Rafael Industries, UNK.

Ramo, Simon. *Let Robots do the Dying*. Los Angeles, California: Figueroa Press, 2011.

Reprieve. *You Never Die Twice: Multiple Kills in the US Drone Program*. 2014.

Riza, Shane. *Killing without Heart*. 1st ed. Dulles, Virginia: Potomac Books, 2013.

Sharkey, Noel E. "Saying 'no!' to Lethal Autonomous Targeting." *Journal of Military Ethics* 9, no. 4 (2010): 369-383. https://search.ebscohost.com/.

Sharkey, Noel E. "The Evitability of Autonomous Robot Warfare." *International Review of the Red Cross* 94, no. 886 (2012): 787-799. https://search.ebscohost.com/.

Singer, Peter W. *Wired for War*. New York, New York: The Penguin Press, 2009.

Singer, Peter W. "Military robots and the Laws of War." *The New Atlantis* (Winter 2009): http://www.thenewatlantis.com/publications/military-robots-and-the-laws-of-war.

Sparrow, Rob. "'Just Say no' to Drones." *IEEE Technology & Society Magazine* 31, no. 1 (2012): 56-63.

Springer, Paul. *Military Robots and Drones*. Santa Barbara, California: ABC-CLIO, LLC, 2013.

Stawser, Jay, ed. Killing by Remote Control: The Ethics of an Unmanned Military. New York, New York: Oxford University Press, 2013.

Suarez, Daniel. *The Kill Decision Shouldn't Belong to a Robot.* TedTalks online video. Directed by TedGlobal. online: TedGlobal, 2013.

U.S. Department of Defense, *Autonomy in Weapons Systems*, Directive 3000.09, November 21, 2012.

U.S. Department of State. "Sixty-Ninth UNGA First Committee Thematic Discussion on Conventional Weapons." U.S. Department of State, accessed 15 February, 2015, http://www.state.gov/t/avc/rls/2014/233251.htm.

United Nations General Assembly. *Report of the commission of inquiry on human rights in the Democratic People's Republic of Korea*. 2014.

United Nations General Assembly. *Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, Christof Heyns*. 2013.