ETHICAL CONSIDERATIONS FOR THE USE OF LETHAL
AUTONOMOUS WEAPONS SYSTEMS

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The character of warfare is on the cusp of a massive transformation. Autonomous technologies and an increasing reliance on human-machine collaboration will redefine how war is waged in future conflicts. It is inevitable that lethal autonomous weapon systems (LAWS) will be a ubiquitous and decisive form of combat power on the battlefield in the near future.

As militaries become more dependent upon lethal autonomous technologies, ethical dilemmas surrounding their use will emerge. The predominate ethical debate over LAWS is concentrated around the acceptableness of lethal decisions made without human intervention or concurrence. This thesis addresses this question in particular as it seeks to determine if it is ethical for the U.S. military to employ LAWS.

In examining this question, a normative ethics approach was pursued using the Ethical Triangle Decision Making Model. Deontological, consequential, and virtuous perspectives were the three viewpoints utilized in the study to investigate the ethical use of LAWS. The results of this study find that the U.S. military is justified in employing human-on-the-loop LAWS.

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ABSTRACT

ETHICAL CONSIDERATIONS FOR THE USE OF LETHAL AUTONOMOUS
WEAPON SYSTEMS, by Major Curtis R. Michael, 108 pages.

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human-on-the-loop LAWS.

ACKNOWLEDGMENTS

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ACRONYMS

ADRP	Army Doctrine Reference Publication
AFRL	Air Force Research Lan
AGM	Air-to-Ground Missile
AI	Artificial Intelligence
AWS	Autonomous Weapon System
CIL	Customary International Law
COA	Course of Action
C-RAM	Counter Rocket, Artillery, and Mortar
DMZ	Demilitarized Zone
DNA	Deoxyribonucleic Acid
DOD	Department of Defense
ICRC	International Committee of the Red Cross
IDF	Israeli Defense Force
IHL	International Humanitarian Law
LAWS	Lethal Autonomous Weapon Systems
LO	Low Observable
LOAC	Law of Armed Conflict
LOW	Law of War
LRASM	Long Range Anti-Ship Missile
NDS	National Defense Strategy
NSS	National Security Strategy
OODA	Observe, Orient, Decide, Act
PLA	People's Liberation Army

PPG	Presidential Policy Guidance
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
UAV	Unmanned Aerial Vehicle
USAF	United States Air Force
USMC	United States Marine Corps

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CHAPTER 1

INTRODUCTION

> The first ultraintelligent machine is the *last* invention that man need ever make, provided that the machine is docile enough to tell us how to keep it under control. It is curious that this point is made so seldom outside of science fiction. It is sometimes worthwhile to take science fiction seriously.
> —Irving John Good, *The First Ultraintelligent Machine*

Overview

Throughout history, American armed forces have epitomized the western way of war. The U.S. military shapes the western of way of war by employing superior technologies, and overwhelming firepower as evidenced through the development of airplanes, rockets, nuclear bombs, stealth, and precision-guided munitions (Parker 2000). Continuing this trend, future U.S. military systems will exploit the rapid increases in information technology, including those related to the autonomous capabilities of unmanned systems. As these systems mature and progressively become more self-reliant and potentially lethal, national and international leaders need to address the questions surrounding the ethical use of semi and fully autonomous weapon systems (AWS).

Before discussing the legal and ethical limitations of armed conflict, it is essential to define what an AWS is and is not. An AWS or lethal autonomous weapon system (LAWS), is a "weapon system that, once activated, can select and engage targets without further intervention by a human operator" (Dep SecDef 2017). Autonomous weapon system is a broad overarching term which encompasses a family of systems that can be further characterized according to the level of human supervision involved: human-on-the-loop or human-out-of-the-loop.

Human supervised, or human-on-the-loop, autonomous weapons systems are "designed to provide human operators with the ability to intervene and terminate engagements, including in the event of a weapon system failure, before unacceptable levels of damage occur" (Dep SecDef 2017). Currently fielded "human-on-the-loop" weapon systems the U.S. military employs in a self-defensive nature are the Phalanx and C-RAM (Majumdar 2014). Human-out-of-the-loop autonomous weapons systems, are those AWS that target and engage targets without the supervision of a human operator. Current DOD policy restricts human-out-of-the-loop targeting by directing that AWS "may be used to apply non-lethal, non-kinetic force, such as some forms of electronic attack, against materiel targets…" (Dep SecDef 2017).

In contrast, a semi-autonomous weapon system is "a weapon system that, once activated, is intended only to engage individual targets or specific target groups that have been selected by a human operator" (Dep SecDef 2017). Examples of semi-autonomous weapon systems include the current MQ-9 Reaper remotely piloted vehicle (RPA) or drone (Figure 1). Semi-autonomous, or human-in-the-loop, weapon systems include not only the platforms that find, fix, and track targets (such as the MQ-9), but also includes munitions. Examples of semi-autonomous munitions include "fire and forget" or "lock-on-after-launch" homing missiles such as the hellfire and AGM-158C Long Range Anti-Ship Missile (Thompson 2018). As semi-autonomous and LAWS are continually improved and made available to political and military leaders, ethical dilemmas surrounding their use will emerge.

The ethical conduct of war is grounded in the Hague and Geneva Conventions. Also, U.S. military professionals ascribe to service specific codes of conduct and creeds

which prescribe values-based, virtuous behavior. For instance, the USAF ethic consists of three fundamental and enduring values of integrity, service before self, and excellence in all we do (USAF 2015). Concise and straightforward, these three ethical principles are beacons for how Airmen should conduct themselves in their personal as well as professional lives. Military beliefs, norms, values, and internationally recognized statutes, set not only the moral and legal boundaries for the actions of soldiers, but also influence the development of weaponry.
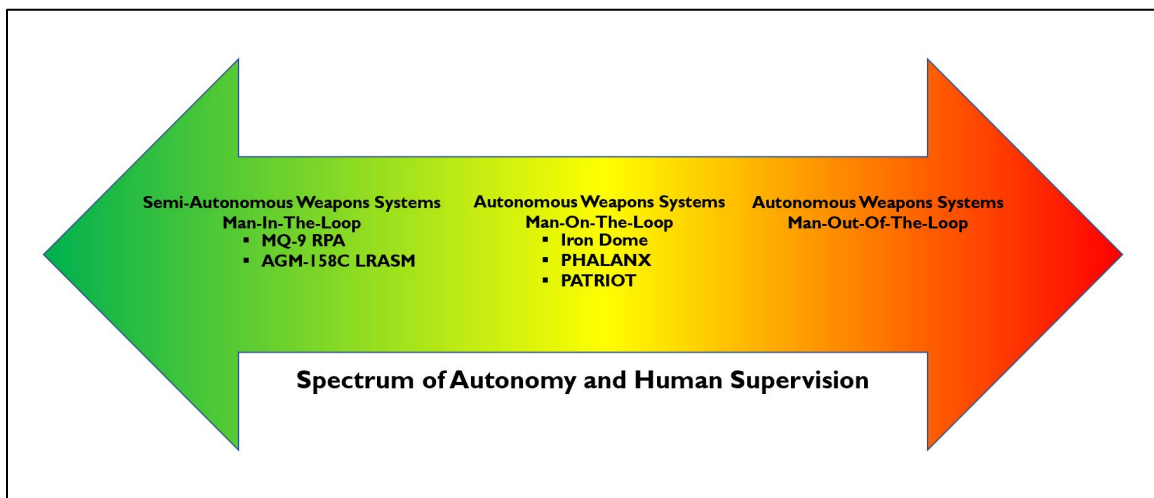
Figure 1.   Spectrum of Autonomy and Human Supervision

Source: Created by the author.

In his book *Army of None*, Paul Scharre aptly states that "technology has brought us to a crucial threshold in humanity's relationship with war. In future wars, machines may make life-and-death engagement decisions all on their own" (Scharre 2018, 4). Despite uncertainty of the future, the U.S. military appears to be taking a very prudent, deliberate approach to the ethical use of autonomous weapons as detailed. The Vice

Chairman of the Joint Chiefs of Staff, General Paul Selva, stated before the Senate

Armed Services Committee:

> Because we take our values to war and because many of the things we must do in war are governed by the laws of war . . . I don't think it's reasonable for us to put robots in charge of whether or not we take a human life . . . We should all be advocates for keeping the ethical rules of war in place, lest we unleash on humanity a set of robots that we don't know to control. (SASC 2017, 47)

General Selva's words are encouraging to critics who believe that it is unethical to have a robot decide who lives or dies. Despite senior government officials and official United States policy on the use of lethal autonomous weapons, the U.S. is spending large quantities of money on autonomous systems and artificial intelligence. For the fiscal year 2019 budget, the United States Department of Defense has requested more than 13.7 billion dollars for investment in technology development. Core technologies requested to be funded are hypersonics, autonomy, cyber, space, directed energy, electronic warfare, and artificial intelligence. The total funding requested for research and development was 92.4 billion dollars. While this accounts for less than 2% of the entire defense budget, it is a 10% increase from the 2018 budget (Office of the Under Secretary of Defense, Comptroller 2018). Whether one likes to admit it or not, the AI arms race has begun.

China, in particular, has embraced the potential for AI and has published a national plan that outlines its research and investment goals for AI. Moreover, they have formally declared that by 2030, their goal is to "become the world's premier artificial intelligence innovation center." Not long after China's bold statement, Russian President Vladimir Putin commented, "Whoever becomes the leader in this sphere (AI) will become the ruler of the world" (Tucker 2018).

Not only are large nation states significantly investing in AI technology, but large commercial corporations such as Amazon, Google, Facebook, and Tesla all recognize the benefits of using AI technologies. Tesla believes that all of their cars will be fully autonomous by 2019 (Marr 2018) and Google has applied AI to its popular Google Translate application which by some accounts is as good or better than human translation (Tegmark 2017, 90). Leveraging the AI successes of Google and Tesla, the U.S. Army expects to test autonomous ground vehicles in 2019 as part of their Automated Ground Resupply program. The objective of this program is to demonstrate that autonomous vehicles can follow a manned vehicle in a "Leader-Follower" manner. The long-term vision as described by the Secretary of the Army, Mark Esper, is to "free up manpower for the front line" and save lives from roadside bombs and ambushes" (Freedberg 2018). The success and domination of AI technologies by commercial corporations over the past few years all but guarantees that future military systems will become more autonomous.

It is a highly probable assertion that autonomous systems, both lethal and non-lethal, will become ubiquitous across the future battlefield much like their semi-autonomous predecessors. The use of semi-autonomous aircraft such as the Predator, Gray Eagle, and Avenger RPA continue to increase. General Atomics reports that their RPA aircraft have flown over 360,311 missions with "more than 90 percent of all missions flown in combat." Their abundant use on the battlefield is further illustrated by the number of flight hours flown, "500,000 flight hours achieved from 1993 to 2008, one million hours in 2010, two million hours in 2012, three million hours in 2014, and four million hours in 2016" (GAA 2018).

Looking at these statistics, it is clear that semi-autonomous military platform use is exponentially rising. Follow-on iterations of these platforms will gradually morph semi-autonomous systems into LAWS. It would behoove political and military leaders to lead turn this transformation. Discussion should focus on what *just* warfare should look like in the future as it pertains to international law, chiefly "Hague Law" and "Geneva Law." In examining these treaties and laws, policy makers should not only judge legal precedence but also determine if the use of LAWS meets the spirit of LOAC. The ensuing paragraphs momentarily introduce the legal and ethical framework of war as it relates to the U.S. military.

Department of Defense (DOD) directive 2311.01E states that all "members of the DOD Components comply with the law of war during all armed conflicts, however such conflicts are characterized, and in all other military operations" (JAG 2018, 9). The U.S. military further defines the law of war as "that part of international law that regulates the conduct of armed hostilities. It is often called the Law of Armed Conflict (LOAC)." Additionally, LOAC encompasses treaties, international agreements to which the U.S. is a party, and applicable customary international law (CJCS 2010). Combat operations conducted within the boundaries of the LOAC ensures actions are legally and morally grounded. Most importantly, it justifies and distinguishes the killing of human beings from the criminal act of murder (Cook 2012). The legal and moral principle that justifies killing is called Just War Theory.

Just War Theory can be separated into three distinct areas: the reasons for going to war (*jus ad bellum*), the way war is conducted (*jus in bello*), and the termination of war (*jus post bellum*). Within the American government, the President of the United States

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and Congress decide if the case of military power is within the confines of *jus ad bellum*. It is important to note that military members, except senior advisors, are not involved in the determination of going to war. Historically, the *jus ad bellum* justification for the authorization of military force requires specific criteria to be met: just cause, declaration of war from a competent authority, comparative justice, righteous intention, conflict is the last resort, a reasonable probability of success, and the principle of proportionality (Kem 2018). Michael Walzer concisely sums up a nations reason for engaging in war by stating "*jus ad bellum* requires us to make judgments about aggression and self-defense" (Walzer 1992, 21).

The second part of Just War Theory concerns the conduct of war or *jus in bello.* In this domain, the responsibility for the conduct of war falls squarely on the military member. *Jus in bello* is governed by rules of engagement, weapon to target pairings, and treatments of prisoners of war and civilians (Cook 2012). Moral requirements of Just War Theory concerning *jus in bello* are characterized by the following principles as spelled out in Army Doctrine Reference Publication (ADRP) 1, *The Army Profession*: military necessity, distinction, proportionality, and unnecessary suffering (HQDA 2015). The moral traditions of Just War Theory attempt to restrain warfare and honor an individual's morality and dignity regardless of their combatant status. *Jus ad bellum* and *jus in bello* principles are not simple checklists with a binary answer. Instead, they are present to ensure leaders at the strategic, operational, and tactical level critically think about the morality of combat operations. This sentiment is further emphasized by The Nuremberg Tribunal observation which stated "the law of war is to be found not only in treaties but in the customs and practices of states… this law is not static, but by continual adaptation

follows the needs of a changing world" (Hartle 2004, 108). The Nuremberg Trials were held at the conclusion of World War Two in Nuremberg, Germany where Nazi leaders were tried for war crimes.

On its surface, it appears as if LAWS are allowed under the *jus in bello* restraints. Critics, however, argue that removing the human from targeting and kill chain decisions crosses a "moral and ethical Rubicon" (Scharre 2018). Peter Asaro, a philosopher at The New School, expands upon this thought as he views autonomous weapons from a *mal en se* "evil in themselves" perspective. He concludes that autonomous weapons, regardless of their overall good, are comparable to actions like torture or slavery and that it is a "fundamental violation" of human rights and human dignity to "delegate the authority to kill to the machine" (Scharre 2018, 271-285).

The dilemma surrounding the use of LAWS appears to pivot around accountability and culpability of action. If the U.S. military decides to employ LAWS in future conflicts will it forfeit the moral and legal high ground which has always been a trademark of U.S. military operations? Members of the military profession are expected to honorably conduct themselves within the expected moral and ethical framework of their profession. The military ethic, while not formally codified in the U.S. military, is inferred through service specific, joint doctrine, and senior leader direction. General Martin E. Dempsey, the 18th Chairman of the Joint Chiefs of Staff, published a white paper discussing the American Profession of Arms. In the article he affirms the importance of values for the ethical military professional:

> We must provide an example to the world that cannot be diminished by hardships and challenges. This example is based upon the words and intent of the US Constitution that each of us takes a personal oath to support and defend. Our oath

demands each of us display moral courage and always do what is right, regardless of cost . . . Commitment to the rule of law is integral to our values which provide the moral and ethical fabric of our profession. (Dempsey 2018)

The Army's military ethic is well nested within General Dempsey's direction as its doctrinal publication on the Army Profession states, "The Army professional's moral awareness and sensitivity is required for legally and morally justifiable action" (HQDA 2015). At the core of this discussion is the reputation of the military profession. The profession of the military officer is distinguishable from others in society because of the officer's expertise in justifying the application of lethal military force. The responsible and moral application of force is the "essence" of the military profession. This thesis examines the legality and military ethics of employing LAWS. It aims to continue the critical political and military discussions that surround this powerful, nascent technology.

Primary Research Question

The U.S. military has always strived to fight wars from a position of strength and advantage. United States Air Force doctrine explicitly states that "asymmetric operations are more effective, achieve results faster, and are less costly than symmetric or serial operations" (USAF 2016). Asymmetric advantages are created through a multitude of ways. Geoffrey Parker identifies five foundational principles that have allowed western nations to dominate the battlefield in contemporary history. The five principles western nations exhibit are technology, discipline (training), creative financing, total defeat of the enemy, and the challenge and response dynamic (Parker 2000, 2-9).

Technology, while not a guarantor of success, typically is viewed as an enabler or catalyst for success on the battlefield. In the nineteenth century, Antoine-Henri Jomini wrote: "The superiority of armament may increase the chances of success in war, but it

does not of itself win battles" (Parker 2000, 2). The U.S. military appears to neatly fit into Parker's *Western Way of War* principles by use of superior technology. Technologies that are innovative and which implement new concepts of warfare have been described by Peter Paret as Revolutions in Military Affairs (Paret 1986, 13). Within the last 70 years, the U.S. has classified these revolutions as "offset strategies." The first offset strategy originated in the Eisenhower administration during the Korean War. In this time period the Soviet Union was challenging American hegemony as they promoted regional instability and fielded a large conventional army – 175 active divisions compared to 29 active divisions in the U.S. Army and Marines. However, the U.S. had more nuclear weapons than the Soviet Union. As a result of its nuclear weapons advantage, President Eisenhower established the "New Look" defense policy, commonly referred to as the first offset, which leveraged nuclear devices and nuclear delivery platforms (Lewis 2017, 20).

By the 1970s, the Soviet Union reached relative parity with the U.S. in nuclear capabilities which resulted in the doctrine of "mutually assured destruction." Despite both nations being equally matched in nuclear capability, the Soviets maintained a threefold numerical advantage of personnel and vehicles compared to the U.S. and its allies. In response, the U.S. saw advancements in electronics and computers as an opportunity to create a second offset strategy. The second offset strategy relied upon information systems and precision weapons (to include stealth) to blunt the numerically superior forces of the Soviet Union (Lewis 2017, 21).

Technologies spawned from the second offset displayed their monopolizing effects during Operation Desert Storm. Pioneering technologies, operated by well-led, and well-trained forces resulted in a decisive victory that had minimal coalition and

civilian causalities. In the two decades since the overwhelming success of Operation Desert Storm, technologies from the second offset have proliferated to other near-peer nation-states, such as China and Russia. And once again, the U.S. military finds itself equally matched by near-peer nations.

With military parity achieved, the focus of the third offset is to "exploit all the advances in artificial intelligence and autonomy and insert them into the DOD's battle network…" (Lewis 2017, 22). The most controversial characteristic of this third offset strategy is, should autonomous weapons systems will be permitted to use lethal force? To answer this question, a primary research question was established. The primary research question is: Is it ethical for the U.S. military to employ LAWS?

<div align="center">Secondary Research Questions</div>

To investigate the primary research question, "Is it ethical for the U.S. military to employ LAWS?" this thesis examines secondary questions related to Just War Theory and International Law.

The secondary questions are:

1. How will LAWS meet/fail the *jus in bello* principles of:

    a. Military necessity

    b. Distinction

    c. Proportionality

    d. Unnecessary suffering

2. What is the ethical framework for when deciding to employ LAWS?

The assumptions to the primary research question, "Is it ethical for the U.S. military to employ LAWS?" will view war as being influenced by the complex relationships between politics, society, and the military. Additionally, this thesis views war as a human endeavor as first espoused by Carl Von Clausewitz. A third assumption is that the U.S. military will continue to pursue and develop AI and LAWS technology.

Furthermore, as society interacts and accepts contemporary technologies, autonomous software and hardware will gradually anchor itself in American and world culture. As AI becomes more pervasive throughout society, its capabilities will be leveraged by the military and political establishment. Consequently, it is assumed that LAWS will be designed with goals and behaviors that align with the values promoted by the country that developed them. Similarly, if LAWS are employed by a nation for combat operations, it assumed that the government using them will satisfy the principles *jus ad bellum* for the legal use of military force.

Lastly, this thesis assumes that the U.S. will adhere to its policy of *Autonomy in Weapon Systems*, as outlined in DOD Directive 3000.09. However, this report recognizes that other sovereign nations, and non-state actors, may not be restricted in their development of LAWS.

Definitions and Terms

The following definitions and terms will provide clarity and a common understanding of concepts to the reader:

Automation: System programmed to perform explicit functions. The system will do exactly as programmed (Clough 2002).

Autonomy: The ability for a machine to perform a task or function on its own. Paul Scharre breaks autonomy down into three distinct concepts: the type of task the machine is performing; the relationship of the human to the machine when performing that task; and the sophistication of the machine's decision-making when performing the task (Scharre 2018, 27).

Customary International Law (CIL): Results from consistent state practice done out of a sense of legal obligation. There are no specific rules on how long a custom must exist before it becomes CIL. CIL is considered part of U.S. law, however, there exists no definitive list of those human rights the U.S. believes to be CIL. Under one widely held view, CIL and treaty law are equal in stature, with the later in time controlling (JAG 2018, 55).

Human-in-the-loop: See definition for semi-autonomous system.

Human-on-the-loop: A lethal autonomous weapon system (LAWS) that is designed to provide human operators with the ability to intervene and terminate engagements, including in the event of a weapon system failure, before unacceptable levels of damage occur (Dep SecDef 2017).

Human-out-of-the-loop: A LAWS where a human is not supervising targeting or engagement (Press 2016).

Jus in bello: One of the pillars of Just War Theory related to the conduct of war. Army doctrine comports that four principles must be satisfied for acts to be moral: military necessity, distinction, proportionality, and unnecessary suffering.

Just War: Principles governing the moral resort to war (*jus ad bellum*), the conduct of war (*jus in bello*), and termination of war (*jus post bellum*).

Law of Armed Conflict (LOAC): That part of international law that regulates the resort to armed force; the conduct of hostilities and the protection of war victims in both international and non-international armed; belligerent occupation; and the relationships between belligerent, neutral, and non-belligerent States. Additionally, it comprises treaties and customary international law applicable to the United States.

Lethal Autonomous Weapon Systems (LAWS): A weapon system that, once activated, can select and engage targets without further intervention by a human operator (Department of Defense 2017). A LAWS can be employed with, or without human supervision. The former is recognized as human-on-the-loop, while the latter is identified as human-out-of-the-loop. An important distinction to make about autonomy is that it does not necessarily imply intelligence, but rather its relationship to the human (Scharre 2015). For this paper, an autonomous weapon system is synonymous with LAWS.

Principle of Distinction: Requires that belligerents distinguish combatants from civilians and military objectives from civilian objects. Parties to a conflict must direct their operations only against combatants and military objectives (JAG 2018, 15).

Principle of Military Necessity: This principle "justifies those measures not forbidden by international law which are indispensable for securing the complete submission of an enemy as soon as possible." The principle mandates that a belligerent not "destroy or seize the enemy's property, unless such destruction or seizure be imperatively demanded by the necessities of war." The principle of military necessity does not authorize acts otherwise prohibited by the LOAC, and it is not a criminal defense for acts expressly prohibited by law (JAG 2018, 14).

Principle of Proportionality: The principle of proportionality requires commanders to refrain from attacks in which the expected harm incidental to such attacks would be excessive in relation to the concrete and direct military advantage anticipated to be gained. It requires commanders to take feasible precautions in planning and conducting attacks to reduce the risk of harm to civilians and other persons and objects protected from being made the object of attack (JAG 2018, 16).

Principle of Unnecessary Suffering: Requires military forces to avoid inflicting gratuitous violence on the enemy. The principle originally arose from humanitarian concerns over the sufferings of wounded soldiers and was codified as a weapons limitation that has three underlying requirements for the legality of weapons and ammunition and the methods in which they are employed. A weapon cannot be declared unlawful merely because it may cause severe suffering or injury. The appropriate determination is whether a weapon's or munition's employment for its normal or expected use would be prohibited under some or all circumstances (JAG 2018, 17).

Sensor Fusion: The ability to combine data from multiple sensors to achieve improved performance for different inference tasks over what could be accomplished by the use of a single sensor (Maracchion, et al. 2018).

Semi-Autonomous Weapons Systems: A weapon system that, once activated, is intended only to engage individual targets or specific target groups that have been selected by a human operator (Dep SecDef 2017). Also referred to as human-in-the-loop.

<center>Limitations and Delimitations</center>

The range of topics related to artificial intelligence and LAWS is broad and constantly changing, as such this thesis focuses on the legal and ethical use of LAWS.

<center>15</center>

Ethical discussion on LAWS will concentrate primarily on *jus in bello* considerations with cursory dialog relating to *jus ad bellum* and *jus post bellum*. Secondly, this thesis considers the ethical conduct of war from a western perspective where international law and the law of armed conflict are universally applied regardless of a nation's recognition of such laws. Thirdly, due to the sensitive nature and classification level of new and developing military weapon systems, this report is unclassified and supported solely by open-source information. Finally, the author was constrained to the U.S. Army Command and General Staff academic year to research, analyze, and publish this thesis.

Chapter Conclusion

If nations choose to pursue development and employ LAWS in combat, then political and military leaders must be able to justify its use under the precepts of international law. This opening chapter addressed the challenging legal and ethical questions that will be associated with the use of LAWS. The following section will discuss the evolution of Just War Theory, customary international law, and the *jus in bello* implications of LAWS as it pertains to the profession of arms and national policy.

CHAPTER 2

LITERATURE REVIEW

> You must remember that some things legally right are not morally right.
> —President Abraham Lincoln, quoted in
> John Smith's, *Inside Lawyers' Ethics*

Chapter Introduction

This chapter will present relevant information to answer the primary research question, "Is it ethical for the U.S. military to employ LAWS?" A significant portion of the literature review covers Just War Theory, customary international law (CIL), and the values expected to be demonstrated by those in the military profession. The chapter concludes by describing the history and current state affairs of AI as it relates to LAWS.

Just War Theory

Ethicists, scholars, and theologians have all contributed to codifying the principles governing war which is referred to as Just War Theory or *bellum justum*. Many argue that Just War Theory is comprised of three components, *jus ad bellum*, *jus in bello*, and *jus post bellum*. Chapter 1 addressed the recourse to war, j*us ad bellum,* and the conduct of war, *jus in bello.* J*us post bellum*, or justice after war, is used to explain a nation's "ethical exit strategy…" and "ease the transition from war back to peace" (Orend 2005). These three pillars support Just War Theory by providing "moral and legal discourse" throughout the spectrum conflict.

Just War Theory can trace its beginnings to as far back as 690 B.C. when the Babylonian leader, Sennacherib, "distinguished those responsible for initiating the war

from those soldiers who fought it" (Christopher 2004, 9). Moral truths concerning the just conduct of warfare have guided leaders for millennia and were in use well before the time of Christ. Chinese, Egyptians, and Romans all prescribed to a set of just war principles. Paul Christopher writes in his book, *The Ethics of War and Peace*, that the ancient Roman politician, Cicero, penned the world's first guidelines for *jus ad bellum*. Conditions required for the just conduct of war by Rome during the time of Cicero were: "war must be waged for revenge or defense, war must be proclaimed and declared by proper authority, and the antagonist must be notified and afforded the opportunity for peace" (Christopher 2004, 12). The Roman motivation for establishing a legal and ethical framework for the initiation of hostilities was to "objectively assess justice." Moreover, Roman law constrained the act of war to members of the military profession and further recognized that "that there is a limit to retribution and punishment" (Christopher 2004, 14).

The first writer to explain Just War from a Christian viewpoint was St. Ambrose. As both a governor and bishop, St. Ambrose viewed the Roman Empire as the "warder of peace." While Ambrose's writings do not explicitly discuss conflict regarding *jus ad bellum* or *jus in bello*, his viewpoints on these matters can be inferred.

Influenced by the earlier writings of Cicero, Ambrose established four cardinal virtues that Christians owe to their community: prudence, justice, fortitude, and temperance. His views on *justum bellum* can be seen by his discussion of the principal virtue of justice as he states "To know a fit opportunity, and to make return according to what is right, belongs to justice." Furthermore, his writing provides insight into the principles of *jus in bello* as he implies that "soldiers have a duty to the innocent" and that

"soldiers are to be respected based on their conduct as soldiers." Lastly, he states "it is a noble thing for a man to refuse to gain the victory by foul acts" (Christopher 2004, 23-25).

St. Augustine builds upon St. Ambrose's works, by fusing the classical works of Plato and Cicero with the Christian religion. His interpretations and edicts prioritize the need for social order over individual rights as evidenced by his statement regarding the moral dissonance that judges endure:

> For human society, which he thinks it a wickedness to abandon, constrains him and compels him to this duty . . . These numerous and important evils he does not consider sins; for the wise judge does these things, not with any intention of doing harm, but because human society claims him as a judge. (Christopher 2004, 40)

It may appear as if St. Augustine is taking a utilitarian perspective of societal actions by subordinating one's intentions to their efforts (i.e., the ends are justified by the means), but this is not the intent of his composition. Instead, he is addressing the dilemma between intentions and known outcomes where the "need for social order is so great that its requirements often override individual rights" (Christopher 2004, 40).

Like Cicero, Augustine establishes that the responsibility for *jus ad bellum* is a political body, "the monarch should have the power of undertaking war if he thinks it advisable, and that the soldiers should perform their military duties on behalf of the peace and safety of the community." Despite Augustine's Christian predisposition to the principles of just war and belief that wars were fought at the "behest of God," his underlying arguments can be viewed in a secular nature as he attributes the security, justice, and peace of a society to its government (Christopher 2004, 37-42).

St. Thomas Aquinas continued and organized the Just War writings of St. Augustine and other contemporary church writers. Aquinas addresses war in his *Summa Theologica* by establishing conditions for its just conduct, specifically he "stipulates that for a war to be just it must be declared by the authority of a head of a state (proper authority), for a proportionally good reason (just cause), and with a morally good aim (right intention)" (Christopher 2004, 52).

Aquinas also discusses the *jus in bello* moral principle of proportionality by specifying that the level of force used must be commensurate with the threat encountered. His thoughts regarding this principle can be seen from his argument that society has the right to rebel against unjust governments, "consequently there is no sedition in disturbing a government of this kind, unless the tyrant's rule be disturbed so inordinately, that his subjects suffer greater harm from the consequent disturbance than from the tyrant's government" (Christopher 2004, 52).

Another essential doctrinal contribution by Aquinas is his doctrine of double effect. The doctrine of double effect was established by Aquinas as a response to Sts. Augustine and Ambrose stance on matters related to self-defense. Unlike Ambrose and Augustine, Aquinas believed that the death of an attacker is permissible so long as the individual acting in self-defense does not will or intend the attacker's death. It is important to note that Aquinas did not mean for the doctrine of double effect to extend to acts of war, it was developed solely to justify the right to self-defense as described in his own words:

> Nothing hinders one act from having two effects, only one of which is intended, while the other is beside the intention. Now moral acts take their species according to what is intended, and not according to what is beside the intention,

since this is accidental . . . Accordingly, the act of self-defense may have two effects, one is the saving of one's life, the other is the slaying of the aggressor. Therefore, this act, since one's intention is to save one's own life, is not unlawful, seeing that it is natural to everything to keep itself in "being," as far as possible. And yet, though proceeding from a good intention, an act may be rendered unlawful, if it be out of proportion to the end. (Christopher 2004, 52-53)

One of the first individuals to apply Aquinas's doctrine of double effect was Francisco De Vitoria. Vitoria was a Spanish theologian who lived from 1483 until 1546. He extensively studied the works of Aquinas and is most well-known for his writings regarding the treatment of Native Americans by the Spanish Conquistadors. Analyzing the Spanish conquests of the Americas, Vitoria resolved that Spain had no right to wage war against the natives. Even if Spain was attacked by the Native Americans, Spain should have defended herself "so far as possible with the least damage to the natives, the war being a purely defensive one" (Christopher 2004, 54). His writings on this topic further established the moral concepts of *jus ad bellum* and *jus in bello* as they relate to international law. Vitoria provides clarification to the moral principles of *jus in bello* by adding that the "deliberate slaughter of innocents is never lawful in itself" (Christopher 2004, 55). However, he understood the reality of combat and that civilians and other noncombatants would become victims. With this thought in mind, Vitoria applied Aquinas's doctrine of double effect to war by stating:

> Sometimes it is right, in virtue of collateral circumstances, to slay the innocent, even knowingly, as when a fortress or city is stormed in a just war, although it is known that there are a number of innocent people in it and although cannons and other engines of war cannot be discharged . . . without destroying innocent together with the guilty. The proof is that war could not otherwise be waged against even the guilty and the justice of belligerents would be balked. (Christopher 2004, 56)

Michael Walzer takes Vitoria's explanation and defines it as "a way of reconciling the absolute prohibition against attacking noncombatants with the legitimate

conduct of military activity" (Walzer 1992, 153). Walzer further distills the doctrine by providing four conditions which describe the effect as listed below:

1. The act is good in itself or at least indifferent, which means, for our purposes, that it is a legitimate act of war.

2. The direct effect is morally acceptable – the destruction of military supplies, for example, or the killing of enemy soldiers.

3. The intention of the actor is good, that is, he aims narrowly at the acceptable effect; the evil effect is not one of his ends, nor is it a means to his ends, and, aware of the evil involved, he seeks to minimize it, accepting costs to himself.

4. The good effect is sufficiently good to compensate for allowing the evil effect; it must be justifiable under Sidgwick's proportionality rule (Walzer 1992, 153-154).

The discussion and evolution of the doctrine of double effect over the seven hundred plus years from St. Aquinas to Walzer reinforce that soldiers show "some sign of positive commitment to save civilian lives." The degree to which soldiers knowingly or unknowingly risk themselves to meet the conditions of double effect as enumerated earlier depends on the environment they are operating in.

The final contributor to the traditional Just War theory is Hugo Grotius. Less than 100 years separated the lives of Francisco De Vitoria and Hugo Grotius. Vitoria deplored the actions of the Spanish while Grotius deplored the effects of the Thirty Years' War. Because the Thirty Years' War was "not constrained by any rules whatsoever," Grotius wrote *The Law of War and Peace* (Christopher 2004, 67). The objective of this document was to "supplant the impotent and corrupt ecclesiastical authority… with a corpus of

international laws." Grotius believed in a completely secular approach to Just War and that natural laws are binding for all of mankind. Natural law, according to Grotius, refers to the interpersonal relationships present within society. Since natural laws are composed of rational human behavioral patterns, they, in turn, can be classified as moral truths. Viewed in this light, moral truths either obligate, prohibit, or by forfeit, permit. The significance of this belief is that the "responsibility for compliance, as well as the culpability for infractions, always rests with individuals" (Christopher 2004, 66-76). Using natural law as a framework for international law, Grotius established the "law of peoples" to set the standard of practices for nations. These standards, known by reason alone, are called customary international law (Cook 2004, 25).

From the historical perspective, Just War is the aggregation of over two thousand years of writings from ancient philosophers, rulers, and theologians. Despite the variances of views, the overarching theme and inherent desire of these brilliant scholars was to establish that the "concern for justice in war is a human, rather than simply Christian characteristic" (Christopher 2004).

Customary International Law and the Law of Armed Conflict

The middle of the nineteenth century was a watershed event for the global recognition of *bellum justum*. President Abraham Lincoln was one of the first political leaders, second only to the Ancient Romans, to establish a code of laws for the conduct of wars. The system of laws he developed was referred to as Lieber's Code (Christopher 2004, 104). No less than six years later, representatives from across the world gathered in St. Petersburg, Russia to discuss and declare that the use of explosive bullets as inhumane. This agreement was revolutionary as it was the first international treaty to

acknowledge and codify the principle of unnecessary suffering; it no longer would be grouped within CIL. Future peace conferences held at The Hague in 1899 and 1907 incorporated President Lincoln's code of conduct in addition to the decree prohibiting explosive bullets.

Since the late nineteenth century, the sources for the laws that mold CIL has expanded significantly (Figure 2). Nations continue to morally shape the character of war through global recognition of conventions and treaties. The United Nations and Geneva conventions, in particular, have profoundly shaped the battlefield in this regard. The Geneva Conventions of 1949 contributed over five hundred articles alone. Other sources that influence CIL are judgments passed by national and international courts such as the Nuremberg Tribunal, and the Rwanda Tribunal (Hartle 2004, 108-109). Collectively, the United States groups the judgments of the courts, international conventions, and signed treaties into the law of armed conflict (LOAC). The DOD's Operational Law Handbook states explicitly that the LOAC "comprises treaties and customary international law applicable to the United States" (JAG 2018, 14). This definition is sometimes referred to as the law of war (LOW) or international humanitarian law (IHL) (JAG 2018). This paper will use the term LOAC to refer to the LOW and IHL.

Department of Defense policy is to comply with the LOAC "during all armed conflicts, however such conflicts are characterized, and in all other military operations." Every Soldier, Sailor, Airman, Marine, and all others accompanying U.S. force must comply with the LOAC, particularly its basic principles and its requirements for humane treatment of detainees (JAG 2018, 14). The basic tenets of the LOAC are outlined according to humanitarian and functional purposes stated below.

1. The humanitarian purposes include (JAG 2018, 14):

    a) Protecting both combatants and noncombatants from unnecessary suffering;

    b) Safeguarding persons who fall into the hands of the enemy; and

    c) Facilitating the restoration of peace.

2. The functional purposes include (JAG 2018, 14):

    a) Ensuring good order and discipline;

    b) Fighting in a disciplined manner consistent with national values; and

    c) Maintaining domestic and international public support.

Figure 2.   Sources of the Law of Armed Conflict

Source: Created by the author with data from JAG 2018.

The Military Profession and Autonomous Systems

The citizens of the United States place great trust in the men and women of the U.S. armed forces. They entrust that military officers will serve the government and defend the values, security, and prosperity of the nation. This selfless, moral motivation to protect the nation and commit "to a particular body of knowledge and skill both for its own sake and for the use to which it is put" infers legitimacy and acceptance of the military as a profession by society (Cook 2004, 59-75). The inherent diversity of U.S.

society promotes a variety of moral and nonmoral values, however, according to Anthony Hartle, there are "verifiable and uncontroversial" fundamental values that American society ascribes to: Freedom, Equality, Individualism, and Democracy (Hartle 2004, 136-140). These values are the moral end of the military, and more importantly, the foundation of the Constitution (Hartle 2004, 155).

Military officers and their enlisted counterparts affix their promise to fellow citizens by taking an oath. The oath is unique in that the officer or enlisted soldier does not pledge allegiance to a person but rather to the Constitution of the United States. Much as the Constitution serves as the foundation of the United States, the oath of office is the foundational document of its military. Commenting on the military oath, Major General Clifford L. Stanley, USMC, said:

> "So help me God" symbolically cements the seal of personal commitment – a commitment so sincere that we are prepared to lay down our lives to support and defend our Constitution. The words of our oath leave no room for situational ethics… we're held to a very high standard of ethical conduct, and our actions, be they positive or negative, "always" reflect on our Nation and uniform we wear. (Bohlman 2005)

The values of the military professional are inseparable from the Constitution. Military professionals are expected to execute judgment that is above reproach, lest they betray the trust of the public and their peers. Dependence on AI and autonomous technology will most likely challenge the integrity of the military profession. Any forfeiture of human judgment or authority to the application of military force should be carefully scrutinized by society and screened against the guiding values of the Constitution.

Legality of Weapons and Arms Control

The approval for the development and fielding of new weapon systems for the U.S. military is a deliberate and rigorous process. It is DOD policy that all weapons undergo a legal review to ensure that the acquisition or procurement of the system is consistent with the LOAC (LOW 2016, 337). Also, DOD attorneys review domestic laws, treaties, international agreements, service-specific directives, and customary international law to verify compliance. Three mandatory questions asked to determine whether a weapon system should be prohibited are:

1. Whether the weapon's intended use is calculated to cause superfluous injury;

2. Whether the weapon is inherently indiscriminate; and

3. Whether the weapon falls within a class of weapons that have been expressly prohibited (LOW 2016, 338).

In addition to the general prohibitions listed above, some types of weapons are specifically prohibited or restrained (Figure 3) in their use as dictated by treaty or CIL. Furthermore, Article 36 of Additional Protocol I of the Geneva Convention requires a legal review of a new weapon, means, or method of warfare.

GENERAL PROHIBITED WEAPONS
- Weapons calculated to cause superfluous injury
- Inherently indiscriminate weapons

SPECIFICALLY PROHIBITED WEAPONS
- Poison, Poisoned Weapons, Poisonous Gases
- Biological Weapons
- Certain Environmental Modification Techniques
- Weapons that injure and non-detectable by X-rays
- Certain types of mines, and booby traps
- Blinding Lasers

WEAPONS WITH SPECIFIC RULES ON USE
- Mines, booby-traps (except those classes prohibited)
- Cluster Munitions
- Laser Weapons (except blinding lasers)
- Incendiary Weapons
- Riot Control Agents
- Herbicides
- Nuclear Weapons
- Explosive Ordnance

EXAMPLES OF LAWFUL WEAPONS
- Edged or pointed weapons
- Small arms, cannons, shotguns, and suppressors
- Large caliber guns
- Blast weapons
- Fragmentation weapons
- Depleted Uranium munitions
- Remotely Piloted Aircraft *
- Autonomy in Weapons Systems **
- Non-Lethal Weapons

* There is no prohibition in the law of war on the use of RPA.

** The law of war does not prohibit the use of autonomy in weapon systems. DoD has developed policy on the use of autonomy in weapon systems.

Figure 3.   Summary of Prohibited and Lawful Weapons

Source: Created by the author with data from the Office of the General Counsel Department of Defense. *The Department of Defense Law of War Manual.* Washington, DC: Department of Defense, 2016.

The development of new weapons often causes public denunciation of their allegedly cruel effects and results in attempts to prohibit their use in combat (LOW 2016, 338). Past examples of this include the crossbow, siege engines for hurling projectiles, bayonets, and gunpowder (LOW 2016, 338). The earliest known documented weapon ban is found in the Laws of Manu which prohibited the use of poisoned or barbed arrows (Scharre 2016, 333). The motivation behind the ban for these types of weapons, as well as many others, is that it violates the principle of unnecessary suffering which forbids injury or destruction that is unnecessary to accomplish a legitimate military purpose (LOW 2016, 58).

Currently, there is a movement by international organizations and special interest groups advocating for the prohibition of LAWS. The International Committee of the Red Cross (ICRC) has voiced concerns over the "type and degree of human control required in the use of weapon systems to carry out attacks – at a minimum, for compliance with IHL and, also, to satisfy ethical considerations" (Davison 2018). From the ICRC perspective, core legal obligations of a military commander during attacks (*jus in bello*) are that "legal obligations, and accountability for them, cannot be transferred to a machine, computer program or weapon system" (Davison 2018).

Other nongovernmental, special interest organizations who believe that LAWS should be banned are the Campaign to Stop Killer Robots and the Future of Life Institute. These organizations, in particular, are worried about the unintended consequences of LAWS. They believe that LAWS will initiate a new, destabilizing global arms race (Future of Life Institute 2018). Additionally, the Campaign to Stop Killer Robots believes that LAWS could potentially lower the threshold for war and "shift the burden of conflict even further on to civilians" (Campaign to Stop Killer Robots 2018).

There are many ways weapons can be controlled. States can self-impose or regulate the development or employment of arms through policy or domestic laws. Regulation can also come in the form of international laws or treaties driven by societal concerns (principle of unnecessary suffering), political concerns (control), or military concerns (strategic stability) (Scharre 2018, 333-339). It is to be determined if LAWS will be regulated.

<u>Implications to National Security</u>

The National Security Strategy (NSS) is a document developed by the office of the President of the United States for addressing the national security concerns and his vision for resolving them. More specifically, it describes how the instruments of national power will be used to achieve objectives that contribute to national security (DOD 2017).

In December 2017, President Donald Trump published the 2017 NSS and identified four pillars essential to the protection of "vital national interests in the competitive world." The four pillars of his NSS vision are:

1. Protect the American People, the Homeland, and the American Way of Life

2. Promote American Prosperity

3. Preserve Peace Through Strength

4. Advance American Influence

What is unique about the 2017 NSS is that it explicitly references autonomous technologies and artificial intelligence. In regards to Promoting American Prosperity, President Trump writes that the U.S. will "prioritize emerging technologies critical to economic growth and security, such as … artificial intelligence. From self-driving cars to autonomous weapons, the field of artificial intelligence, in particular, is progressing rapidly." He continues the discussion by identifying the importance of AI as it relates to national security in his pillar of Preserve Peace Through Strength by stating that "Risks to U.S. national security will grow as competitors integrate information derived from personal and commercial sources with intelligence collection and data analytic capabilities based on AI and machine learning" (POTUS 2017).

The Secretary of Defense, James Mattis, refines the strategic guidance outlined in the 2017 NSS by stating in his unclassified summary of the 2018 National Defense Strategy (NDS): "The security environment is also affected by rapid technological advancements and the changing character of war . . . New technologies include . . . artificial intelligence, autonomy, robotics… the very technologies that ensure we will be able to fight and win the wars of the future" (SecDef 2018). Furthermore, Secretary Mattis clearly states the importance that autonomous technologies will have in future wars by directing that the DOD will "invest broadly in military application of autonomy, artificial intelligence, and machine learning" (SecDef 2018).

The strategic objectives in the NSS and NDS appear to signal the inevitable use of LAWS. Recognizing the risk associated with AI and autonomous technologies, the DOD established policy for the development and use of autonomous and semi-autonomous weapon systems in DOD Directive 3000.09. This directive does not prohibit the use of semi-autonomous or autonomous weapons; instead, it ensures rational and deliberate processes are established to justify their use. DOD policy regarding the employment of autonomous and semi-autonomous weapons is based upon five rules outlined below.

It is DOD policy that:

1. Autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force (Dep SecDef 2017).

2. Persons who authorize the use of, direct the use of, or operate autonomous and semi-autonomous weapon systems must do so with appropriate care and in accordance with the laws of war, applicable

treaties, weapons systems safety, rules, and applicable rules of engagement (ROE) (Dep SecDef 2017).

3. Autonomous and semi-autonomous weapon systems intended to be used in a manner that falls within the policies:

   a. Semi-autonomous weapons systems may be used to apply lethal or non-lethal, kinetic or non-kinetic force

   b. Human-supervised autonomous weapon systems may be used to select and engage targets, with the exception of selecting humans as targets, for local defense to intercept attempted time-critical or saturation attacks for:

      1) Static defense of manned installations.

      2) Onboard defense of manned platforms.

   c. Autonomous weapon systems may be used to apply non-lethal, non-kinetic force, such as some forms of electronic attack, against materiel targets in accordance with DOD Directive 3000.03E.

4. Autonomous or semi-autonomous weapon systems intended to be used in a manner that falls outside the policies (listed above) must be approved by the Under Secretary of Defense for Policy; the Under Secretary of Defense for Acquisition, Technology, and Logistics; and the CJCS.

5. International sales or transfers of autonomous and semi-autonomous weapon systems will be approved in accordance with existing

technology security and foreign disclosure requirements and processes, in accordance with DOD Directive 5111.21 (Dep SecDef 2017).

Interpreting DOD Directive 3000.09, it is apparent that the U.S. military is not willing to use autonomous weapon systems to select and engage human targets without human supervision. Autonomous weapon systems that are employed by the U.S. military will be used in a defensive nature with human-on-the-loop supervision. Like the U.S., other nations recognize the importance of the human-machine relationship with any future LAWS. Russia, for instance, stated at a recent United Nations conference that the "loss of meaningful human control" was "inadmissible" (Tucker 2018). Similarly, China does not appear to have a fully automated approach to warfare. According to Elsa Kania, "PLA thinkers have, in fact, highlighted the importance of human-machine collaboration and manned-unmanned teaming." Additionally, the PLA expects AI to reshape the character of war from "informatized" to "intelligentized" warfare (Tucker 2018, 14).

It would be naïve to think that nations hold the same perspective on the use of LAWS as the U.S. The U.S. government has explicitly stated that it intends to use LAWS in a self-defense manner while China and Russia ambiguously state the importance of a human in the process. If an international treaty banning or restricting the use of LAWS is to be established and ratified by all countries, then a shared ethical understanding is required. This will be challenging considering how nations view the application of military force with respect to *jus ad bellum* and *jus in bello*. The Israeli Defense Force (IDF), for example, has a professional military ethic called *The Spirit of the IDF* which states that "the obligations to fulfill the mission and be victorious in war will be the compass guiding any effort to balance the system of values and basic principles of *The*

Spirit of the IDF" (Hartle 2004, 176). How are nations to reconcile these differences when the values of one nation are incongruent with another? More importantly, how can nations trust the actions of a non-biological system when they do not trust their fellow man?

Brief History of Autonomous Machines

Artificial intelligence, at its core, is a non-biological system that has "a capacity to learn" (Bostrom 2017, 27). Nick Bostrom, a professor of philosophy at Oxford, wrote the book, *Superintelligence*, to explain the possible paths, dangers, and strategies related to AI. In defining AI, he adds that it has "some faculty for extracting useful concepts from sensory data and internal states" (Bostrom 2017, 27). Essentially, a non-biological system can intellectually mature much like a human albeit at a much faster pace. Presently, machines and humans process information at comparable speeds, however, machines can store and recall significantly more information than humans. For reference, Max Tegmark states that "synapses store all your knowledge and skills as roughly 100 terabytes' worth of information, while your DNA stores merely about a gigabyte" (Tegmark 2017, 28). While machines have substantial capability to store and recall information, they have limited cognitive and reasoning skills. Currently fielded AI technology can only achieve very specific goals, researchers and developers define this as narrow intelligence.

Narrow AI systems are used exclusively in the entertainment and shopping industries. Amazon and Netflix utilize a suite of narrow AI software called affinity analysis. Affinity analysis is a data analysis and data mining technique that discovers

relationships among activities. Commercial business' use it to analyze a customer's search and purchase history to recommend new products (Barrat 2015, 73).

The DOD uses a similar AI program, called Project Maven, to analyze the video streams from UAVs. Project Maven is a pioneering military AI technology as it uses biologically inspired neural networks to extract objects of interests autonomously from video or still imagery. It is currently used in the fight against the Islamic State of Iraq and Syria to identify specific objects from video, and other data feeds. While Project Maven is an autonomous technology, it is designed for "people and computers to work symbiotically." The overall goal of this system is to allow an analyst to accomplish twice as much work, if not more, using algorithmic and machine deep learning processes (Pellerin 2017).

If non-lethal militarized applications of AI, like Project Maven, prove useful in achieving military objectives, then it seems logical that lethal AI applications (i.e. LAWS) will have similar advantages. Some researchers have argued that LAWS "may reduce the risks to civilians by making targeting more precise and firing decisions more controlled, especially compared to human soldier failings that are so often exacerbated by panic, vengeance… as well as the limits of human senses and cognition" (Anderson, Reisner and Waxman 2014, 393). Moreover, they believe that increased levels of automation coupled with advanced autonomy could reduce target misidentification, calculate collateral damage estimates, and allow for the minimum use of force as compared to human decision making (Anderson, Reisner and Waxman 2014, 394). Still, researchers admit that it is impossible to predict exactly how a LAWS will behave. The current inability to audit or understand how AI systems make decisions raises two

primary concerns. The first is that as "people who need to use the data won't trust it when it's working correctly, and the second is that the opacity allows an adversary to mingle with the processing on the inside and produce a potentially dangerous result" (Atherton 2018).

Apprehension continuously surrounds the development and use of AI technology, especially with regards to military applications. Some researchers fear that autonomous technologies will eventually achieve a state of artificial general intelligence, a singularity moment, where AI systems possess the ability to accomplish any cognitive task at least as well as humans (Tegmark 2017, 39). Their fear is not necessarily based on the potentiality of an evil autonomous robot with "red eyes," rather people should fear autonomous systems "whose goals are misaligned with ours." Tegmark encapsulates this anxiety stating "Intelligence enables control: humans control tigers not because we're stronger, but because we're smarter. This means that if we cede our position as smartest on our planet, it's possible that we might also cede control" (Tegmark 2017, 44). The possibility of misaligned goals poses a serious concern for the use of LAWS in combat. If militaries develop LAWS, they must ensure that their autonomous systems can find, fix, track, target, and engage legal military targets while avoiding unintended engagements such as fratricide and civilian causalities.

Even though Project Maven is a non-lethal application of AI technology, its use has raised concern. Much like nuclear technology, AI technology is dual-use. With regards to nuclear weapons, many international treaties have been established in an attempt to control the use, development, and manufacture of atomic weapons. For LAWS, no treaties have been developed despite the efforts of the ICRC and other special

interest groups. This is especially worrisome as the pace and tempo of new technologies has exhausted man's capability to understand and manage it (Tegmark 2017, 317).

Semi-autonomous systems have been used by militaries around the world for decades. Some analysts believe that the U.S. Patriot, Phalanx, and Israeli Iron Dome weapon systems are examples of human-on-the-loop LAWS (Anderson, Reisner and Waxman 2014, 389). Their implementation has changed the face of warfare as previously described in the Second Offset. Despite extensive reliance and trust in their capabilities, non-biological, semi-autonomous system have proven to be fallible, often with catastrophic consequences. One example that highlights the destructive potential of such a system was the Soviet automated missile alert system. In September 1983, the Soviet early warning system reported the launch of five U.S. intercontinental ballistic missiles at the Soviet Union. At the time, Soviet doctrine required the officer on duty to report the attack to higher headquarters. However, the officer in charge, Lieutenant Colonel Stanislav Petrov, did not report the attack as he determined that a pre-emptive launch of five missiles was unlikely. Petrov was correct in his assessment, after investigating the incident the Soviet's discovered that the satellites registered "false positives" from the reflection of sunlight from clouds (Scharre 2016, 35).

Another example of an imperfect automated system is the shootdown of Iran Air Flight 655 by the USS Vincennes. On 3 July 1988, the guided missile cruiser's radar system warned the ship's Captain of an incoming aircraft. The Captain of the USS Vincennes, William Rodgers III, inferred his ship was being attacked by an Iranian F-14 and gave the approval to fire. Unfortunately, the radar warning system incorrectly reported the civilian airliner to be descending when it was ascending. Additionally, the

radar user interface had a poor design feature in that it did not uniquely display civilian aircraft from military aircraft. Both factors led Captain Rodgers III to believe he was being attacked by a hostile aircraft and henceforth authorized the use of fire (Tegmark 2017, 111).

Both examples highlight the importance of sound human thought and direction in stressful situations. The perception with automated systems, including LAWS, is that they will be the panacea for human fragility, however, these examples illustrate the fallacy of perfect technology. Militaries must have the ability to safely control autonomous weapons, prevent unintended engagements, and trust that they can accomplish the mission as well or better than their human counterparts.

<u>Chapter Conclusion</u>

The literature review was intended to be a broad, yet comprehensive investigation of the relevant topics which surround the debate of LAWS. These topic areas were selected to provide information and viewpoints that apply to the primary and secondary research questions. In general, this chapter covered the guiding principles and values of the U.S. military profession as well as a brief history of autonomous machines. The next chapter will discuss the research methodology used to evaluate the research questions posed by this thesis.

CHAPTER 3

RESEARCH METHODOLOGY

The utopia of surpassing the human being is full of inhumanity.
—Dominque Janicaud, *Robots on the Battlefield*

Chapter Introduction

This chapter establishes the evaluation criteria for answering the primary research question: Is it ethical for the U.S. military to employ LAWS? The methodology for evaluating the primary research question will be a stepwise approach using the concept of the Ethical Triangle as the mechanism for analysis. Specific details related to the Ethical Triangle and associated evaluation criteria will be discussed in the succeeding sections of this chapter. Chapters 4 and 5 will complete the analysis of the primary research question by providing the reader with a review of the results followed by recommendations and conclusions.

Research Methodology

The Ethical Triangle (Figure 4) is a model that one can use to view and understand ethical dilemmas. In particular, the model sees an ethical dilemma from three unique perspectives: Principle-based ethics, Consequence-based ethics, and Virtues based ethics (Kem 2016). Before applying the Ethical Triangle to a situation, an ethical dilemma must first be established. Ethical dilemmas essentially consist of competing virtues that one considers important but which cannot be simultaneously honored (Kem 2016). Ethical dilemmas define a problem in terms of "right versus right." The four most

commonly acceptable dilemmas are truth versus loyalty, individual versus community, short-term versus long term, and justice versus mercy.

THE ETHICAL TRIANGLE

Principles
"Act as if the maxim of your action was to become a universal law of nature."
What rules exist?
What is my moral obligation?

Consequences
"Do what produces the greatest good for the greatest number."
What gives the best "bang for the buck?"
Who wins and loses?

Virtues
Golden Rule: "Do to others what you would have them do to you."
What would Mom think? WWJD?
What if my actions show up on the front page?

Figure 4.   The "Ethical Triangle"

Source: Kem 2016.

After defining the ethical dilemma in terms of right versus right, the evaluator determines possible courses of actions (COA) which are responses to the difficulty in question. Once multiple COAs are declared, each COA is evaluated against the three perspectives intrinsic to the Ethical Triangle. This thesis will view each COA from a principles-based standpoint first, followed by the consequentialist viewpoint, and lastly virtues-based standpoint. The final step of the Ethical Triangle is to select the COA that best suits the "context of the organizational climate and culture, as well as the professional values of the organization" (Kem 2016).

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Evaluation Criteria

To begin, it is necessary to establish the ethical dilemma that surrounds the use of LAWS. Declaring the ethical dilemma is an essential first step as it defines the problem and appropriately sets the stage for the discussion of the ethical question presented. This thesis has established in Chapters 1 and 2 that human-on-the-loop LAWS are produced and operational in the U.S. military and other militaries across the globe. Furthermore, it appears that the commercial development of autonomous technologies will continue. The unrestricted growth of autonomous technologies coupled with the national strategic strategy of the U.S. leads one to assume that human-out-of-the-loop systems will begin to field as human-on-the-loop weapon systems become more ubiquitous in the future. With the environment shaped in this manner, the ethical dilemma can be stated as, "What level of human supervision should LAWS have?"

The second step of the Ethical Triangle Decision Making Model is to determine possible solutions or actions that an agent could take to respond to the dilemma at hand. In this situation, there are varying degrees of human supervision ranging from no human oversight, or human-out-of-the-loop, to complete human control or banning all forms of LAWS to include those presently in use. Thomas Sheridan, a former professor at MIT and Director of the Human-Machine Systems Laboratory, as well as the Air Force Research Lab (AFRL), have both developed models that help one visualize the spectrum of automation as it relates to decision making and human information processing (Clough 2002). Refer to Tables 1 and 2 for the AFRL and Sheridan Levels of Autonomy.

Table 1.   Sheridan's Levels of Autonomy

Sheridan's Levels of Autonomy	
Level	**Description**
1	The Computer Offers No Assistance, the Human Must Do It All
2	The Computer Offers a Complete Set of Action Alternatives
3	The Computer Narrows Down Alternatives to a Few
4	The Computer Suggests an Alternative
5	The Computer Executes that Suggestion if the Human Approves
6	The Computer Allows the Human a Restricted Time to Veto Before Automatic Execution
7	The Computer Executes Automatically, then Necessarily Informs the Human
8	The Computer Informs the Human after Execution Only if the Human Asks
9	The Computer Informs the Human after Execution if it Decides to Do So
10	The Computer Decides Everything and Acts Autonomously, Ignoring the Human Completely

Source: Created by the author with data from Sheridan and Parasuramam 2000, 286-297.

Table 2.   Air Force Research Lab Levels of Autonomy

AFRL's 11 Levels of Autonomy	
Level	**Level Description**
0	Remotely Piloted Vehicle
1	Execute Pre-Planned Mission Remotely
2	Changeable Mission
3	Robust Response to Real Time Faults/Events
4	Fault/Event Adaptive Vehicle
5	Real Time Multi-Vehicle Coordination
6	Real Time Multi-Vehicle Cooperation
7	Battlespace Knowledge
8	Battlespace Single Cognizance
9	Battlespace Swarm Cognizance
10	Fully Autonomous

Source: Created by the author with data from Clough 2002.

The tables established by AFRL and Sheridan are vital as they help bridge the gaps between human-in-the-loop, human-on-the-loop, and human-out-of-the-loop systems. It is important to note that Sheridan's table describes the output functions of an automated system and not the inputs. The inputs, Sheridan reasons, may also be automated (Sheridan and Parasuramam 2000). The model Sheridan prescribes nicely aligns with Colonel John Boyd's human-decision making process, commonly referred to as the OODA Loop: Observe, Orient, Decide, Act (Boyd 2018). Figure 5 is a modified OODA Loop that shows where autonomous inputs and outputs may be designed in LAWS. The modified OODA Loop in Figure 5 was developed by the author, and its design was influenced by a technical report by Ronald Arkin, titled *Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture* (Arkin 2007).

The OODA Loop was established by Col Boyd to address tactical air-to-air engagements. However, the model has applicability to operational and strategic problem sets (Boyd 2018). The loop begins when a system or person begins to sense or *Observe* the environment they are participating in. The function of this first phase is to assess the environment, one's place in it, and the interaction of the two (Boyd 2018). This raw, unprocessed environmental data is then forwarded to the *Orientation* phase. In the orientation phase, information is synthesized and filtered to generate a set of responses. Following the orientation phase, is the *Decision* phase where a response is selected. A preferred response is determined according to a multitude of considerations such as "least harmful, quickest, most consequential, and so on" (Boyd 2018). The last stage of the OODA Loop is *Act*. In this stage, the selected response is implemented (Boyd 2018).

AFRL's autonomy levels along with Boyd's OODA Loop will be used to develop three distinguishable COAs (Figure 5).
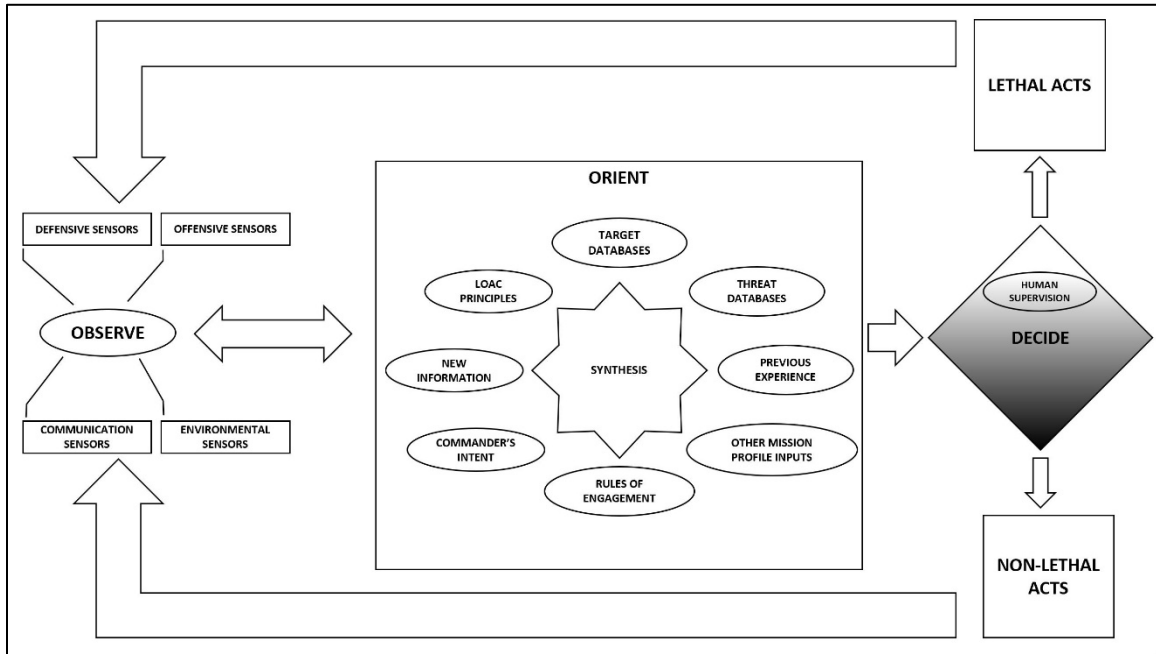
Figure 5.   LAWS Modified OODA Loop

Source: Created by the author with data from Boyd 2018.

Although a gross oversimplification of autonomous processes, the OODA Loop provides a useful framework for developing unique COAs for LAWS as it displays the varying levels of automation and autonomy. Considering Sheridan's table, AFRL's autonomy charts, the OODA Loop and the current disposition of autonomous technologies, three solutions appear to be most relevant and feasible in the coming years for LAWS. The three distinct COAs are conceptual and defined from a tactical perspective. See Tables 3, 4, 5, and 6 for graphical representations of these COAs.

1. COA 1 is the development of an offensive-oriented LAWS that embodies levels one, two, and three of AFRL's autonomy model. A weapon system characterized by this COA would have limited autonomy levels across all four areas of the OODA Loop. Human intervention and supervision are explicit in this COA as human operators will plan in great detail the mission profile and target(s) to be struck.

2. COA 2 is an advanced LAWS that encompasses levels one through six on the AFRL autonomy scale. The discriminator for this COA is that human approval is needed for the performance of any lethal action. A LAWS with the capabilities of this COA has significantly more autonomy with regards to its ability to *orient* itself within the battlespace.

3. COA 3 is a highly autonomous LAWS. This COA is not a human-out-of-the-loop LAWS but comes very close. Concerning AFRL's autonomy scale, a COA 3 system would exhibit levels one through nine. The distinguishable feature of this system is that human approval is not needed for lethal action. However, human supervision is present (human-on-the-loop) and has "veto" power or the ability to abort any maneuver or operation employed by the LAWS.

Tables 4, 5, and 6 describe the three COAs in greater detail as they pertain to Col Boyd's OODA Loop. In the orienting phase, sensor fusion is defined as the ability to combine data from multiple sensors to achieve improved performance for different inference tasks over what could be accomplished by the use of a single sensor (Maracchion, et al. 2018).

Table 3.   COA Levels of Autonomy

Level of Autonomy for LAWS

| Observe (Situational Awareness) | Orient (Analyze) | Decide (Decision Making) | Act (Human Intervention) |
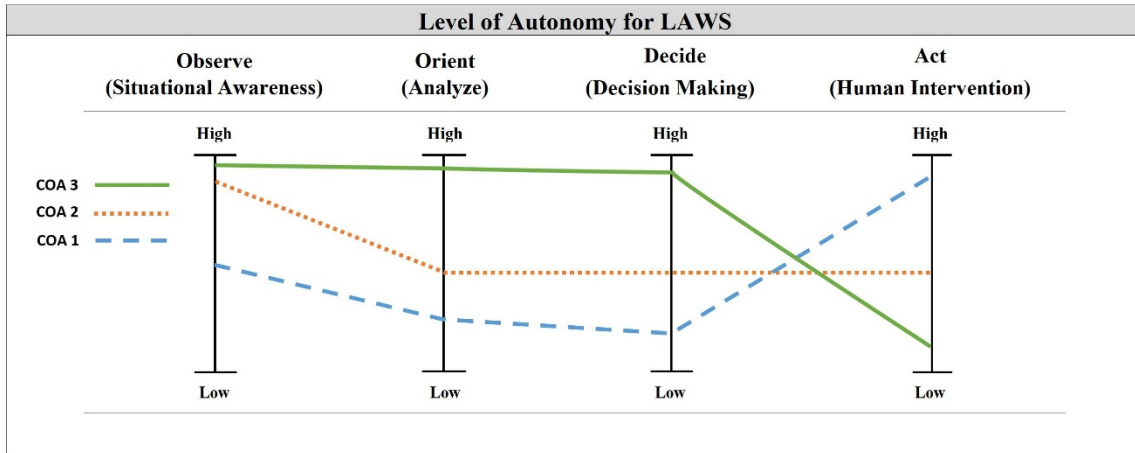
Source: Created by the author.

Table 4.   COA 1 OODA Loop Description

COA	OBSERVE	ORIENT	DECIDE	ACT
1.	**Sensor Suite: Limited** - Defensive sensors have the capability to view a limited area of the EM spectrum - Offensive sensors are programmed to explicitly find, fix, track, target, and engage those targets mission planned by human operators	**Sensor Fusion: Limited** - Sensors do not coordinate or cooperate with external systems - Sensor fidelity limited to pre-mission planned databases loaded on system **Freedom of Maneuver: Limited** - System constrained by mission planned waypoints and corridors - Limited non-lethal, self-defense reactions allowed (Electronic attack not allowed) - Cannot change target inflight unless mission planned	**Freedom of Decision: Limited** - Navigation to the target area restricted to mission planned azimuths and ranges - Computer will develop multiple routes to target area, but navigational freedom is limited - Human authorization for lethal action is explicitly planned	**Human Intervention: High** - Human operators plan mission profile and targets in extensive detail - No human intervention once mission begins due to detailed planning

Source: Created by the author.

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Table 5.   COA 2 OODA Loop Description

COA	OBSERVE	ORIENT	DECIDE	ACT
2.	**Sensor Suite: Moderate** - **Defensive sensors have the capability to view a wide area of the EM spectrum** - **Offensive sensors are programmed for explicit targets, however, if time, space, and mission orders allow, the system will search for additional targets. An example would be those on the Joint Integrated Prioritized Target List (JIPTL)**	**Sensor Fusion: Moderate** - **Sensors have limited ability to coordinate or cooperate with external systems** - **System has reach back to cloud database for threat and target identification** **Freedom of Maneuver: Moderate** - **Not constrained by mission planned waypoints or corridors** - **Non-lethal, self-defensive reactions allowed to ensure mission success** - **Can change target inflight if mission orders allow** - **Limited ability to coordinate or cooperate with other systems in the battlespace**	**Freedom of Decision: Moderate** - **System will determine most survivable decision based upon existing TTPs which allows mission success and pass recommendations to the human operator for approval**	**Human Intervention: Moderate** - **Human approval required for lethal strike**

Source: Created by the author.

Table 6.   COA 3 OODA Loop Description

COA	OBSERVE	ORIENT	DECIDE	ACT
3.	**Sensor Suite: Extensive** - **Offensive and defensive sensors same as COA 2** - **System and sensors have ability to adjust real-time according to environmental or battlespace conditions to optimize sensing data**	**Sensor Fusion: Extensive / Novel** - **Sensors have the ability to coordinate or cooperate with external systems to include reach back to cloud databases** - **Unidentified or new threats / targets can be assessed real-time for vulnerabilities** **Freedom of Maneuver: Extensive** - **Includes same characteristics as COA 2** - **Self-defense reactions and suppression allowed to ensure mission success. Includes novel or potentially untested TTPs that are both lethal, and non-lethal in nature** - **Ability to coordinate real-time with other manned and unmanned assets for mutual support and mission success (i.e. part of a strike package or task force)**	**Freedom of Decision: Extensive** - **System will determine most survivable decision which allows mission success** - **System is able to interpret commanders intent and suggest or execute novel TTPs**	**Human Intervention: Low** - **Human approval is not needed, however, humans have "veto" power throughout the mission**

Source: Created by the author.

After forming three distinguishable COAs, or responses to the ethical dilemma, the third step is to critically assess each response from three distinct ethical perspectives; principles, consequential, and virtue. Viewing the dilemma from a principles-based lens, "consideration must be made for the rules that exist or should exist" (Kem 2016). Essential questions to ask when considering the principle-based approach are "what rules exist" and "what are my moral obligations" (Kem 2016). More specifically, this study will look at international law and treaties ratified by the U.S. as well as the Just War principles of *jus in bello* when evaluating the COAs from a rules-based perspective.

Evaluation criteria for consequence-based approaches are utilitarian and primarily consider who wins and who loses. Another way of looking at this ethical approach is to ask "What produces the greatest good for the greatest number?" People who view situations from this point of view believe the "ends justify the means" and seek to identify the action(s) which produce "the biggest bang for the buck" (Kem 2016). The primary evaluation question from a consequential viewpoint as it relates to the COAs is which COA maximizes the good in the long-term and the short-term from a U.S. military perspective?

The final set of evaluation criteria to be considered is virtues-based ethics. Virtue-based ethics are perhaps the most difficult to characterize as the focus is not on "what one should do" but rather "what kind of person should one be?" (Kem 2016). Virtuous skills are learned over time and emphasize the goodness of the human soul. Important questions to ask when considering the virtues-based approach are "what would my mother think?" or "what if my actions showed up on the front page of the newspaper?" (Kem 2016). The three virtue-based questions for this thesis are: Which COA reflects the virtues as

described by St. Augustine or Aristotle; which COA reflects the spirit and intent of American foundational documents, and; which COA best embodies the military profession? Refer to Figure 6 and Table 7 for a summary of the ethical dilemma and associated questions.
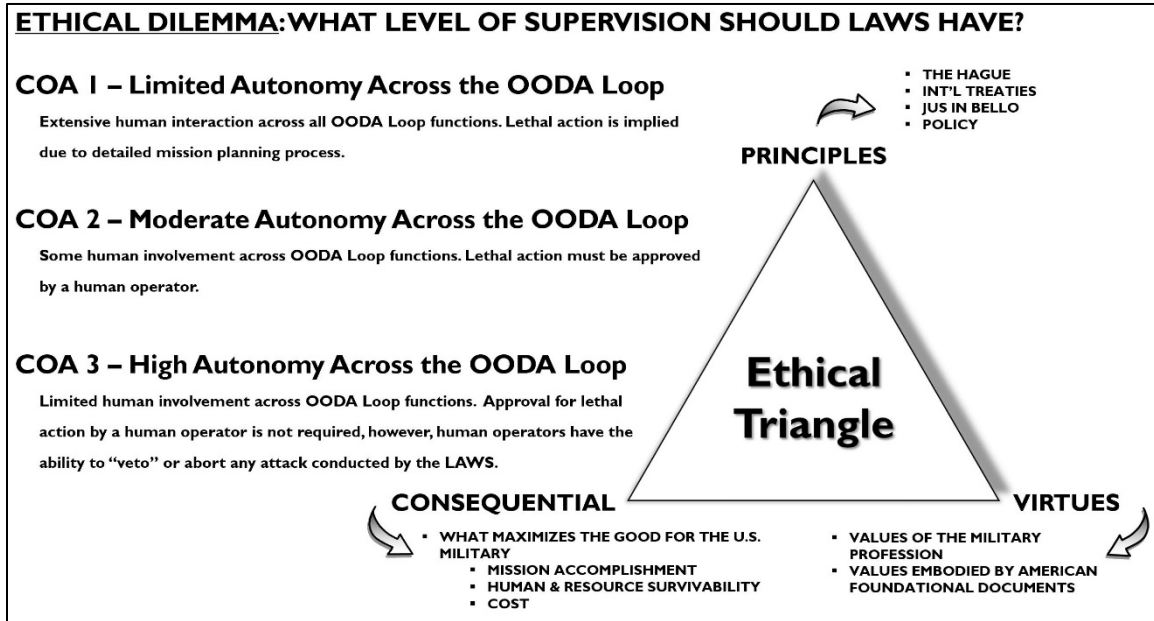
Figure 6.   LAWS Ethical Dilemma, COAs, and Evaluation Criteria

Source: Created by the author.

Table 7.   Summary of Ethical Questions

DEONTOLOGICAL QUESTIONS	COA 1	COA 2	COA 3
1. Does a COA violate any rules that currently exist?			
2. Does a COA violate any moral obligations?			
3. Does the COA violate rules that are not stated?			
CONSEQUENTIAL QUESTIONS	COA 1	COA 2	COA 3
1. Which COA maximizes the good from a U.S. military perspective?			
2. Which COA maximizes the good in the long-term from a U.S. military perspective?			
VIRTUE QUESTIONS	COA 1	COA 2	COA 3
1. Does the COA reflect the virtues as described by St. Augustine or Aristotle?			
2. Which COA reflects the spirit and intent of American foundational documents (Declaration of Independence and Constitution)?			
3. Which COA best emodies the military profession?			

Source: Created by the author.

<u>Threats to Validity</u>

According to G. David Garson, "a study is valid if its measures actually measure what they claim to, and if there are no logical errors in drawing conclusions for that data" (Garson 2016, 11). Using this definition, Garson identifies three areas where the question of validity arises. The first area is "at the level of the item or measure" where the researcher is concerned with the content. A second area is "at the level of the construct." Within this context, the researcher is concerned with "whether the indicator measures cohere well within the construct they are intended to measure and are not also indicators for other constructs in the model." The final area is the "at the level of the study." The final level of study ensures statistical procedures have been appropriately applied, research design is sound, and generalizations are appropriate (Garson 2016, 12).

In this study, AI and LAWS information content is relatively new. As such, ethical and moral perspectives vary with regards to how autonomous systems should be used in the commercial, government, and military sectors. Moreover, the ecological validity, or the study of subjects in their natural environments, is unknown for human-out-of-the-loop LAWS and limited to defensive operations for human-on-the-loop weapon systems. The information presented in this thesis attempts to record all relevant viewpoints of LAWS. However, government and military documentation related to this subject are limited due to the sensitive and classified nature of military programs.

This chapter and the following address Garson's second and third validity questions (the level of construct and the level of study) for this thesis. It is essential to understand that there are many methodologies, both qualitative and quantitative that could have been used to evaluate the primary research question. The author selected the Ethical Triangle Method as it is an effective and comprehensive assessment of a problem from differing ethical perspectives.

Lastly, it is important to remark on the author's own biases. The author's experiences as a USAF officer and pilot as well as Christian religious beliefs are worth noting. The professional and religious predispositions as previously listed could skew the validity of the study. In this situation, these threats to internal validity potentially would manifest as specification bias, the Hawthorne effect, and evaluation apprehension (Garson 2016, 27).

Chapter Conclusion

The Ethical Triangle is a decision support model that is well suited to answer the secondary questions of this thesis. By answering the secondary research questions from

the three ethical perspectives, this thesis provides insights into the future use of LAWS through the prism of normative ethics, ultimately shaping how the primary research question is answered. The following chapter examines the future use of LAWS and offers the reader a "snapshot" of the possible issues that societies, governments, and militaries will have to contend with when justifying the use of autonomous systems.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

Had I known that the Germans would not succeed in developing an atomic bomb, I would have done nothing for the bomb.
— Albert Einstein, *The New York Times*

Chapter Introduction

This chapter will answer the primary research question, "Is it ethical for the U.S. military to employ LAWS?" The chapter begins with a summary of steps one, and two of the Ethical Triangle decision-model described in the previous chapter. Following this review, steps three, four, and five of the methodology will assess each COAs response to the ethical dilemma surrounding the use of LAWS. A literature review will not be explicitly accomplished; instead it is incorporated in the analysis of the COAs in step three. Lastly, this chapter concludes with the combined evaluation results of all three COAs and the answer to the primary research question.

Step 1: Identify the Ethical Dilemma

The ubiquitous nature of autonomous systems in government and commercial industries suggests that human supervision and oversight of these systems will steadily decrease. Viewed in this light, the ethical dilemma surrounding the weaponization of autonomous systems becomes "What level of human supervision should LAWS have?"

Step 2: Determine Possible Courses of Action

Determining the left and right bounds of human intervention in LAWS will be debated for years to come. This thesis attempts to further the discussion of the ethical

boundaries of a LAWS by identifying three unique COAs with varying levels of human oversight. The three COAs are:

1. COA 1 is the development of an offensive-oriented LAWS that embodies levels one, two, and three of AFRL's autonomy model (Table 2). A weapon system characterized by this COA would have limited autonomy levels across all four areas of the OODA Loop. Human intervention is explicit in this COA as human operators will plan in great detail the mission profile and target(s) to be struck.

2. COA 2 is an advanced LAWS that encompasses levels one through six on the AFRL autonomy scale. The critical discriminator for this COA is that human approval is needed for the performance of any lethal action. A LAWS with the capabilities of this COA has significantly more autonomy with regards to its ability to *orient* itself within the battlespace.

3. COA 3 is a highly autonomous LAWS. This COA is not a human-out-of-the-loop LAWS, but comes very close. Regarding AFRL's autonomy scale, a COA 3 system would exhibit levels one through nine. The distinguishable feature of this system is that human approval is not needed for lethal action. However, human supervision is present (human-on-the-loop) and has "veto" power or the ability to abort any maneuver or operation employed by the LAWS.

Step 3: Examine Courses of Actions

The third step of the Ethical Triangle decision model is to evaluate the COAs through deontological, consequential, and virtuous perspectives. Deontological-based, or

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rule-based, views will be discussed first, followed by consequential-based viewpoints with virtues-based ethics addressed last. Virtues-based ethics intentionally closes out step three as virtue ethics serves as an integrating function by bridging deontological imperatives with consequential outcomes. Virtuous agents understand that there are variances to choices that are excessive which helps them uncover the "golden mean" or middle ground of the dilemma at hand (Kem 2016).

Deontological or Principles-Based Approach

Table 8.   COA 1 Deontological Evaluation Data

DEONTOLOGICAL QUESTIONS	COA 1	COA 2	COA 3
1. Does a COA violate any rules that currently exist?	NO	NO	NO
2. Does a COA violate any moral obligations?	NO	NO	NO
3. Does the COA violate rules that are not stated?	NO	NO	NO

Source: Created by the author.

From the deontic perspective, consequences do not matter. Immanuel Kant, a central figure in modern philosophy, best summarized this perspective by stating, "Act as if the maxim of your action was to become a universal law of nature" (Kem 2016). This is an important distinction as deontology guides agents to prioritize the *right* over the *good*. If an act is not *right*, then it may not take place, regardless of the *good* it could produce (Stanford Encyclopedia of Philosophy 2016a).

When examining the COAs through a rules-based lens, three primary questions surface to represent what is *right* for the use of LAWS: What rules exist, what are my

moral obligations, and does the COA violate rules that are not stated? Evaluation criteria for the first question are centered on current international law with the second focused on the Just War principles of *jus in bello*. The third question strives to bound the use of LAWS by codifying principles that are not formally recognized, but generally accepted.

When determining the legality of any weapon system, the U.S. government conducts internal and external policy reviews. These policy reviews ensure each new weapon system follows established "weapons laws" and "targeting laws." An analysis of weapons law certifies that new weaponry follows international law and domestic policies (i.e., DOD Directive 3000.09). In contrast, targeting law reviews validate the intent and use of a weapon. The principles of *jus in bello* are the guiding values in targeting law. These processes are rigid, deliberate, and lengthy; however, they are essential in legitimizing the development, acquisition, and fielding of any new U.S. military weapon system.

At present, with regards to weapons law, the law of war does not prohibit the use of autonomy in weapon systems (LOW 2016, 395). Although there are no specific laws or treaties restricting LAWS, there may be laws that apply to a particular weapon type which would prohibit or limit its use in an autonomous nature. For instance, the DOD Law of War Manual states that "to the extent, a weapon system with autonomous function falls within the definition of 'mine' in the CCW Amended Mines Protocol, it would be regulated as such" (LOW 2016, 353). Furthermore, rules applicable to all current weapons would apply to weapons with autonomous functions as well. An example of this would be that a LAWS cannot cause superfluous injury or be inherently

indiscriminate as outlined in Geneva Convention Protocols. Refer to Figure 5 in Chapter 2 for examples of weapons that are indiscriminate or cause unnecessary harm.

According to the DOD Law of War Manual, a LAWS as described by the three COAs in this thesis do not violate any internationally recognized laws. Moreover, from a U.S. military standpoint, these COAs adhere to DOD Directive 3000.09 as they "allow commanders and operators to exercise appropriate levels of human judgment over the use of force" (Dep SecDef 2017). Commanders and operators exercise their judgment over LAWS as described in COA 1 through explicit mission planning inputs and constraints. Human judgment is exercised in COAs 2, and 3 through deliberate approval of force, as well as the ability to "veto" or "abort" weapon employment.

With the three COAs successfully negotiating weapons law, this thesis looks at targeting law to determine if the COAs satisfy the four moral principles of *jus in bello*. The four principles of *jus in bello* to be considered are Military Necessity, Distinction, Proportionality, and Unnecessary Suffering.

The principle of military necessity "justifies those measures not forbidden by international law which are indispensable for securing the complete submission of an enemy as soon as possible." Secondly, the principle mandates that a belligerent not destroy the enemy's property, unless "such destruction be imperatively demanded by the necessities of war." Lastly, military necessity does not justify an act that is otherwise prohibited by international law or the LOAC (JAG 2018, 14). Actions that are not permitted include cruelty or wanton violence as explained in the principle of unnecessary suffering.

Unnecessary suffering requires that military forces avoid inflicting gratuitous violence on the enemy. The principle originally arose from humanitarian concerns over the sufferings of wounded soldiers and was codified as a weapons limitation that establishes the legality of a weapon, its ammunition and the methods in which they are employed. An important distinction with this principle is that a weapon cannot be declared unlawful merely because it may cause suffering or severe injuries. The appropriate determination for unnecessary suffering is whether the normal or expected employment of a weapon or its munition would be prohibited under some or all circumstances (JAG 2018, 17). The principle of unnecessary suffering is tightly woven into the principle of military necessity as together they coherently prescribe that a LAWS should use only the necessary amount of lethal force on a legitimate military target.

The principle of proportionality requires commanders to refrain from attacks in which the expected harm incidental to such attacks would be excessive in relation to the concrete and direct military advantage anticipated to be gained. It requires commanders to take feasible precautions in planning and conducting attacks to reduce the risk of harm to civilians and other persons and objects protected from being made the object of attack (JAG 2018, 16).

Implicitly nested within the principle of proportionality is the principle of distinction. The principle of distinction requires that belligerents distinguish combatants from civilians and military objectives from civilian objects. The DOD Law of War Manual amplifies this definition stating: "Parties to a conflict must direct their operations only against combatants and military objectives" (JAG 2018, 15).

To help subordinate leaders and troops comply with the principles of *jus in bello* as previously described, commanders typically provide supplemental guidance, codified in ROE as well as commander's intent. ROE define the circumstances, limitations, and manner in which force may be applied (JAG 2018, 80). Similarly, commander's intent is a clear and concise expression of the purpose of a military operation which helps guide supporting commanders achieve the desired results without further orders (DOD 2017). Commander's intent and ROE are vital in satisfying the principles of *jus in bello* as they establish the limits of military necessity, distinction, proportionality, and reinforce the prohibition of unnecessary suffering. An essential requirement for any LAWS to adhere to targeting law will be the ability to be programmed with ROE, and commander's intent easily. The following paragraphs explain how COAs 1, 2, and 3 would follow the principles of *jus in bello*.

The principle of proportionality is exercised in COA 1 through extensive mission planning by human operators. Incorporation of this principle would be demonstrated by the lethal action taking place at a specific time of day, along a route that is relatively clear of non-combatants, or solely at the time and place of the human operators choosing. COA 2, and COA 3 would be programmed with similar logic. However, these autonomous systems would have the ability to assess whether a lethal action would be proportional. Conceptually, the burden of proportionality shifts from the human to a LAWS for COA 2, and COA 3. In the event a COA 2, or COA 3 LAWS miscalculates a proportionality analysis, human intervention would be required.

From a technological maturation viewpoint, sensor suites with a high degree of fidelity would be required for a LAWS to satisfy the principle of proportionality and

distinction. Sensors are the critical components in these systems as they help an autonomous system understand the behaviors of combatants and non-combatants in a particular battlespace. Since programming a LAWS to sufficiently comprehend all possible scenarios on the battlefield is unlikely, sensor fidelity and environmental conditions will define the level of human supervision needed for a LAWS (Press 2016). Lastly, high fidelity sensor suites will serve as a safeguard against unnecessary suffering in LAWS. If a sensor can classify an object as a target, it should also be able to determine whether a target has been incapacitated or unable to perform an action contributing to combat, thus upholding the principle of unnecessary suffering.

For COA 1, the sensors are capable but limited. The sensor suite in COA 1 generally speaking is more reactive compared to COA 2 or COA 3. COA 1 sensor processing would influence the LAWS tactical profile; however, mission planning inputs related to navigation and targeting limit the system's ability to modify its mission or targeting profiles. In contrast, sensor suites in COA 2, and COA 3 are more capable with improved abilities to distinguish combatants from non-combatants. Ideally, these sensors would be able to quickly perform battle damage assessments and identify the number of combatants and non-combatants within a specific area with high confidence.

The sensor suite in COA 2 lends itself to operations in less ambiguous environments such as rural, desert, or ocean environments. In contrast, sensor systems in COA 3 are suited for diverse and obscure environments such as urban complexes. Mitigation factors for a COA 2, or COA 3 LAWS incorrectly applying the principle of proportionality or distinction are its comprehension of ROE and commander's intent. The final mitigation factor is human intervention.

In satisfying the principle of military necessity, the LAWS is assumed to be programmed and trained to engage legitimate military targets. Target programming in COA 1 would come exclusively from human operators. Qualified military personnel would operate and plan, in great detail, the target or target(s) to be struck. Similar to COA 1, a COA 2 LAWS could only attack programmed targets and target types. The nuance with COA 2, however, is that a COA 2 LAWS has more freedom of maneuver and autonomy in prosecuting targets. This is achieved through improved sensor fusion capabilities, and reach back to combat databases. Finally, COA 3 builds upon the sensor fusion, database access, and battlespace cooperation capabilities established in COA 2. COA 3 operates at a very high level of autonomy as it can identify and engage targets of opportunity within the bounds of ROE and commander's intent.

Concerning targeting law, all three COAs would satisfy the principles of *jus in bello.* For each COA, the LAWS is assumed to be programmed and trained to engage legitimate military targets by discriminating between combatants and non-combatants. While all COAs can identify targets, COA 2, and COA 3 are unique in that they can make informed decisions related to the principles of proportionality and distinction. Guiding values for these decisions would be ROE, commander's intent, and the LOAC.

It is clear that there are currently no international or U.S. policy restrictions to the use of a LAWS system as described in the three COAs. The only known policy that restrains the development and acquisition of autonomous weapon systems in the U.S. is DOD Directive 3000.09. At this point, the use of a LAWS as characterized by COAs 1, 2, and 3 appear to be justified by the rules as they currently exist in weapon and targeting

laws. In the final rules-based assessment, this study considers all three COAs with respect to *what rules should exist*.

Opponents and proponents of LAWS are concerned not only with the rules that currently exist but also with what rules should exist. One of the primary underlying issues that divide pundits and supporters of LAWS is that of accountability. In a technical report, Ronald Arkin argues that there is some precedence of robots possessing "moral intelligence" where the autonomous agent "adheres to a system of ethics" which determines what acts to conduct or refrain from. Additionally, he states that a set of moral policies, such as rules of engagement or the LOAC, that is "replicated by the robot's behavior" could enforce "a particular morality through the robot itself" (Arkin 2007, 9). Arkin also believes that robots could evaluate the ethical appropriateness of a lethal response through the implementation of an *ethical governor* (Arkin 2007, 63). The role of an ethical governor in LAWS is to ensure that a lethal response is ethical. If the response is not ethical, the governor would direct the autonomous system to reorient itself to the tactical environment, and notify the operator of the unethical action.

In contrast to Arkin's position, Mary Ellen O'Connell writes in her chapter of the book, *Banning Autonomous Killing*, that conscience, common sense, intuition, and other human qualities are unprogrammable (O'Connell 2014). Additionally, she writes that "it seems essential that a human being who has training and a conscience and who may be held accountable should always make the awesome, ultimate decision to kill" (O'Connell 2014).

The duty of military commanders and their associated responsibilities are established by Articles 86 and 87 in Additional Protocol I of the Geneva Conventions. It

states that an act committed by a "subordinate does not absolve his superiors from penal or disciplinary responsibility" (JAG 2018, 1140). During World War Two, General Yamashita of Japan was found guilty of war crimes for not controlling, preventing, or suppressing his troops from committing acts against the people of the Philippines that violated the law of war (JAG 2018, 1077). What is interesting about the conviction of General Yamashita was that no evidence was presented showing he ordered the violence and murder, nor was aware of the specified acts (Walzer 1992, 320). The tribunal found that he failed "to discharge his duty as commander to control the operations of the members of his command, permitting them to commit brutal atrocities" (Walzer 1992, 320).

Considering the statements of Arkin, O'Connell, and Additional Protocol I, the three COAs as listed in this thesis appear to satisfy the intent and limitations of all parties. Each of the COAs has human supervision to some degree and would operate under a lawful order to strike a legitimate military target. Secondly, commander's intent, ROE, and the LOAC are integrated into each COA. COA 1 abides by ROE and LOAC through detailed human operator mission planning, while COA 2, and COA 3 are explicitly programmed with these directives. The ethical governor, as conceived by Arkin, could be the implementation mechanism for a COA 2, and COA 3 LAWS to filter lethal decisions.

The conviction of General Yamashita provides some expectation of what could happen to a military commander if a LAWS violated the LOAC through wanton acts of violence or cruelty. General officers, however, rarely find themselves performing tactically related tasks. The U.S. military chain of command, for example, has multiple

echelons of leadership separating the general officer from the tactical unit engaged in battle. The physical and temporal distance that a general has relative to the battlefield makes it doubtful that he would be aware of or responsible for every action of his subordinates.

This brings one back to the original question at hand, does the COA violate rules that are not stated? Considering the arguments of Arkin, O'Connell, and internationally recognized regulations of the Geneva Conventions, this thesis believes that LAWS should not be operated without some degree of reasonable human supervision. Additionally, the human operators who oversee the actions of a LAWS should be working at the tactical level (or as close as practically allows) to preclude dilution of critical battlefield information as well as enable timely intervention.

In summary, all three COAs pass the rule-based evaluation criteria (Table 8). This section's deontological focused examination provides answers for the secondary research questions of the thesis. The LOAC together with the commander's intent and ROE is a useful framework for the employment of LAWS. Despite the lack of internationally recognized rules directed towards LAWS, the law of war provides sufficient direction for what is and what is not acceptable for the employment of autonomous weapons. As long as scientists and engineers can design LAWS following the moral and legal precepts of the LOAC, the use of offensive autonomous weapons in future combat seems all too likely. With the deontological assessment complete, the next section addresses the three COAs through the consequential lens.

Table 9.   Consequential Evaluation Data

CONSEQUENTIAL QUESTIONS	COA 1	COA 2	COA 3
1. Which COA maximizes the good from a U.S. military perspective?	GOOD	BETTER	BEST
2. Which COA maximizes the good in the long-term from a U.S. military perspective?	UNCERTAIN	UNCERTAIN	UNCERTAIN

Source: Created by the author.

In this second evaluation, this thesis will focus on the consequences of implementing a specific COA. From a consequential perspective, acts are morally assessed solely by the states of affairs they bring about (Stanford Encyclopedia of Philosophy 2015). States of affairs are often termed *the good* and are favored above *the right*. Consequentialists thus prefer actions that maximize the good. "The ends justify the means" is a common maxim used to describe the consequential viewpoint. For this thesis, the consequential questions asked are: "Which COA maximizes the good from a U.S. military perspective in the short-term and the long-term?" The good, in this instance, is defined as the COA which favors U.S. military success without compromising moral values.

From the U.S. military perspective, the DOD's enduring mission "is to provide combat-credible military forces needed to deter war and protect the security of our nation" (Mattis 2018). To that end, the U.S. military must field capabilities that "defeat enemies and achieve sustainable outcomes that protect the American people…" (SecDef

2018). For the U.S. military to prevail, or "win," it must field forces and capabilities that are survivable and lethal.

In this thesis COA 1 prioritizes human intervention. Human supervision is prioritized so much in this COA that it potentially limits the survivability of the LAWS as it navigates to its intended target. Also, a significant amount of battlefield information and intelligence is required to plan a mission for a LAWS as described in COA 1. Depending on the currency and reliability of these intelligence products, baseline planning facts and assumptions could substantially change from the time mission planning was initiated to mission execution. Third, if the LAWS in COA 1 cannot meet the human planned thresholds for a lethal attack (range, azimuth, corridor restrictions, etc.), then the LAWS will abort or return to base.

From a consequential perspective, COA 1 appears to provide the least good as it relates to mission success and economy of force. The inability of a LAWS to sufficiently react to a changing battlespace lessens the opportunity for mission success. Although the U.S. military would theoretically be saving human lives in this example by not putting them in harm's way, the military would have a higher probability of wasting expensive resources if they are unable to survive and strike their target effectively.

In contrast to COA 1, COA 2 has less human intervention in the periods preceding mission execution, but higher human intervention during mission execution. In COA 2, the survivability and success of a LAWS is dependent upon high fidelity, and robust sensor suites supplemented with accurate threat and target databases. Additionally, the mission profiles for COA 2 are more generic as the LAWS would be guided by ROE,

commander's intent, and the LOAC when determining the most feasible, acceptable, and suitable tactic.

LAWS with extensive sensor fusion capabilities and freedom of maneuver gives military commanders a great deal of flexibility as the system could theoretically take actions within the scope of "disciplined initiative" as defined in U.S. military joint doctrine (DOD 2017). Third, the Tactics, Techniques, and Procedures (TTP) used by a LAWS in COA 2 would be vetted, or prescribed according to the service branch which utilizes the system. Prohibiting the use of novel, or self-learned TTPs could potentially limit the survivability and success of an autonomous system; however, a certain amount of predictability is needed in military operations. Finally, COA 2 mitigates some of the targeting dilemma caused by COA 1 (limited attack range, azimuth, corridor), as the autonomous system can reorient itself to the objective, however, mission success is still put at risk as the LAWS must wait for targeting approval from a human operator.

From a consequential perspective, COA 2 is better suited to mission success compared to COA 1. Given the freedom to observe and orient its actions in a more survivable and lethal manner, a LAWS of this type would have a higher probability of mission success. Moreover, resources are used more economically in this COA. Human capital would not be wasted in the performance of laborious processes and tasks associated with mission planning. Additionally, a higher mission success rate would limit the number of military personnel put at risk.

For COA 3, human intervention is limited across the entire spectrum of LAWS employment. To illustrate, a LAWS as described in COA 3 could mitigate intelligence shortcomings by dynamically reacting, analyzing, and sharing information of the

environment in real-time. The tactical advantage of an adaptable system was highlighted in a 1993 RAND report regarding Low Observable (LO) aircraft: "Adaptive route planning may be an important capability for enhancing the survivability of LO aircraft" (Hura and McLeod 1993, 14). Other benefits of adaptive systems are the ability to observe unseen or unknown obstacles, recognize sensor failures, and identify navigational jammers. With the ability to identify these threats real-time, a LAWS could change its mission profile or switch to an alternate navigation source such as celestial or terrain based.

Of all the COAs, COA 3 would have the highest probability of mission success, and it would mitigate a considerable amount of risk to soldiers. An advantage COA 3 has over COA 2 is the timeliness in which it can execute an action. For instance, in a scenario where a LAWS is tasked to strike a mobile high-value-target, time is of the essence. If COA 2 were executing this mission, it could potentially miss the opportunity to strike as it awaits human approval. In contrast, with COA 3 the LAWS would decide to strike the target, thus negating the human approval decision time but still maintaining the ability of the human operator to abort the attack if he deemed it necessary.

Despite the clear advantage of rapidly executing the kill chain, COA 3 runs the increased risk of a catastrophic decision being made by the LAWS. The USS Vincennes is a blunt reminder that autonomous weapons can be wrong and that human operators cannot blindly trust what the "computer" is telling them.

Compared to all three COAs, COA 3 provides the most good as it relates to military success. The ability to rapidly adapt to the environment and decisively engage, and eliminate a target has been a motivator for militaries throughout millennia. However,

by analyzing the three COAs in this study, a general trend has surfaced; human intervention and risk have an inverse relationship. From a consequential perspective, this risk may not matter if the probability of military success has not decreased. Consider the experience of Lieutenant Colonel Stanislav Petrov as described in Chapter 2; if the Soviets were using an autonomous system (like COA 3) on that day, would Petrov have had the time to veto a retaliatory Soviet response?

From a short-term tactical perspective, LAWS hold considerable promise in accomplishing military objectives. The speed at which an autonomous system can coordinate, integrate, and synchronize activities has distinct advantages in combat. Having a LAWS that operates on nanosecond time scales would be an asymmetric advantage for the U.S. military as it potentially allows commanders to establish and maintain an operations tempo that disrupts an enemy's decision processes. The drawback of human-on-the-loop LAWS as categorized in COA 1, 2, and 3 is that human supervision could unnecessarily prolong an action thus negating the tactical advantage a LAWS affords.

<div align="center">Long Term Consequences</div>

With U.S. military mission success as the definitive good, this thesis now turns to evaluate the COAs from a less tactical perspective to a more broad, long-term perspective. Analyzing the COAs from a strategic, Clausewitzian lens, three primary influencers of military success come to light; the people, the government, and the military commander. These three elements are described by Clausewitz as a "paradoxical trinity" and describe his theory of war (Clausewitz 1989, 89). These three elements "are deeply rooted in the nature of the subject" of war, and "at the same time variable in degree."

Henceforth, military commanders must consider the tendencies of the people and its governing body else a nation's theory of war would be a contradiction of reality (Clausewitz 1989, 89).

From a political viewpoint, palatable conflicts generally have limited casualties, are relatively inexpensive, and generally improve the state of affairs for a nation. The previous discussion has shown that all three COAs decrease the number of American combat troops needed to accomplish a mission. While the amount of human capital held at risk is relatively constant amongst the COAs, the amount of financial capital is not. This logic stems from the premise that less survivable weapon systems are less economical as more resources are needed to replace systems that have been destroyed.

Furthermore, policies that govern the occurrence of war, or *jus ad bellum*, will be redefined depending upon which type or types of LAWS a government endorses. One concern, in particular, is that the threshold required for combat operations will be lowered due to the perception of lethal actions becoming relatively risk-free (Doare, et al. 2014, 137). This rationalization is best summarized by Grossman when he writes about the relationship between killing and physical distance, "from a distance I can deny your humanity; and from a distance, I cannot hear your screams" (Grossman 1996, 102).

Regardless of a nations proclivity for combat operations, LAWS will most certainly affect policies governing the use of lethal force. Considering the political motivations for military success, it is uncertain which COA would maximize the good as it relates to domestic policy. With regards to economies of scale, it appears as if COA 3 would be the best option as it is the weapon most likely to accomplish the mission and be the least burdensome for a nation's strategic resources.

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Government policies authorizing the employment of LAWS will have far-reaching second and third order effects throughout the military and society. Militarily, as the human to machine ratio decreases, the structure, and character of the military institution will change. Each of the three COAs listed in this paper provides a glimpse of how traditional military decision processes will be radically transformed when LAWS are brought into battle. What makes LAWS potentially so revolutionary, is that they not only increase the capability of the combatant, but autonomous weapons shift the cognitive burden from humans to machines (Doare, et al. 2014, 129). Optimizing the human-machine relationship to address innovative processes will change the nature of leadership, its aptitudes, and attributes (Doare, et al. 2014, 38).

To illustrate, in conflicts where each antagonist has similar LAWS capability, battlefield success could be determined by the state who is more liberal in their use of LAWS (i.e., human oversight is limited). Conversely, a LAWS capability disparity between rival nations may allow more opportunity for human operator involvement as the temporal advantage it provides is far superior to the limited LAWS nation. Despite this advantage, countries with excellent LAWS may still decide to maximize the capabilities afforded to them by LAWS by rationalizing that its use results in a shorter, less costly war. Viewed in this light, it is difficult to determine which COA maximizes the long-term good of the military.

The last pillar of Clausewitz's trinity is the people. Societal consciousness, or people's emotions and passions as classified by Clausewitz, have a profound influence on the government and the military commander. What is unique about a LAWS is that their development changes the paradigm of the relationship between the government and the

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military. This is most evident when one considers the possibility of a LAWS taking part in a stability operation or humanitarian motivated combat operation. Generally, speaking these operations are seen as humanizing in nature and seek to promote human welfare. Promoting human welfare implies compassion and the development of genuine relationships. The use of a LAWS or any other non-lethal adaptive autonomous system seems to be in direct opposition to these principles. This dehumanization of security, law, and society could be dangerous and significantly alter western society's fragile relationship with their government and the military (Doare, et al. 2014, 132). Thus, from a long-term societal perspective, it is uncertain which COA would generate the most good (Table 9).

From the strategic, Clausewitzian perspective, no COA was identified that maximized the good as it relates to military success. The employment of a LAWS, or any autonomous system for that manner, seems to magnify the chameleon-like nature of war by adapting "its characteristics to the given case" as exerted by Clausewitz (Clausewitz 1989, 89). Despite the opaque outlook on the long-term effects of LAWS, this section was able to provide a clearer picture of the short-term impacts of LAWS. In summary, this analysis accepts that autonomy and mission success are linearly related from a consequential viewpoint. The last section will analyze the three COAs from a virtue ethics perspective.

Table 10.   Virtues Evaluation Data

VIRTUE QUESTIONS	COA 1	COA 2	COA 3
1. Does the COA reflect the virtues as described by St. Augustine or Aristotle?	YES	NO	NO
2. Which COA reflects the spirit and intent of American foundational documents (Declaration of Independence and Constitution)?	YES	NO	NO
3. Which COA best emodies the military profession?	YES	NO	NO

Source: Created by the author.

In the last ethical evaluation, this thesis will focus on the virtuousness of implementing a specific COA. From the western perspective, Plato and Aristotle are the founding fathers of virtue ethics. Their writings on moral philosophy serve to guide individuals as to "what sorts of persons we should be and how we should live" (Stanford 2016b). Aristotle categorizes virtues into two categories, intellectual and moral. For a man, moral virtue is "acquired by repetition of the corresponding acts…. and are made perfect by habit" (Aristotle 2009, 24). Intellectual virtue, on the other hand, is one's ability to receive instruction or to learn. Aristotle describes this virtue in terms of scientific knowledge, and practical wisdom (Aristotle 2009, 104). The core takeaways from Aristotle's teachings regarding virtuous actions are that it is a learned skillset and it "aims at what is intermediate" (Aristotle 2009, 30). In finding the intermediate, a virtuous COA would ideally be acceptable to the U.S. military, American society, and the international community.

COA 1, which is the most limiting in terms of autonomous functions, would be the most virtuous COA. The primary reasons for this COA being viewed as the most acceptable are its extensive reliance on detailed human planning by a member of the U.S. military. Heavy dependence on human planners for this COA stems from its narrow, limited, and highly scripted mission profile. A limited mission profile makes the LAWS more predictable but potentially less survivable due to human set restraints. This implies that the success of a COA 1 LAWS relies almost entirely on the intellect and wisdom of the human mission planners.

Mission planners for a COA 1 LAWS would ideally be subject matter experts on the TTPs for this type of weapon. Moreover, planning experts would be military personnel, or lawful military combatants, that are experienced in combat operations. Rigorous military training, battle drills, and large force exercises would qualify a mission planning individual as a *morally virtuous* military member, permitting them to operate and employ a COA 1 LAWS. Focused instruction and training on the LAWS would then qualify an individual as an *intellectually virtuous* planner who understands the regime in which the LAWS can operate in, thus making the planner the expert in employing the LAWS with "the right motive, and in the right way" as Aristotle would desire. In essence, the virtuousness of the soldier, or mission planner, is reflected upon the LAWS.

On the surface, COA 2 looks similar to COA 1 with the main exception being greater freedom of maneuver in avoiding threats and selecting targets. Human involvement is minimal prior to mission execution, but increases during mission execution as the human operator explicitly approves strikes. However, the virtuous problem with this COA is that the solutions recommended by a LAWS of this type may

not be transparent or auditable. Understanding how and why a solution was reached is essential within military operations. For Aristotle, understanding is the critical quality when issuing commands; he refers to this as practical wisdom (Aristotle 2009, 112). If military commanders do not understand how or why their subordinates, or a LAWS in this instance, recommended a decision, then he will not trust them. Practical wisdom is not conferred solely by understanding, but judgment as well according to Aristotle (Aristotle 2009, 113). These two principles, understanding and judgment, are held in high regard for military commanders. Subordinates who lack grasping these ideas are not trusted, and LAWS will be no different.

COA 3, the most autonomous of the three COAs, is the least virtuous COA from an Aristotelian perspective. Much like COA 2, military commanders employing the services of a LAWS of this type would have significant reservations in the lethal employment of a system that was indeterminate in the actions it conducted. The risk is further compounded with this COA if it can execute novel or untested TTPs on the battlefield. While human intervention is present in this COA, it is limited to veto authorization. This poses additional dangers in situations where the human operator is unable to "keep pace" with the LAWS as it transitions from a non-lethal mission profile to a lethal profile. In time-sensitive situations where targets are fleeting, human operators may not be able to intervene in time or blithely trust the actions of the LAWS.

In the final evaluation of the virtuousness of the three COAs, this thesis considers the last two questions: Which COA reflects the spirit and intent of foundational American documents, and which COA best embodies the military profession? The Declaration of Independence and the Constitution are the foundational documents that legitimize the use

of military force and describe the fundamental values of American society. As discussed in Chapter 2, Hartle identifies these fundamental values to be: Freedom, Equality, Individualism, and Democracy (Hartle 2004, 136-140).

Comparing these values to the Laws of War, Hartle states that "personal freedom of choice is the foundation of moral responsibility… which makes freedom a moral value in the spheres of both the laws of war and American values" (Hartle 2004, 144). In the military profession, freedom of choice and the principle of equality are firmly established within the LOAC, specifically the Geneva Conventions (Hartle 2004, 144). Using Hartle's definition of freedom and equality, all three of the COAs allow human operators to preserve their freedom of choice and honor the principle of equality through explicit planning, and strike approval, or disapproval. However, one could reasonably argue that a human operator's options become more limited and reactive as the level of autonomy increases from COA 1 to COA 3. From this vantage point, the COA that unshackles humans from the impulses of a LAWS and provides humans the most freedom while preserving the principle of equality is COA 1.

Tightly coupled to the principle of freedom is individualism. Hartle describes individualism as the ideal "that each person is self-determining…. [and] thus directly responsible for their actions" (Hartle 2004, 144). The notion of culpability was addressed earlier in this chapter and is emphasized in the concluding paragraph of Mary Ellen O'Connell's essay as she states that it is "imperative that human beings not give up sovereignty over these vital aspects of what it is to be human: to have a conscience and to be subject to accountability" (O'Connell 2014, 235).

Responsibility for the actions of a LAWS in the COAs enumerated in this thesis all reside with the human operator. One area where culpability is unclear, however, is concerning the non-lethal actions or decisions that a LAWS makes, mainly as explained in COA 3. Unexpected or novel non-lethal actions may produce unintended second and third order effects which human operators may not plan for. A possible scenario might be a LAWS that impedes the performance of other friendly assets in a battlespace. A LAWS that saturates communications nodes with nonessential information could potentially block more critical information from getting through. Another issue with LAWS operating near manned or other assets is their predictability. Manned assets would be reluctant to operate near an autonomous system that performed novel or innovative maneuvers or had limited means of battlespace coordination. These examples highlight the importance of complete, and robust testing for LAWS. With this in mind, operational testing of LAWS should establish key performance parameters that measure trust in the human-machine interface (Lewis 2017).

Lastly, Hartle reasons that democracy is an ideology "filled out by the values of freedom, equality, and individualism" (Hartle 2004, 141). He contends that American democracy "is a shining moral light" that "reflects our general culture tendency to see the world in moral terms" and that it is the "most enlightened and humane form of government" (Hartle 2004, 141). At present, the general American inclination is to progress with extreme caution with regards to LAWS development. The U.S. government is representative of this value system as it clearly states in DOD Directive 3000.09 that there will be human supervision for autonomous weapon systems that engage human targets (Dep SecDef 2017). Commercial industry powerhouses like Google and Microsoft

have gone one step further by denouncing the development of LAWS altogether (Pfaff 2019). International organizations and special interest groups have supplemented this narrative as well.

Comparing the three COAs of this thesis to Hartle's definition of democracy, it is difficult to determine whether their use is aligned with the values of American democracy. Of all the COAs, COA 1 would satisfy the spirit of American democracy as it presently exists for three distinct reasons. First, COA 1 has significant human operator involvement. Extensive interaction with a system typically produces operators that are comfortable and confident manipulating the system which ultimately generates trust. Secondly, LAWS that are deterministic, like COA 1, provide human operators with information that is transparent and auditable. Auditable data reinforces that a LAWS can make decisions in line with commander's intent, ROE, and the LOAC. Finally, ceding life and death decisions to a machine would discredit or dishonor the military profession. Addressing this dilemma, Paul Scharre states:

> If we lean on algorithms as a moral crutch, it weakens us as moral agents. What kind of people would we be if we killed in war and no one felt responsible . . . at least it says something about our morality that someone sleeps uneasy at night . . . Someone should bear the moral burden of war. If we handed that responsibility to machines what sort of people would we be? (Scharre 2018, 290)

This awesome responsibility for determining who lives or dies is what defines the military profession (Scharre 2018, 293).

Step 4: Determine the Best Course of Action

The evaluation of the three COAs from a normative ethics perspective illustrates how complicated the decision to employ LAWS can be. In choosing the best COA, a holistic outlook was used to account for the climate, culture, and professional values of

the U.S. military. From a virtuous perspective, COA 1 is the most suitable option for employment of offensive-oriented LAWS. This COA maintains sufficient human supervision of a LAWS while leveraging the technological benefits of an autonomous weapon. Essential characteristics of COA 1 are that its mission profile is deterministic and consequently more transparent. Transparent operations allow commanders to trust a LAWS of this type than compared to COA 2 or COA 3 LAWS, even if they may have a higher probability of mission success. Lastly, COA 1 preserves the quintessential responsibility bestowed only to those who are sworn to protect and defend the Constitution, the taking of human life. A lethal action conducted by a LAWS as described in COA 1 is a deliberate, intentional, and human activity from beginning to end. COAs 2 and 3 bring in human interaction in the final stages of a lethal act.

In contrast to the virtuous perspective, the consequentialist perspective favors COA 3. A LAWS with these types of properties maximize the good in terms of purpose (mission accomplishment), time, and cost. Weapon systems unconstrained from initial planning assumptions, and allowed to react to the battlespace dynamically are significantly more survivable than systems handcuffed to human decision-making processes or unable to take the initiative (i.e., COA 1). Additionally, an autonomous system designed with COA 3 traits can shorten the kill chain timeline and maintain operational tempos much quicker than traditional human-operated systems. Finally, the cost of a COA 3 or similar LAWS would most likely be more cost effective than current human operated weapon systems. For instance, most military combat aircraft are built with elaborate life support systems like ejection seats. Ejection seats allow a pilot and his crew to safely escape from a crippled aircraft should it sustain battle damage or

experience a catastrophic malfunction. The cost of a typical ejection seat is more than

$130,000 (Martin Baker 2019). As a reference, the USAF has 66 B-1B bombers, and

each aircraft has four ejection seats (Biondo 2018). The cost savings from eliminating

ejection seats and other associated human life support from weapon systems is

substantial.

Lastly, the rules-based perspective seeks to accomplish the right as opposed to

maximizing the good. From a theoretical standpoint, all three COAs appear to be able to

meet the deontological values as directed by the LOAC. As previously discussed, Ronald

Arkin believes that programming ethical LAWS is achievable. Currently fielded, nascent

autonomous systems make it reasonable to assume that this hypothesis is within reach as

game playing autonomous systems have demonstrated that they can follow the rules and

beat human champions in a range of games, such as chess, AlphaGo, and Scrabble

(Bostrom 2017, 15-16). However, the burden of proof for ensuring that a LAWS can

perform as well or better than their human counterparts within the confines of the LOAC

is the DOD test and evaluation enterprise. Based on the analysis of normative ethics

discussed above, the COA that would be most acceptable to the U.S. military is COA 1.

Table 11. Aggregate of Evaluation Data

DEONTOLOGICAL QUESTIONS	COA 1	COA 2	COA 3
1. Does a COA violate any rules that currently exist?	NO	NO	NO
2. Does a COA violate any moral obligations?	NO	NO	NO
3. Does the COA violate rules that are not stated?	NO	NO	NO
CONSEQUENTIAL QUESTIONS	COA 1	COA 2	COA 3
1. Which COA maximizes the good in the short-term from a U.S. military perspective?	GOOD	BETTER	BEST
2. Which COA maximizes the good in the long-term from a U.S. military perspective?	UNCERTAIN	UNCERTAIN	UNCERTAIN
VIRTUE QUESTIONS	COA 1	COA 2	COA 3
1. Does the COA reflect the virtues as described by St. Augustine or Aristotle?	YES	NO	NO
2. Which COA reflects the spirit and intent of American foundational documents (Declaration of Independence and Constitution)?	YES	NO	NO
3. Which COA best emodies the military profession?	YES	NO	NO

Source: Created by the author.

Answer to Primary Question

Is it ethical for the U.S. military to employ a LAWS? Yes, however, a LAWS must have a reasonable level of human control, and it must be shown to adhere to the ethical frameworks of war, such as the LOAC, ROE, and commander's intent. If a LAWS can meet these requirements, then the use of a LAWS is justified. Despite satisfying these principles, there still seems to be a problem with a machine deciding of who lives and dies as illustrated by COA 2 and COA 3. The integrity, virtuousness, and values of the U.S. military profession conflicts with the delegation of lethal decisions to machines.

This professional dissonance is best articulated by Scharre's view regarding the use of autonomous weapon systems: "My concern is not just winning. It's winning correctly, ethically, and keeping our moral compass as we win" (Scharre 2018, 284).

If the U.S. military is to maintain its moral compass and win ethically as Arkin states, then additional constraints need to be levied upon the use of a LAWS. Adhering to the LOAC, ROE, and commander's intent are not enough; employment of a LAWS requires further refinement. Specifically, military commanders should augment ROE, the LOAC, and commander's intent by limiting the use of a LAWS with respect to time, distance, purpose, scope of use, and operational domain. Operational and strategic timelines, as well as the frequency of human interaction, should determine what the acceptable level of autonomy is on the battlefield. The importance of time and its enduring effect on warfare was rightly described by Napoleon when he said: "…space we can recover, time never" (Krause and Phillips 2010).

Closely tied to time is distance. Nick Bostrom illustrates the time-distance relationship by stating:

> The speed of light becomes an increasingly important constraint . . . faster minds face greater opportunity costs in the use of their time for traveling or communicating over long distances . . . Agents with large mental speedups who want to converse extensively might find it advantageous to move near one another. (Bostrom 2017, 65)

This discussion of latency lends credence to Boyd's OODA Loop. Optimizing the human-machine relationship in a LAWS will be crucial in providing timely, and relevant information to commanders. Appropriate and timely data are essential in combat operations as it allows a commander to create multiple dilemmas for the enemy and stay

"inside" the enemy commander's OODA Loop by sowing confusion and disorder (Boyd 2018, 385).

The purpose or objective of military operations will also be a crucial determiner of autonomy. ROE, as well as protections afforded by the Geneva Conventions, differ in humanitarian and combat operations. Additionally, the scope of autonomous integration and cooperation between commanders, platforms, and sensors will change depending on the military action being conducted.

Lastly, the domain (air, land, sea, space, and cyberspace) in which an autonomous system is operating within will shape its level of autonomy. Sharre articulates how a geographic domain, such as the Demilitarized Zone (DMZ) separating North and South Korea, can affect the degree of independence a LAWS has. If it is illegal for, and highly unlikely that civilians would cross the DMZ, then commanders may be more willing to increase the autonomy associated with those weapons systems (Scharre 2018, 104). The maritime domain, especially subsurface, has also been identified as a realm where high levels of autonomy might be exercised due to an ostensibly empty expanse void of any collateral damage concerns.

Military commanders and their subordinates cannot forget that they are the moral agents who ensure the just application of lethal force. Deciding when to use deadly force is dependent upon an infinite number of variables, many of which are not fully understood until one reflects on the situation after a decision has made. Despite the unique circumstances that shape a military commander's decisions, a machine should not be, as Scharre states, the "moral crutch" for the justification of its use.

Chapter Conclusion

The U.S. military is a revered and respected profession and institution. Military acts while violent and at times regretful are nonetheless necessary. Decisions military leaders make on the battlefield are unique; a commander may prioritize consequentialist ideals over virtuous norms in one instance, then prioritize deontological imperatives moments later. This agility of ethics shows how difficult it is to justify the use of LAWS. In some wartime situations, a LAWS like COA 3 may be acceptable, while in others its use would be atrocious. Even though the U.S. military executes combat operations from a position of advantage, it expects troops to act as moral agents and be the "shining light" Hartle refers to.

Autonomous technologies have considerable benefits both in military and civilian applications. Regardless of where these technologies are utilized, humans will need to decide how much autonomy they are willing to relinquish to machines. Any forfeiture of human judgment should be carefully scrutinized to determine second and third order effects, and if they are acceptable.

The Ethical Triangle is one such way to evaluate these effects and their acceptability. From a normative ethics perspective, this thesis contends that human-on-the-loop LAWS are justified so long as humans meet the following criteria: First, humans must have reasonable control over an autonomous system, particularly when it is allowed to conduct lethal acts. Secondly, human operators must have a firm grasp of the tactical and operational environment the LAWS is operating in, confirming its compliance with the LOAC, ROE, and commander's intent. If these standards are met, then the use of a LAWS is justified.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

> Decent men and women, hard-pressed in war, must sometimes do terrible things, and then they themselves have to look for some way to reaffirm the values they have overthrown.
>
> —Michael Walzer, *Just and Unjust Wars*

Chapter Introduction

Militaries have always sought to exploit technologies which provide an advantage on the battlefield. Military history offers numerous examples of technologies that have reshaped the character of warfare. The evolution of war from sword and shield tactics to nuclear weapons, stealth, and now LAWS has taken place over thousands of years. As these battlefield systems have modernized, the dynamics of the human-machine interaction changed as well. Military revolutions include the advent of railroads, telegraph, gunpowder, and advanced fighter aircraft with exquisite avionics systems. Most of these innovative weapon systems were designed with the intent to eliminate or ease a soldier's burden on the battlefield. Oddly enough, these new weapon systems redefined rather than reduced the need for a soldier, sailor, airman, or marine.

Steve Fino, the author of *Tiger Check*, studied the evolution of fighter aircraft and pilots from World War One to the Gulf War. Through his evaluation, Fino concluded that:

> [The] pilots' intuition and skill were never subsumed by their new equipment. A pilot was always needed to make the system work, to provide the heart . . . the will . . . the reasoning power in the cockpit. One of the great ironies within fighter aviation during the period 1950 to 1980 is that the systems the pilots once feared would push them out of the cockpit in fact became increasingly reliant on skilled pilots remaining in the cockpit. (Fino 2017, 272)

This is an interesting and refreshing perspective as it reinforces that the character of war will continue to most likely be shaped by increasing human-machine collaboration, even if weapons, like LAWS, can think for themselves. As LAWS are developed and tested, new and interesting revelations will no doubt emerge when humans and autonomous machines work together and not in isolation (Fino 2017, 353).

Conclusion(s)

This paper has sought to further the discussion of LAWS by addressing the ethical dilemmas surrounding their use. LAWS offer numerous benefits to military commanders, most noticeably in terms of timeliness, cost-effectiveness, and mission accomplishment. The worry of this capability, however, is that it potentially mortgages the morality of the military profession. *The Armed Forces Officer*, by Richard Swain and Albert Pierce, define the honorableness of the military profession by writing:

> The basic notion of the warrior's honor, that not all killing and destruction are legitimate, is nearly universal, transcending historical periods and cultures. It serves more than one purpose: distinguishing between those who fight honorably and those who do not, regulating acceptable weapons and practices . . . Only men and women who fight under such codes are members of an honorable profession. (Swain and Pierce 2017, 44)

The men and women of the U.S. Armed Forces are the individuals who maintain the integrity of the military institution. They are the ones that embody the values of the Constitution and are responsible for wielding the awesome destructive power of the U.S. military. If the military profession "averts its eyes" to this responsibility as Walzer states, then the profession will fail to recognize and condemn evil acts (Walzer 1992, 326).

<u>Recommendations</u>

In the evaluation of the ethical use of LAWS this thesis has identified three recommendations. The recommendations address LAWS issues related to human involvement, government policies, and military testing. The common thread amongst all of these topics is that humans will be the decision authority for any lethal action performed by an autonomous system.

The primary conclusions from this study were that humans must have reasonable control over an autonomous system and that human operators must have a firm grasp of the environment the LAWS is operating in. Additionally, this thesis recommends that military commanders at the tactical and operational level be allowed to adjust the level of autonomy exhibited by a LAWS. A commander's decision to modify autonomy levels should be influenced in terms of time, distance, purpose, scope, and geography as discussed in Chapter 4. The ability to customize the autonomy levels of a LAWS allows commanders to address the unique characteristics of each tactical situation, much like task organizing maneuver units, or force packaging aircraft for specific missions.

Secondly, the DOD's developmental and operational test enterprise will be required to rethink how it tests and evaluates critical performance parameters for LAWS (Lewis 2017). The inevitable use of LAWS emphasizes the importance of trustworthiness that spawns from the human-machine relationship. In establishing and promoting trust for autonomous systems, operators and commanders must operate advanced weapon systems in realistic scenarios and environments. Strategically, the U.S. military's test and evaluation enterprise requires a change in underlying assumptions when assessing the effectiveness of autonomous systems. Larry Lewis comments that the "current [test and

evaluation] process is unsuited for factoring in the particular challenges of autonomous weapons…. [as these] systems will not be predictable from a deterministic sense" (Lewis 2017, 45). Testing of LAWS will be different as decision making will perhaps be the most critical performance indicator. It is conceivable that the testing and evaluation of a LAWS will look more like a formal military training program such as pilot training or infantry school as opposed to a strict metric driven test plan exclusively authored and assessed by engineers.

From a policy standpoint, the U.S. government should be as transparent as national security allows regarding the use of LAWS. Stated "red-line" policies that limit military options are risky as they inform and disclose sensitive information related to military operations. However, clear policies may ultimately be an advantage for the U.S. as they clearly state the individuals or offices accountable for actions related to LAWS.

Transparent policies reinforce the morality and values of the U.S. This in turn, reassures citizens, American allies, and the international community that the use of LAWS will be bounded and justified. Developing autonomous systems within an alliance lends credibility and legitimacy to their use as well. More importantly, nations that cooperate will inexorably work towards addressing the issue of trust by resolving interoperability issues and national policies governing the use of LAWS (Lewis 2017, 48-49). Equally important, disclosed autonomous policies that are agreed upon by multiple nations mitigates the prospects of hasty and irrational motivations for their use.

The situation surrounding the 2013 Presidential Policy Guidance (PPG) for counterterrorism operations outside the declared areas of conflict is a good case study that demonstrates of the benefits of transparent policies. Before 2013, the U.S.

government was criticized for the perceived recklessness of targeted killings by UAVs in lawless regions of sovereign countries. In response to this criticism, an 18 page, slightly redacted, PPG memorandum was released. The PPG outlined the processes and procedures required for lethal and non-lethal use of force against terrorist targets outside the U.S. and areas of active hostilities (POTUS 2013). After the release of the policy initiative, international and domestic disapproval significantly decreased.

<u>Parting Thoughts</u>

It is uncertain if future autonomous technologies will trump morality, however, it is certain that the human-machine relationship will become more ubiquitous. Understanding and optimizing this relationship is the challenge for current and future generations of military officers, principally as it relates to the LOAC. Senior military leaders will need to determine if LAWS technologies align with the U.S. military value system and what tactical and strategic risks they are willing to accept fielding these systems. Beholden to the Constitution and the values of American society, military professionals are confronted with the prospect of warfare conducted by adaptive machines.

Willfully avoiding honest discussion, debate, and research of LAWS is to relinquish distinctive advantages to less morally constrained competitors, which places U.S. national interests at great risk (Pfaff 2019). Polarizing the decisions to study or research LAWS is unwarranted as academic inquiry does not necessarily imply endorsement or intent. Instead, such conversation informs as it alleviates the mystique and fanaticism that surrounds emerging technologies, like autonomous weapons, and communicates factual information. Communication, according to Robert Hurley, is the

bridge between trust and ethics (Hurley 2011, 40). Failing to communicate the morality

of LAWS properly could make war less human and far more costly, for the military and

civilian populations (Pfaff 2019).

In closing, there appears to be no clear, comprehensive answer to the ethical use

of LAWS. Thomas Nagel's essay, *War and Massacre*, written over 45 years ago in

response to the Vietnam War, discusses the moral conduct of war from an absolutist and

utilitarian perspective. His words are powerful and resonate today as governments,

militaries, and society debate the value of LAWS. Nagel's concluding paragraph

eloquently states:

> We must face the pessimistic alternative that these two forms of moral intuition
> are not capable of being brought together into a single, coherent moral system,
> and that the world can present us with situation in which there is no honorable or
> moral course for a man to take, no course free of guilt and responsibility for evil .
> . . Given the limitations on human action, it is naïve to suppose that there is a
> solution to every moral problem with which the world can face us. (Nagel 1972,
> 143-144)

Perhaps the only real, concrete takeaway from Nagel's evaluation, Just War theory, and

normative ethics is the fundamental necessity for human judgment in sacred, existential

matters. The military profession captures the essence of this belief in the commission of

officers as it bestows "special trust and confidence" to those appointed who protect and

defend the Nation.

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