Strategy Research Project

Robot Warriors - A Case for Lethal Autonomous Weapon Systems

by

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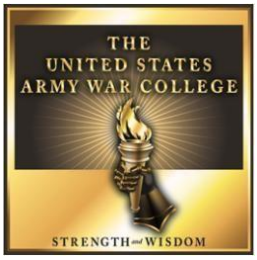

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This paper argues for the development and use of lethal autonomous weapon systems by the Department of Defense. Despite the appeal of significantly minimizing human loss of life and maintaining a military competitive advantage, U.S. pursuit of this capability has met with considerable consternation and resistance. The analysis suggests that the benefits outweigh the risks; adversaries are pursuing this capability with or without U.S. involvement; and its value as a deterrent should not be wasted. Many of the objections to pursuing autonomous technologies while seemingly convincing are logically flawed. This analysis includes an examination of concerns over human accountability, responsibility, and trust that underpins the legality of using autonomous weapon systems. While there are legal concerns that must be addressed, a human chain of responsibility exists and will continue to provide the requisite accountability. The analysis concludes with recommendations on a way ahead for DoD's pursuit of lethal autonomous weapons.

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Abstract

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Robot Warriors - A Case for Lethal Autonomous Weapon Systems

> A robot may not injure a human being or, through inaction, allow a human being to come to harm. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
>
> —Isaac Asimov[1]

The Department of Defense (DoD) and United States (U.S.) government writ large have long supported investments in the development of military technologies which provide the Armed Forces with dominance across all warfighting domains and negate any numeric superiority or geographic advantage potential adversaries may possess. Recent advances in the field of artificial intelligence have given viability to the development of autonomous robots, networks, and machines for use in both commercial and military sectors. The DoD has even developed a conceptual strategy around these technological advancements to secure funding for research, development, and eventual deployment, referred to as the Third Offset. However, despite the appeal of revolutionizing warfare by significantly minimizing human loss of life and maintaining a military competitive advantage on the battlefield, the autonomous centerpiece of this strategy has met with considerable consternation and resistance.

At the heart of the debate are the potential moral, ethical, and legal implications of removing the human element from waging warfare and ultimately ceding control over the act of killing. This paper will argue that there is a place for lethal autonomous weapon systems (LAWS) in the U.S. military, a position currently advocated by few, but supported by three rationales. First, that autonomous systems may minimize casualties through better distinction and proportionality on the battlefield while having the potential for sounder ethical decision making. Second, unlike previous disruptive military technologies, autonomy is being driven externally by the global commercial sector

permitting a low barrier to entry, and failure to lead the effort allows others to leverage LAW's potential and to decide how they will be used. Third, like nuclear weapons, lethal autonomous weapon systems possess a deterrence value that the United States cannot capitalize on unless these weapons are fully developed and employed.

This analysis includes an examination of the degree of trust, control, and accountability that must exist to address the ethical concerns associated with just war theory and the legal implications regarding the law of armed conflict. It also considers the validity of key ethical objections to employing lethal autonomous weapon systems. Framing this problem begins by describing both the historic and contemporary operating environments driving pursuit of technology offset capabilities as well as the corresponding resistance to adopting them.

Many military historians have chronicled the evolution of warfare—or what Clausewitz would refer to as the "changing character of war"—brought about by the introduction of more lethal, accurate, and longer ranged weapons.[2] With few exceptions, the pursuit and use of these weapons has been motivated by a desire to swiftly and decisively defeat the enemy's armed forces with minimal loss of friendly life. The world's adoption and general adherence to the Laws of Armed Conflict (LOAC) governs the conduct of hostilities and the protection of war victims under the Latin term *jus in bello*, or the law in waging war.[3] The interdependent principles of military necessity, humanity, proportionality, distinction, and honor form the foundation of the LOAC and also serve as a driving force in the development of precision guided munitions, remotely piloted aircraft, and autonomous weapon systems.[4] Through each successive evolution of warfare, technology has effectively reduced indiscriminate killing on the battlefield.

Technology has also reduced the combatant's physical presence in war, a cause of concern among some just war theorists and legal scholars. While diminishing the human element in war seems to be the natural progression of things, it comes at the price of control. Ironically, the need for control appears to be at odds with the pursuit of autonomous systems and the fear of losing control of these systems is a principal source of contention.

Constructive dialogues on the role of autonomous weapon systems tend to quickly devolve into rants concerning killer robots. While this observation is purely anecdotal in nature, it may suggest the presence of heuristic bias born from science fiction and what some argue is a historic technophobia dating back to the introduction of automation in U.S. factories.[5] In 1942, Isaac Asimov, a well-known science fiction writer, published a story around three laws which he suggested should govern the actions of robots.[6] Although purely a work of fiction, Asimov's laws of robotics, cited in this paper's epigraph, encapsulate the sentiments of many today. The laws, in total, state that a robot must not harm humans or allow harm to be caused; must obey mankind unless it causes harm to humans; and must protect itself unless that conflicts with the previous laws.[7] For decades, the movie industry has effectively leveraged variations of this theme concerning the failure of autonomous robots to follow these laws. These plots usually involve an attempt to extinguish the human race after observing its fallibility and hypocrisy. Surprisingly, the fears exploited by Hollywood are rooted in a history of man's resistance to automation.

In a May 2014 article entitled "Do We Need Asimov's Laws," writers for the MIT Technology Review suggest that while the fear of rebellious robots destroying people is

unfounded, conflict between man and machine dates back to the Industrial Revolution and is real.[8] One of the best examples was a movement to destroy weaving machines by a group known as Luddites during Britain's industrial revolution in the 1800s.[9] The issue became so serious that the Parliament made the destruction of weaving machines a capital crime and deployed the British Army to deal with the violent movement.[10] The authors conclude by stating "…what we fear about robots is not the possibility that they will take over and destroy us but the possibility that other humans will use them to destroy our way of life in ways we cannot control," a warning concerning the potential for a lack of human accountability rather than robotic negligence.[11]

Fortunately, there are laws that govern both the actions of human combatants on the battlefield and the use of autonomous weapon systems, an important distinction that will be explored in a legal context later. The historical, societal bias against robots is relevant because it may be negatively influencing DoD policy in the fielding of autonomous weapon systems. Examining DoD strategy and policy concerning autonomy is the logical next step in framing the problem and determining if these constraints are necessary or beneficial for the future force.

The recent push for the introduction of autonomous systems in the DoD is primarily due to their inclusion in a military strategy known as the Third Offset Strategy (3OS). The 3OS was formally announced in 2014 as an attempt to leverage innovative technologies and concepts to restore the technological overmatch that the United States has leveraged against its enemies since the end of World War II.[12] The first offset refers to the development of a triad of ground, air, and sea launched nuclear capabilities that many credit as the principal deterrent in preventing a full-scale war with the Soviet

Union during the Cold War period. Beginning in the 1970s, the Soviet Union reached nuclear parity with the United States prompting the pursuit, initially, of precision guided munitions (PGM) for mounted and dismounted infantry.[13] During this period, known as the second offset, the United States continued to expand its arsenal across the warfighting domains and enjoyed a military monopoly on PGMs. These actions effectively continued to discourage conflict with Russia and a rising China at the strategic level while providing the United States tactical dominance on the battlefield. Due in large part to the effects of globalization, the 3OS differs in several ways from its predecessors.

In a RUSI Journal article entitled “Europe and the Pentagon’s Third Offset Strategy,” Daniel Fiott describes these differences which include a multi-polar threat environment, the diffusion of technology which can be improvised to asymmetrically counter legacy military capabilities, and an economic climate which makes the strategy of continuing to outspend the adversary unsustainable.[14] Faced with these challenges, the 3OS hopes to leverage innovations from the commercial sector to posture the United States for continued military dominance. Deputy Secretary of Defense (DEPSECDEF) Robert Work asserts that the principal focus of the 3OS is to strengthen U.S. conventional deterrence at the operational level of war.[15]

During a recent conference at the Center for Strategic and International Studies, DEPSECDEF Work provided five lines of effort (LOEs) through which DoD seeks to enhance its “operational battle network,” a term which refers to the collective systems of U.S. capabilities across all five warfighting domains.[16] These efforts include leveraging innovative technologies and concepts in the following areas:

1. Autonomous learning systems
2. Human-machine collaborative decision making
3. Assisted human operations
4. Advanced manned-unmanned system operations
5. Network-enabled, cyber and EW hardened, autonomous weapons and high-speed weapons.[17]

When describing the LOEs, DEPSECDEF Work deliberately emphasized the human-led rather than machine aspects of the 3OS. His language suggests an awareness that pursuing these technologies could create a public backlash based on a perception that control for making life or death decisions is being ceded to a machine which cannot be held accountable for its actions.

In acknowledgement of these concerns over accountability and control, DoD leaders have committed to keeping humans in control of LAWS. The Vice Chairman of the Joint Chiefs of Staff, General Paul Selva, addressed what has come to be known as the “terminator conundrum” by stating that, at present, technology will require another decade of maturity before robotic-based LAWS could be employed and, more important, that the United States has no intention of building one.[18] It seems unlikely that the decision to limit the degree of autonomy in future weapon systems will benefit the United States strategically or make soldiers and civilians on the battlefield any safer. It is also unclear whether this pronouncement is the product of genuine concern about the legal and ethical implications of employing LAWS. This paper will explore the validity of these decisions. Ironically, the only DoD policy concerning fully autonomous weapon systems neither bars their development nor their use.

Published in November 2012, DoD Directive (DODD) 3000.09 assigns responsibilities for the development and use of autonomous functions in weapon systems, to include manned and unmanned systems.[19] The policy states that autonomous and semi-autonomous weapon systems shall be designed "to allow commanders and operators to exercise appropriate levels of human *judgment* over the use of force" rather than human *control,* which is an important distinction to note.[20] The directive largely focuses on ensuring that systems are designed with safeties and control mechanisms, such as system deactivation, that allow human intervention in the event of a malfunction or system degradation. Similarly, the policy directs that rigorous operational hardware and software testing be performed to ensure system integrity from compromise and tampering.[21] Of note, DODD 3000.09 states that in the event an autonomous system is unable to complete an engagement consistent with its orders, it either terminates the engagement or seeks additional instructions before continuing.[22]

Department of Defense Directive 3000.09 also defines three categories of autonomous systems differentiated by degree of autonomy. *Semi-autonomous* weapon systems include manned or unmanned platforms and munitions that may apply lethal and non-lethal force, but require a human in the decision loop to select targets for engagement.[23] *Human-supervised* autonomous weapons require a human on the decision loop with the capability to intervene and even terminate the activities of an autonomous system if required.[24] Finally, *fully autonomous* weapon systems are those that once activated, require no human interaction in the decision loop to select and engage targets.[25]

The directive currently limits the use of human-supervised autonomous weapon systems to the engagement of targets associated with the defense of manned installations and platforms when the interception of an attack is of a time critical or overwhelming nature.[26] Human targets may not be engaged in this mode of operation. Likewise, fully autonomous systems may only apply non-lethal, non-kinetic force such as cyber operations or electronic warfare activities against an adversary.[27] This review of DoD policy and strategy has provided a valuable framework for examining the validity of the legal and ethical objections to lethal autonomy in warfare.

A logical start point for discussing the legal and ethical issues is by examining the current laws that regulate their use. The DoD Law of War Manual declares that it is illegal to use weapons that are "inherently indiscriminate" or "cause superfluous injury," such as biological weapons.[28] Under international law, certain types of weapons may only be employed under specific conditions. Cluster munitions are a common example of a conditions-based weapon that has the potential to be illegally employed. Under the Law of War, autonomous weapons are legal weapons and require no restrictions for their use.[29] The manual also notes that people, not machines or weapons, are required to comply with these laws. The *jus in bello* obligations of proportionality and distinction in the conduct of war cannot be imposed upon inanimate objects.[30] It is the combatant employing the autonomous weapon who is responsible for ensuring that its use will not cause excessive or incidental harm. Regardless of how accountability for the actions of LAWs is assigned, concerns over the conduct of war on the battlefield remains the most common objection.

This objection centers around the belief that removing the soldier from the battlefield or airman from the cockpit of an aircraft decreases the ability to adhere to *jus in bello* principles. The basis of this argument suggests that humans will act more ethically than a machine that lacks beliefs, feelings, and an appreciation for the sanctity of life. However, this argument seems to discount man's inhumanity to man on and off the battlefield since the beginning of recorded history. A 2006 report from the U.S. Surgeon General's Office assessed the battlefield ethics of U.S. ground forces (soldiers and Marines) deployed during Operation Iraqi Freedom and identified some disturbing findings:

1. Over one third of U.S. troops reported torture was permissible in order to save a life or extract important information.
2. Only 37 percent of U.S. troops agreed they would report a unit member for destroying private property.
3. Only 42 percent of U.S. troops agreed non-combatants should be treated with dignity and respect.
4. Less than 50 percent of U.S. troops agreed that they would report a service member who had killed or injured an innocent non-combatant.
5. Almost one third of U.S. troops reported facing ethical situations that they were not prepared to respond to.
6. Those experiencing anger were twice as likely to engage in unethical behavior.[31]

For any military professional, these findings are difficult to read but are by no means a condemnation of the U.S. military institution. The ethical transgressions cited

by the Surgeon General are not unique to the Army or warfare in the 21st century and, arguably, no country's armed forces have completely avoided such behaviors in battle. There are a number of explanations for these behaviors that run the gambit from combat stress and dehumanization of the enemy to revenge and poor training. Perhaps autonomous weapon systems on the battlefield could do better.

In a 2010 article entitled "The Case for Ethical Autonomy in Unmanned Systems," Ronald Arkin offers six reasons why autonomous weapon systems may be capable of outperforming humans on the field of battle.[32] The first reason is that autonomous systems will not be compelled to place self-preservation above ensuring that they have properly identified an enemy combatant and will thus avoid the "shoot-first, ask-questions later" scenario.[33] Second, the use of robotic sensors and optics will enable such systems to observe and discriminate better than humans.[34] Third, a robot is not encumbered with the emotions of a human and will not suffer lapses in judgement due to fear, anger, or frustration.[35] Forth, unlike humans, robots are not susceptible to patterns of behavior such as "scenario fulfilment" and confirmation bias in decision making.[36] Fifth, autonomous systems can access, process, and integrate information more quickly and accurately than humans.[37] Finally, Arkin suggests that the teaming of humans and autonomous weapon systems on the battlefield may allow for objective monitoring of ethical behavior and reduce human violations.[38]

The potential ethical benefits suggested by Professor Arkin are but a few of the advantages of employing autonomous weapon systems on the battlefield. Robots can be designed with the capabilities to act quicker and with greater precision than humans. They can operate in austere and toxic environments such as terrain contaminated by

radiation, biological, or chemical weapons. The costs associated with deploying and sustaining these systems could also be cheaper than deploying potentially multiple soldiers to execute the same mission. While the current immaturity of autonomous technologies prevents the scientific community from conclusively demonstrating how fully autonomous weapon systems could improve the ethical character of war, the results to date are promising.

The next aspect of just war theory that merits examination are objections that the use of LAWS will erode the *jus ad bellum*, or just cause aspects of warfare. There are two principal facets to this objection. First, the introduction of autonomous weapon systems, in lieu of humans, creates a degree of asymmetry related to over-match that would encourage aggression rather than seeking other forms of conflict resolution. While this aspect of the objection seems plausible on the surface, it remains totally at odds with the core principles of *jus ad bellum*. The Charter of the United Nations provides the legal framework and rationales that justify resorting to force. The United States has never been accused by the United Nations Security Council (UNSC) of committing a war of aggression. Even aggressor states have sought to legitimize their actions by tying them to the rationales for using force. These rationales include self-defense, UNSC-directed action to restore or maintain peace, humanitarian intervention, and the consent of the territorial state.[39] Additionally, it is difficult to conceive of a scenario where the existence of overwhelming military asymmetry between two nations could be used to subvert any of these rationales. The other facet of this objection suggests a U.S. feeling of impunity would grow as the risk of danger to U.S. troops is reduced.

Concerns over impunity are not unique to the use of autonomous weapons in warfare but have been vocalized each time advancements in the tools of war moved the warrior farther from the battlefield. Impunity from one's actions suggest that an individual is exempt from punishment or accountability for his or her actions, typically predicated upon wrongdoing. If one agrees with this description of impunity, then for it to be present, two conditions must exist: an illegal act and a lack of accountability. As discussed earlier, the DoD Law of War Manual categorizes autonomous weapons as legal weapons and places no restrictions on their use, thereby invalidating this argument. It is similarly baseless to suggest that merely the use of autonomous systems creates a lack of accountability.

Autonomous systems are still just machines. Relationships exist between the autonomous systems and the programmer that designed its software, the operator that activated the system and provided its mission instructions, and the leader that directed its employment. If the use of an autonomous system resulted in unintended consequences, such as the death of a non-combatant on the battlefield, the incident would require an investigation to determine the circumstances underlying the event. A human chain of responsibility exists to provide the requisite accountability. Commanders will still be held responsible for violating the laws of war, exercising poor judgment, and accepting unnecessary risk. Operators and programmers will be held responsible for negligence and avoidable human error. When a plane crashes due to mechanical failure, liability for the associated deaths is determined in accordance with the circumstances of the event. The aircraft manufacturer is not automatically held responsible for the accident, neither is the airline for faulty maintenance, nor the pilot for

his actions. The source of failure is always situationally dependent. However, there are some changes in the character of decisions that may complicate determining the degree to which those in the chain of responsibility should be held accountable.

Tim McFarland, a PhD candidate at the Melbourne School of Law, suggests that "the key legal distinction between autonomous systems and other complex military systems is that machine autonomy affects the process of deciding to perform an action, whereas other complex systems have an effect only after a decision has been made."[40] This means that holding the military decision maker solely responsible for an event may now give way to a diffusion of responsibility between the decision maker, the programmer, and potentially the operator. This diffusion of responsibility ultimately changes the character of the decision.[41] According to McFarland this change alters decisions in three ways:

1. The generalization of decisions grow from what were largely, human decisions regarding specific situations to broader policy-like decisions influenced by programmatic instructions.
2. The timing of decisions will change from the point at which a situation arises to the point when the behavior and directives were programmed into the LAWS.
3. Depending upon the degree of autonomy, the informational basis upon which decisions are made will not be based upon direct observations, but will be based upon the information and forethought available at the time of programming.[42]

These phenomena change the causal relationship between the human decision maker and the action taken by the autonomous system.[43] While any changes to military-decision making would require modifications to the legal system, the law will continue to be the dominion of people, not machines. Challenges to the employment of autonomous weapon systems should not cause a preemptive ban of the technology, as some would suggest. A sub-component of accountability is the need to begin establishing trust in these systems.

The DoD's Defense Science Board, an advisory committee established to provide technical advice to the Secretary of Defense, recently completed a comprehensive study on autonomy. They identified the issue of building trust in autonomous systems and trustworthiness with future human counterparts to be among the most critical areas of focus moving ahead.[44] The study points out that, while significant breakthroughs in the development of commercial systems can be leveraged for military applications, commercial design "rarely considers the possibility of high-regret outcomes in complex, unpredictable, and contested environments" required to operate effectively in a combat zone.[45] These are by no means insurmountable challenges as advances in artificial intelligence continue to break barriers in learning, adapting to, and effectively operating in environments never conceivable just a few years ago.

One of the latest breakthroughs occurred in February 2017, when an artificial intelligence program named Libratus beat the world's best poker players in a 20-day, No-Limit Texas Hold'em tournament.[46] What is significant about this achievement is that not only is poker one of the most complex games in terms of possible outcomes (10 to

the power of 160) but it is also an incomplete-information game full of unknowns and ambiguity, such as bluffing.[47] This challenge was overcome with a mathematical algorithm designed to learn both from weaknesses in the opponent's strategy and weaknesses in its own strategy that were exploited by the opponents.[48] In similar fashion, other scientists are making progress in creating ethical robots using algorithms built around logical programming statements, which are the basis by which humans reason and make ethical choices.[49] These efforts also include creating logic programs that can make decisions based upon the doctrines of double and triple effect. The doctrines will allow an autonomous system to see the potential outcomes of its actions and take into account "whether the harm caused is the intended result of the action."[50] An example of double effect is an autonomous system acknowledging that it may have to cause incidental injury during the act of pushing a human out of the away of an oncoming car in order to save them from greater harm. A government funded project is also underway to verify that the outcomes of ethical programs are predictable. Predictability provides a way to verify the reasoning behind the actions of an autonomous system and may effectively bridge the trust issue.[51]

Despite the pervasiveness of technology and the degree to which it is relied upon to consistently perform critical functions in society, there remains a natural inclination to fear for the worst. Many of the objections to pursuing autonomous technologies, while seemingly convincing, are logically flawed. This information, while not obvious to the casual observer, is known to the academic and scientific communities. Despite the availability of this knowledge, last year more than 1,000 scientists and technologists, to include Stephen Hawking and Elon Musk, signed a letter advocating an international

ban of LAWS suggesting that they might create an arms race.[52] This action would have benefited from a critical look back at some previous attempts to ban emerging technologies.

Lieutenant Colonel Shane Reeves and Major William Johnson, both Judge Advocates at the United States Military Academy, co-authored a paper about the failures of campaigns to ban weapons and the resulting dangers that ensued. A well-known example was the ban on the practice of aerial bombardment that begun shortly after the introduction of the hot air balloon in the late 18th Century.[53] A series of prohibitions brokered during The Hague Conventions of 1899 and 1907 stifled the research of some 24 countries while others continued to develop this military capability.[54] Less than four decades later, aerial bombardment became a critical component of World War II and a mainstay of war. Unfortunately, prohibitions prevented what would have allowed the development of technologies to improve bombing accuracy and bring "aerial bombardment into compliance with existing laws of armed conflict."[55] The result was that hundreds of thousands may have died due to inaccurate and often indiscriminate aerial bombing.[56] Ironically within a matter of decades following the end of the war, technologies were developed to distinguish military targets within meters of a civilian object.[57]

The authors conclude their article by warning those crusading against autonomous weapons to avoid making the same mistake that their predecessors made. Say Reeves and Johnson,

> Autonomous weapons will be a reality, and if their use means winning the war, they will be used. But they can be made better. The technology needs to be

pushed in front of the necessity before valuable time and a purposeful direction are lost.[58]

Similarly at risk is the ability of the United States to provide an effective defense against the emerging technologies of adversarial nations.

As previously noted, one of the most significant challenges to DoD's successful implementation of the 3OS is the low cost, rapid speed, and ubiquitous nature of technological development in the current operating environment. In an article entitled "Deterring Emergent Technologies," authors John Geis and Theodore Hailes cite statistics that show that the United States and DoD have, over the past 50 years, lost their monopoly on technological development.[59] Their data indicates that today only 30 percent of research funding world-wide is occurring in the United States and 70 percent of that research is a commercial rather than government efforts.[60] They also report that less than four percent of modern technological research is conducted under the direction of the DoD and equates to a 46 percent reduction since the 1960s.[61] Equally concerning is the rate of technological advancement that the world is experiencing.

The article suggests that the 21st century will experience 1,000 times the technological change that occurred in the previous century.[62] In such an environment, the challenge of maintaining sustained overmatch or a qualitative military edge is daunting and self-imposing restrictions on the development and use of technologies that offer more potential for good than harm is unfathomable. Even DEPSECDEF Work is quick to point out that in a "world of fast [technology] followers" sustained overmatch cannot be maintained without seizing and maintaining the initiative by leveraging

innovative breakthroughs.[63] Both the allies and adversaries of the United States are actively pursuing efforts to fully leverage these technologies.

In late January 2017, during a meeting of the Russian military-industrial commission, the Russian president publicly endorsed the development of robotic weapon systems.[64] Mr. Putin was quoted as stating, “These systems could radically change the spectrum of weaponry for the general purpose forces,” and pointed out that these efforts must be informed by “the clear understanding of the potential conflict’s nature and mainstream trends in the development of armed forces both globally and domestically.”[65] The timing of Putin’s announcement was not coincidental, since two weeks earlier, news services had reported that KB Integrated Systems, a Russian weapons manufacturer, had developed a backpack sized combat robot.[66] The light tactical robot, referred to as the RS1A3 Mini Rex, is armed with 7.62 mm caliber automatic weapons, can climb stairs, and operate in most environments for up to 15 hours without requiring a recharge.[67] While this robot is reported to be remotely controlled, the manufacturer suggests that “the transition to autonomous control of such a weapon is often blurred...” which may simply be a clever way of stating that the development of that capability is well underway.[68] Even some of the United States’ closest allies are developing and have deployed autonomous weapon systems.

As early as 2010, South Korea was testing weapons platforms capable of autonomous engagement along the demilitarized zone (DMZ).[69] Today, these sentinel robots are not only permanently installed there, but are being utilized by allies such as Israel with similar, security challenges.[70] While these countries publicly claim that the systems are not being operated in autonomous modes, the capability exists and its

continued technological refinement is not being hampered by unnecessary regulation. These countries' decisions to move forward with their pursuit of autonomous weapons have served two purposes. The first is a capability that enhances the security posture along their borders. The second is the creation of a new form of deterrence with respect to their adversaries.

The effective application of deterrence theory requires a threat, usually in the form of a superior or overwhelming capability, combined with the ability and willingness to execute said threat. Colin Gray, author of "Gaining Compliance: The Theory of Deterrence and its Modern Application," suggests that among the ingredients critical to successfully executing deterrence is ensuring that the adversary "is not denied the knowledge that should dissuade him."[71] A rather humorous example offered by Gray is provided in the movie *Dr. Strangelove* where the United States was "not deterred by the Soviet Union's Doomsday Machine, which guaranteed Armageddon for everyone on Earth, because it did not know that the device existed."[72] So, if the DoD is waiting for a more palatable time to announce the pursuit of lethal autonomous weapon systems then the secrecy is undermining its potential value as a deterrent.

Gray also notes that "the less attractive our military options are believed to be, the greater the incentive to ramp up perceptions of determination."[73] In this case, the author seems to be speaking to the credibility aspect of deterrence theory which requires a unified commitment to use a technology or capability. Here again the U.S. is missing an opportunity to leverage the deterrence potential of a technology that promises to drastically change the character of war. It is conceivable, for example, that the deployment of LAWS to countries under threat from Russian incursion by irregular

and proxy forces could serve as a credible deterrent against such action. Changing course on the pursuit of lethal autonomous weapons will require a successful implementation strategy to allay some of the concerns discussed in the analysis.

The DoD should lead the effort in developing reliable systems that can be trusted to operate among its forces and as technologies mature with less and less human control. The pace and ubiquity of technological development would suggest that waiting until American society fully embraces autonomous systems before the DoD can exploit their full potential is unwarranted and risky. There are many weapon systems currently in the inventory that already operate semi-autonomously, such as the Tomahawk Land Attack Missile or the Patriot Missile System. There are even systems that possess characteristics of a human-supervised autonomous weapon system, like the Counter Rocket, Artillery and Mortar System used for base defense against indirect fire. Pursuit of similar human-on-the-loop systems for offensive use should be the next priority.

One such near-term goal might be the development of a weapon system with scalable degrees of autonomous lethality. The degree of autonomy would be driven by the conditions on the ground. As the danger to U.S. troops in contact increased, the commander of an autonomous weapon system could use his authority to increase the degree of autonomy. This is just one approach to the incremental and responsible development of such technologies. Coupled with investments in continued research and development, the DoD must pursue a strategic communications campaign (SCC) that encourages a positive societal view of autonomy while simultaneously deterring all adversaries. The latter is accomplished by communicating the intent to fully leverage these capabilities in order to defend the nation, its interests, and allies.

Given the historical bias against and fear associated with autonomy that seems to exist in U.S. society, the SCC must promote the benefits of autonomous systems and showcase advancements in trust, reliability, and security of related research and development programs. The SCC must also focus efforts to discredit counterfactual narratives. The DoD has an obligation to be transparent with its intent and activities. The SCC should complement and keep pace with the successful infusion of non-lethal, commercial autonomy in society as well. Similarly, the deterrence narrative requires the promotion of the life-saving benefits of autonomous weapon systems rather than the lethality of them. Adversaries can be effectively deterred by the realization that there may no longer be U.S. troops on the battlefield to harm. The idea of a battlefield filled with heavily armed drones and lethal autonomous ground vehicles swarming enemy fighting positions is a reality that requires no additional promotion.

Technology will continue to shape the world and the manner in which war is waged. Countless books have chronicled the winners and losers in both business and battle which were often determined by their willingness to adapt to change and lead rather than follow innovation. The use of LAWS in the conduct of war has the potential to revolutionize warfare. Given the rapid pace of change, late adopters will not just fall behind—they will be left behind. In the context of national security, the consequences of failing to lead this effort means that potential adversaries get to define the rules of engagement. The DoD cannot allow fear, bias, and counterfactual objections to stymie its efforts to responsibly develop and employ lethal autonomous weapon systems. It must lead the effort, own the narrative, and guide the future use of LAWS. Dr. Leon Megginson, a social scientist from Louisiana State University, expressed a truism of life

that seems to have been forgotten, “It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.”[74]

Endnotes

[1] Isaac Asimov, “Runaround,” March 1, 1942, http://web.williams.edu/Mathematics/sjmiller/public_html/105Sp10/handouts/Runaround.html (accessed February 1, 2017).

[2] Carl von Clausewitz, *On War*, ed and trans. Michael Howard and Peter Paret, ind. ed. (Princeton: Princeton University Press, 1984), 89.

[3] General Council of the Department of Defense, *Law of War Manual* (Washington, DC: U.S. Department of Defense, June 13, 2015), 1, https://www.defense.gov/Portals/1/Documents/DoD_Law_of_War_Manual-June_2015_Updated_May_2016.pdf (accessed January 26, 2017).

[4] Ibid., 50.

[5] MIT Technology Review, “Do We Need Asimov’s Laws?” May 16, 2014, https://www.technologyreview.com/s/527336/do-we-need-asimovs-laws/ (accessed January 10, 2017).

[6] Ibid.

[7] Asimov, “Roundaround.”

[8] Ibid.

[9] Ibid.

[10] Ibid.

[11] Ibid.

[12] Daniel Fiott, “Europe and the Pentagon’s Third Offset Strategy,” *The Rusi Journal* 161, no. 1 (March 16, 2016): https://rusi.org/publication/rusi-journal/europe-and-pentagon%E2%80%99s-third-offset-strategy (accessed February 15, 2017).

[13] Ibid.

[14] Ibid.

[15] Center for Strategic and International Studies Panel, “Part 1: Defining the Offset Strategy,” November 18, 2016, *YouTube*, video file, https://www.youtube.com/watch?v=jaSPSDRFGBY (accessed February 22, 2017).

[16] Ibid.

[17] Ibid.

[18] Matthew Roenberg and John Markoff, “The Pentagon’s ‘Terminator Conundrum’: Robots That Could Kill on Their Own,” *New York Times Online*, October 26, 2016, http://nyti.ms/2eApcwz (accessed on November 29, 2016).

[19] Ashton B. Carter, *Autonomy in Weapon Systems,* Department of Defense Directive 3009.09 (Washington, DC: U.S. Department of Defense, November 21, 2012), 1.

[20] Ibid., 2.

[21] Ibid.

[22] Ibid.

[23] Ibid., 14.

[24] Ibid.

[25] Ibid.

[26] Ibid., 3.

[27] Ibid.

[28] General Council of the Department of Defense, *Law of War Manual*, 316-317.

[29] Ibid., 318.

[30] Ibid.

[31] Ronald C. Arkin, “The Case for Ethical Autonomy in Unmanned Systems,” *Journal of Military Ethics* 9, no. 4 (December 16, 2010): 335.

[32] Ibid., 333.

[33] Ibid.

[34] Ibid.

[35] Ibid.

[36] Ibid.

[37] Ibid.

[38] Ibid., 334.

[39] General Council of the Department of Defense, *Law of War Manual*, 43-45.

[40] Tim McFarland, “Factors Shaping the Legal Implications of Increasingly Autonomous Military Systems,” *International Review of the Red Cross* 97, no. 1 (November 21, 2016): 1333,

https://www.icrc.org/en/international-review/article/factors-shaping-legal-implications-increasingly-autonomous-military (accessed February 14, 2017).

[41] Ibid.

[42] Ibid., 1334-1335.

[43] Ibid.

[44] Defense Science Board, *Summer Study on Autonomy* (Washington, DC: Under Secretary of Defense for Acquisition Technology and Logistics), 1.

[45] Ibid.

[46] Tia Gose, "All in: Artificial Intelligence Beats the World's Best Poker Players," *Live Science,* February 1, 2017, http://www.livescience.com/57717-artificial-intelligence-wins-texas-hold-em.html (accessed February 21, 2017).

[47] Ibid.

[48] Ibid.

[49] Boer Deng, "The Robot's Dilemma, Working out How to Build Ethical Robots is One of the Thorniest Challenges in Artificial Intelligence," *Nature - International Journal of Science* 523, no.7558 (July 1, 2015): http://www.nature.com/news/machine-ethics-the-robot-s-dilemma-1.17881 (accessed February 21, 2017).

[50] Ibid.

[51] Ibid.

[52] Geoff Dyer, "Pentagon Rules out 'Terminator Troops': Combat Robots," *Financial Times*, April 28, 2016, https://search-proquest-com.usawc.idm.oclc.org/docview/1792237538?accountid=4444 (accessed February 11, 2017).

[53] Shane R. Reeves and William J. Johnson, "Autonomous Weapons: Are You Sure These Are Killer Robots? Can We Talk About It," *The Army Lawyer*, April 1, 2014, 28.

[54] Ibid.

[55] Ibid., 29.

[56] Ibid.

[57] Ibid.

[58] Ibid., 30.

[59] John Geis and Theodore Hailes, "Deterring Emerging Technologies," *Strategic Studies Quarterly* 10, no. 3 (Fall 2016): 49, http://www.airuniversity.af.mil/Portals/10/SSQ/documents/Volume-10_Issue-3/Geis.pdf?ver=2016-12-05-210259-130 (accessed February 16, 2017).

[60] Ibid.

[61] Ibid.

[62] Ibid., 47.

[63] Center for Strategic and International Studies Panel, "Part 1: Defining the Offset Strategy."

[64] "Putin Proposes Development of Robotic Weapons in Russia: Russia Defense," *EFE News Service,* January 26, 2017, https://search-proquest-com.usawc.idm.oclc.org/docview/1861840402?accountid=4444 (accessed February 20, 2017).

[65] Ibid.

[66] Thai News Service Group, "Russia: Military Prodigy: Russia Develops Advanced Light Tactical Robot," *Asia News Monitor*, January 15, 2016, https://search-proquest-com.usawc.idm.oclc.org/docview/1756630368?accountid=4444 (accessed February 20, 2017).

[67] Ibid.

[68] Ibid.

[69] Keith Wagstaff, "Future Tech? Autonomous Killer Robots are Already Here," *NBC Tech*, May 15, 2014, http://www.nbcnews.com/tech/security/future-tech-autonomous-killer-robots-are-already-here-n105656 (accessed February 29, 2017).

[70] Ibid.

[71] Colin S. Gray, "Gaining Compliance: The Theory of Deterrence and its Modern Application," *Comparative Strategy Journal* 29, no. 3 (July 22, 2010): 279.

[72] Ibid.

[73] Ibid.

[74] Leon C. Megginson, "Lessons from Europe on American Business," public speech, Southwestern Social Sciences Convention, San Antonio, TX, April 12, 1963.