

Harvard University

Artificial Intelligence and Lethal Autonomous Weapons:
A Policy Recommendation

Jefferson Bowers

Michael Ellinger

Tas Islam

Eric Noland

Policy Analysis Capstone

In Partial Fulfillment of the Requirements of the ALM

May 10, 2020

Table of Contents

EXECUTIVE SUMMARY	4
INTRODUCTION	5
A NARRATIVE OF JUSTIFICATION	8
A LEGISLATIVE HISTORY	12
A HISTORY OF AUTOMATION IN WAR AND THE MARCH TOWARD AUTONOMY	12
THE DOD'S RESPONSE TO AUTONOMOUS WEAPONS	14
REGARDING THE UNITED STATES' FORMAL LEGISLATIVE HISTORY	16
POTENTIAL BIASES AND UNIQUE PERSPECTIVES	21
A DISCUSSION OF CURRENT AND POTENTIAL STAKEHOLDERS	23
THE DEPARTMENT OF DEFENSE AND THE MILITARY INDUSTRIAL COMPLEX	24
NEAR PEER STRATEGIC COMPETITORS	24
AMERICA'S GEOSTRATEGIC INFLUENCE	25
FOREIGN PERCEPTIONS OF AMERICAN INFLUENCE	27
METHODOLOGIES AND SOURCE MATERIAL	28
SOME POTENTIAL LIMITATIONS TO OUR RECOMMENDATION	31
EXISTING SECURITY CLASSIFICATIONS	31
THE LEGITIMATE MILITARY CAPACITY OF NEAR PEER COMPETITORS	32
OUR PRIMARY RECOMMENDATIONS	34
MAINTAIN THE STATUS QUO	34
INCENTIVIZE MARKET PARTICIPANTS	35
EXPAND OVERSIGHT - LEGISLATION AND THE NSCAI	37
A BRIEF SET OF POTENTIAL ALTERNATIVES	39
DEMAND WEAK, OR EVEN COMPLETELY RESTRICT, DEVELOPMENT	39
DEVELOP WITH CAUTION	40
ACCELERATE DEVELOPMENT	40
CONCLUSION	41
APPENDIX A	44

APPENDIX B	46
APPENDIX C	48
REFERENCES	49

EXECUTIVE SUMMARY

Artificial intelligence (AI) and lethal autonomous weapon systems (LAWS) are experiencing ever-increasing use on the battlefield. However, there are significant moral and ethical concerns regarding war, the act of killing, and machine decision making. Simultaneously, there are moral and ethical concerns regarding the responsibility of our elected officials to maintain American leadership within these technological realms while protecting the American public, and the American Way of Life.

First, we justify the nature of this increasingly relevant issue while providing a brief legislative history that helps to frame artificial intelligence and autonomous weapons narrative. Next, we discuss the stakeholders we considered while investigating our potential recommendations, those limitations that may impact our endorsement's accuracy, as well as the methods by which we came to our conclusions.

We will conclude by providing three policy recommendations. The first being that the United States must maintain the technological lead. Secondly, we must further incentivize developers and manufacturers to construct reliable machines that operate within the moral and ethical parameters outlined within the law of war. Finally, we recommend expanding the expertise-driven oversight apparatus presided over by the National Security Commission on Artificial Intelligence (NSCAI). We do not consider any of the three recommendations to be overtly contentious, politically unfeasible, nor overly expensive. Furthermore, we postulate that the United States of America is thoroughly capable of maintaining its innovative stride for the duration of this security dilemma, while simultaneously improving its international relationships and driving the development of an ethically appropriate and morally substantial international legal framework that might govern the future use of these weapon systems.

INTRODUCTION

What we consider “operative” artificial intelligence (AI) *in practicum* can no longer be considered novel nor obscure. Self-driving cars, facial/voice recognition software, and recreational drones are no longer considered exceptional. In many ways, they have become the rule. For the most part, they go unnoticed and are misunderstood, yet they have proven themselves to be extraordinarily capable. While their specialized algorithms rapidly evolve, they continuously gather and digest untold information, all the while assessing patterns and making complex decisions at tremendous speeds. Their modern-day capabilities were honed via repetitive competition, as they independently observed and eventually learned how to play complex human strategy board games such as *Go* and *Chess*. Recently, the combination of deep learning algorithms, computational power, and unlimited access to large swaths of data have demonstrated that today’s AI is no longer bound by the logical parameters of an 8x8 or 19x19 virtual grid. Dominant performances over human competitors during “No Limit Texas Hold ‘Em” poker tournaments demonstrate that human cognitive processes such as insight and discernment are no longer entirely our own.

We are now faced with the reality that the earliest logical decision tree algorithms have now crossed over into the human realm. If anything, today’s AI has thoroughly demonstrated that once it learns the rules of a game, humanity can no longer expect to compete with it at any discernible level. The days of marveling at Chess Grandmasters going toe-to-toe with IBM’s Deep Blue computer have forever fallen by the wayside. Speed kills, and today’s artificial intelligence wholly surpasses the cognitive capacity of human beings, leaving us to make sense of the veritable asymmetry left in its wake. The presence of malevolent actors notwithstanding, open-source availability of AI algorithmic source code to millions of computer users poses at

least some threat to the normative interactions of governments and formal institutions. At the extreme end of the spectrum, the presence of AI-driven Lethal Autonomous Weapons Systems (LAWS) now calls us to question whether this technology poses an existential threat to our globalized society. Because it is so closely linked to our own, AI's full potential has yet to be realized, yet given its well-documented evolution, we would be prudent in assuming that it might one day severely impact the overall nature of the human conflict. AI and LAWS are both in their infancy.

To illustrate AI's wartime potential, allow us to submit three current examples that seemingly embody this new technological reality: Israel, America's closest regional ally in the Middle East, maintains and deploys a fire and forget anti-radar loitering drone designated as the "Harpy." Once launched, Harpy (and its onboard ordinance) are programmed to autonomously seek and destroy any radar signal operating within the parameters of a pre-specified bandwidth. Upon discovering the desired signature and ensuring that the signal fits within its parameters, it terminates its flight path at the source of the signal, effectively destroying whatever object it deems responsible for broadcasting it. In short, Harpy acts as an unmanned kamikaze drone. It is entirely unknown whether or not the target's proximity to human beings plays a significant part in Harpy's decision-making paradigm.

Next, ten years ago, South Korea unveiled its first fully autonomous weapon system. The Super Aegis II is an autonomous machine gun fully capable of tracking, targeting, and engaging ground-based targets at a range of up to four kilometers, all without human input. These are common along the North Korean/South Korean demilitarized zone.

Not to be outdone, Russian defense manufacturer JSC Kalashnikov Concern publicly stated that it is developing an unmanned aerial vehicle (UAV) that is autonomously driven by

state-of-the-art neural network software. This drone is rumored to maintain the capacity to make its own targeting judgments without *any* human intervention whatsoever. The development of these weapon systems closely parallels future strategies laid out by our near-peer adversaries. In 2017, while speaking to a group of schoolchildren, Russian Federation President Vladimir Putin made the disconcertingly prophetic statement that “artificial intelligence is the future, not only for Russia but for all humankind...whoever becomes the leader in this sphere will become the ruler of the world.”¹

Efforts to develop and deploy AI-driven Lethal Autonomous Weapons against the complexity of today’s modern battlefields have already begun. Be that as it may, any best practices or lessons learned through either independent and collective efforts of global powers such as the United States, the European Union, Russia, China, and even a few Middle Eastern nation-states are rarely shared, let alone distributed. Moreover, associated battlefield environments are not limited to the traditional domains that govern physical combat. Rather, LAWS may accomplish strategic objectives that other weapons throughout history could not, by essentially redefining and in some circumstances altogether casting aside the restraints of traditional wartime domains. It is a near certainty that AI-driven LAWS will continue to evolve within the existing physical framework and/or parameters associated with modern combat (land, air, and sea), but their digital anatomy suggests that they will also navigate and influence the less observable domains of cyber and space warfare. Upon closer examination, it does, in fact, seem that the historically distinct and observable spectrums that govern human conflict are quickly becoming proletariat fragments of the last two decades. As it stands today, the United States is

¹ Tass, “Putin notes importance of developing AI technology for quick decisions,” Russian News Agency, May 30th, 2019. <https://tass.com/science/1060846>

woefully underprepared to address the potential legal, ethical, and political ramifications of this emerging technology.

The presumptive, yet conceivably existential risk associated with the rapid and unchecked progress of these weapons, coupled with the raw computational capacity that characterizes modern “task-oriented” AI have already proven effective *despite* the overall lack of an emergence of a “Strong-AI” framework-one can make decisions outside the scope of its original programming. Therefore, to maintain a realistic geostrategic technological hegemony, the United States requires a robust and continued command over the tangible scientific and industrial environments deemed pertinent to the advancement of artificially intelligent autonomous weapons platforms. We must also endeavor to accomplish this task righteously, by incorporating and leveraging an ethical and moral policy/legislative standard that addresses the inherent risks discussed within the preceding paragraphs as well as those to come. This is not only necessary but an essential prerequisite for ensuring fruitful international cooperation and stability for decades to come.

A NARRATIVE OF JUSTIFICATION

“War is still, somehow, a rule governed activity, a world of permissions and prohibitions- a moral world, therefore, in the midst of hell.”²

The modern tools we utilize to accomplish our individual objectives and navigate our daily lives are quickly outpacing our collective ability to intuit and comprehend the potential effects they may level upon ourselves and our communities. Essentially, we have radically translated the electrical pulses that govern our central nervous systems into variables and strings, lines of code that make our decisions for us. Only within the last decade has this digital super

² Michael Walzer, *Just and Unjust Wars* (London: Allen Lane, 1978), 36

structure posed any significant challenge to the sophisticated human biological mechanisms from which it was conceived. Today our society not only allows but *expects* this technology to govern complex cognitive processes once reserved only for the human mind. Artificial intelligence now keeps track of our pace, distance and direction of travel while simultaneously influencing both ordinary citizens and decision makers occupying leadership positions at the highest echelons of national and international organizations alike. Is it any surprise then, that those perceived as distancing themselves from this technology, or attempting to independently ascertain and determine the forthcoming value of the continued unfettered propagation of the same, are met with collective howls from commentators within the public arena?

Blasphemous as it may seem to some, we believe that the forthcoming social evolution hinging upon the binary is not without consequence. For instance, research has already demonstrated that an over-reliance on GPS navigation erodes an individual's capacity to construct their own cognitive maps.³ However, simple observation also suggests that those same navigational tools developed by our largest transnational organizations may have demonstrably improved the overall efficacy of our global logistical and trade networks. Here we bear witness to the dilemmas most often associated with the inherent attributes of emerging technology...its innate potential to be of "dual-use". To clarify, these technological innovations may allot our international community the opportunity to communicate and integrate more effectively than ever before, yet that very same technology could also be re-engineered and leveraged during an offensive military campaign.

³ Maguire, E.A., Woollett, K. and Spiers, H.J. (2006), London taxi drivers and bus drivers: A structural MRI and neuropsychological analysis. *Hippocampus*, 16: 1091-1101. doi:10.1002/hipo.20233

The application of violence as a means toward achieving personal and political aims has and will likely continue to exist across two competing spectrums, the moral and the practical. While the consequences may be tangible, the moral application of violence is made up of many elements that are decidedly intangible and exist under constant philosophical tension. The practical application of violence is, on the other hand, utterly tangible and mostly a question regarding *range*. Lethal Autonomous Weapon Systems (LAWS) upend our conceptual understanding of both, and therefore provide us with four justifications for entry into this particular area of study.

First, the U.S. military's unwavering pursuit of technological superiority provides us with a rich history from which to draw. Such a storied history might also allow us to deduce future outcomes as we come closer to autonomous conflict. Second, the overall shift in the balance of power creates a strategic junction between the US, her geostrategic military superiority, and her capacity to export political-military force abroad. This junction also exists in direct competition with the geostrategic state of her near-peer adversaries. Both are routinely compounded by the mass media's ever-present and often pervasive grip on the AI narrative. Moving forward, our intent will be to directly address these issues, annotating, and analyzing their shortcomings as well as the potential windfalls of emerging autonomous weapons technology. Third, the absence of restrictive policy, legislation, and federal oversight allows for a seemingly unregulated release of LAWS related technologies. Historically, market regulation has been utilized to set precise operative boundaries for producers, suppliers, consumers, and governments. Through market regulation new industries are monitored and, in some cases, controlled to prevent the emergence of monopolistic tendencies or, at the very least, some semblance of a fair and equitable economic system.

The fourth and final justification is an exploration of the moral/ethical component. For millennia, combatants have tested each other on countless battlefields. Aside from the topography of the battlefield itself, weapons have mostly governed the proximity of clashing armies. Like all tools conceived by mankind, weapons have taken on an evolutionary process all their own. The capability to move out of range of an adversary while still inflicting casualties upon his troops is an undeniable advantage at both the tactical and strategic level. That capability is now being expanded at an unprecedented level. If we operate under the premises of *Jus Ad Bellum*⁴ and *Jus In Bello*⁵ and suppose these ideas to be legitimate and equitable, we are now faced with a unique dilemma...the undeniable transfer of lethal responsibility from man to machine.

Since its official founding at Dartmouth in 1956, the advent of artificial intelligence and machine learning have provided realistic opportunities for reducing operating costs (economic and otherwise) across a broad spectrum of industries. Machine learning and our subject corollary, Autonomous Weapon Systems (AWS), have already begun to rapidly reduce the highest conventional military costs; those normally associated with deploying a brigade level military element and its logistical component across the ocean and into the relevant theater of operations. We are experiencing an unforeseen association of enhanced performance alongside an unbridled technological evolution-allowing military solutions and the overarching costs associated with implementing them to become much cheaper. To be clear, we believe that this may lead to ethical trade-offs and a cognitive determination that the United States is willing to foot the bill for unnecessary military action. The necessity to understand, evaluate, and regulate

⁴ The aggressor is responsible for the destruction that follows the initial offensive act.

⁵ History and society judge a nation by their actions upon entering conflict. They judge the individual soldiers and commanders by observing and scrutinizing "How the war was fought." See Walzer's "Just and Unjust Wars".

the development of these complex systems should not be willfully ignored, and if that be the case, we ignore them at our own peril.

A LEGISLATIVE HISTORY

A HISTORY OF AUTOMATION IN WAR AND THE MARCH TOWARD AUTONOMY

Mankind has a long history and tremendous experience in exercising the conduct of war. One day over a millennia ago, a man-made a decision to throw a rock instead of swinging his fist. Since then, he has also sought to distance himself from that experience. The history of automation, war, and the search for the fully autonomous weapon is as robust as the history of our species. Regarding autonomous weapons specifically, we begin in the mid-nineteenth century.

During the First Italian War of Independence, several autonomous Italian regions fought against armies led by the Austrian Empire and the French Republic. On August 22, 1849, one of these Italian republics, the Republic of San Marco, surrendered to Austria after a prolonged period of siege warfare. The surrender of San Marco is not necessarily important-what is important that the Battle for San Marco was the first instance of drones used in war; shrapnel balloons would be deployed from frigates and expire over the city of Venice. In fact, an account states that “The captain of the English brig Frolic, and other persons then at Venice, testify to the extreme terror and the morale effect produced on the inhabitants.”⁶

The success of this automation would stir further progress. In 1862, Richard Gatling developed the Gatling Gun-the intent of the development is ironic; he intended to create a device that would limit the number of men exposed to the horrors he experienced during the Civil War.

⁶ Brett Holman, “The first air bomb: Venice, 15 July 1849,” Airminded, August 22, 2009.

Through the end of the nineteenth century and through World War I and II, the technological developments that would allow a single person to kill many others quickly and simultaneously, accelerated horrifyingly.

The event that provided the real impetus for today's AI/LAWS controversy, was the Cold War. From 1950-1977, to counter the Russian threat, several of the United States' premier research agencies made tremendous developments in the fields of computerization and modernization.⁷ The improvements would ultimately lead to today's modern computer systems, the Internet, an even more pronounced capacity to kill at a distance, and the first algorithms that could make a recommendation about that capacity.

The knowledge and experience of developing weapons that not only kill automatically but also autonomously, has only accelerated in the past twenty years-the nature of the Middle East has provided an unaccountable, if not lawless, atmosphere for aspiring research and development institutions, to include those outside of the United States. As countries have modernized and reinvented themselves in the 21st century-aspirations to remain competitive in the near-peer military space have grown just as drastically; 2018, Zeng Yi, a senior executive within NORINCO, China's third-largest defense firm stated that:

“In future battlegrounds, there will be no people fighting.” Zeng [predicts] that by 2025 lethal autonomous weapons [will be] commonplace and said that his company believes ever-increasing military use of AI is “inevitable [...] We are sure about the direction and that this is the future.”⁸

The transformation from the automated balloon to modern weapon systems such as Israel's Harpy, Northrop Grumman's X-47B, and Russia's Status 6 autonomous nuclear torpedo

⁷ Examples include organizations like, but certainly not limited to, DARPA.

⁸ Gregory C. Allen, “Understanding China's AI Strategy,” Center for a New American Security, February 6, 2019.

is remarkable. Their similarity is that an individual was, or is, responsible for deploying the weapon and setting conditions on its behavior. It should remain that way.

THE DOD'S RESPONSE TO AUTONOMOUS WEAPONS

*"The more you know about the past, the better prepared you are for the future."*⁹

One thing the military has shown is they are soberly focused on the impact AI will have on their operations and personnel; this understanding can be traced through ten years of Department of Defense memorandums. Moreover, since 2013, the Legislative Branch in their annual National Defense Authorization Acts has referenced autonomous weapons which have allowed the military to operate legally within the U.S. war paradigm.

The formal military policy began with a document detailing the future of Unmanned Aircraft Systems. The "United States Air Force Unmanned Systems Flight Plan, 2009-2047" lays out the vision of the future of robotic warfare and the utility of technological advances within the context of the Observe, Orient, Decide and Act (OODA) loop.¹⁰ While it was a start, this document does not contain a formal policy directive-however, it does mention the strategic advantages for computers and AI in conflict:

Advances in computing speeds and capacity will change how technology affects the OODA loop. Today the role of technology is changing from supporting to fully participating with humans in each step of the process. In 2047, technology will be able to reduce the time to complete the OODA loop to micro or nanoseconds. Much like a chess master can outperform proficient chess players, UAS will be able to react at these speeds and therefore this

⁹ Attributed to Teddy Roosevelt.

¹⁰ United States Air Force. "United States Air Force Unmanned Aircraft Systems Flight Plan 2009-2047." *Headquarters, United States Air Force*. May 18, 2009. Accessed April 6, 2020. https://fas.org/irp/program/collect/uas_2009.pdf; 16.

loop moves toward becoming a “perceive and act” vector. Increasingly humans will no longer be “in the loop” but rather “on the loop” – monitoring the execution of certain decisions.

The DOD’s first official policy statement addressing artificial intelligence and the future of autonomous weapons systems is the “2011 DOD Roadmap.” It states that human control must be maintained within the decision loop; “decisions over the use of force and the choice of which individual targets to engage with lethal force will be retained under human control in unmanned systems.”¹¹ The Roadmap does not further expand on the rules nor guidelines controlling AI or the development of LAWS. Although additional foresight in 2011 could have led to earlier adoption of specific protocol within the military ranks-what it invariably portrays is an ethical concern by the military to *not* relinquish decision-making from humans to a new technology...a machine lacking uniquely human characteristics and a fundamental understanding of decisions related to life or death.

One year after the Roadmap, the DOD laid out a definitive policy for the development of artificial intelligence generally and for autonomous weapons specifically, DOD Directive 3000.09. The 2012 Directive titled “Autonomy in Weapons Systems” had a two-tiered purpose:

1. Establishes DOD policy and assigns responsibilities for the development and use of autonomous and semi-autonomous functions in weapon systems, including manned and unmanned platforms.

¹¹ Office of the Under Secretary of Defense, “Unmanned Systems Integrated Roadmap FY2011-2036,” *Defense Technical Information Center*. October 2011. Accessed April 10, 2020. <https://apps.dtic.mil/docs/citations/ADA558615>

2. Establishes guidelines designed to minimize the probability and consequences of failures in autonomous and semi-autonomous weapon systems that could lead to unintended engagements.¹²

DOD Directive 3000.09 remains today as the US government's official policy regarding autonomous weapons systems. Its importance also lies in the precedent it set for DOD personnel and American society at large. The document did not explicitly forbid the development and implementation of LAWS but instead provides general guidance when designing and using these unmanned platforms:

Autonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgement over the use of force.¹³

This statement seems to support the idea that military leaders want to ensure humans are in the decision-making loop, maintaining a moral factor concerning LAWS. The statement also suggests that military personnel and military contractors must abide by the legal and ethical principles that govern the conduct of warfare. The military's orders to keep a human in the decision-making loop is one factor; what also must be considered is oversight and legislation from our elected officials.

REGARDING THE UNITED STATES' FORMAL LEGISLATIVE HISTORY

The major piece of legislation affirming Congress's military oversight is the annual National Defense Authorization Act (NDAA). Congress dictates the spending limit and

¹² Ash Carter, "Department of Defense Directive 3000.9," Department of Defense. July 21, 2018. Accessed April 11, 2020. <https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf>.

¹³ Carter, Ibid.

authorizes the Department of Defense to identify and set critical National Defense priorities.¹⁴ Outside of the NDAA's, Congress has devoted nominal efforts to introduce meaningful legislation into the AI and LAWS debate. Annual defense spending is crucial to National Defense, but so is oversight of the military and its defense contractors-a review of the limited legislative history is accomplished by reviewing recent NDAA's and bills introduced on the topic of AI.

From 2013 to 2018 there is minimal mention of artificial intelligence and autonomous systems in any NDAA. The 2013 NDAA was the first congressional record of artificial intelligence in any capacity. The Act referenced, "varying levels of autonomy for systems, multi-player gaming techniques, and artificial intelligence could reduce the number of personnel required to support certain training exercises for members of the Armed Forces, and thereby reduce the overall cost of the exercises."¹⁵ The 2018 NDAA contains only a single reference to Unmanned Systems, Autonomous Systems, and Artificial Intelligence. Congress deemed it appropriate for the Secretary of Defense to "establish and implement policies and procedures" for selecting and distributing work orders to multi-institution along with university faculty, staff, and students.¹⁶ NDAA's through 2018 had limited references to AI but that trend would change the following year.

The 2019 and 2020 NDAA's expanded what the military could do with Congressional funds in the field of AI. The 2019 NDAA set guidelines for the Secretary of Defense to develop

¹⁴ James Inhofe, "FY 2020 National Defense Authorization Act," *Senate Armed Services Committee*. Accessed April 13, 2020. <https://www.armed-services.senate.gov/imo/media/doc/FY%202020%20NDAA%20Executive%20Summary.pdf>; 2.

¹⁵ Howard McKeon, "National Defense Authorization Act for Fiscal Year 2013," *The House Armed Services Committee*. January 2, 2013. Accessed April 6, 2020. <https://www.congress.gov/bill/112th-congress/house-bill/4310>

¹⁶ Mac Thornberry, "National Defense Authorization Act for Fiscal Year 2018," *The House Armed Services Committee*. December 12, 2017. Accessed April 11, 2020. <https://www.congress.gov/bill/115th-congress/house-bill/2810>

a “strategic plan to develop, mature, and transition artificial intelligence technologies into operational use.”¹⁷ In addition, the DOD is to “work with appropriate officials to develop appropriate ethical, legal, and other policies for the Department governing the development and use of artificial intelligence-enabled systems and technologies in operational situations.”¹⁸ The 2019 Act also made it clear that comprehensive reports on the advancements and competitiveness in AI are to be submitted to the House and Senate Defense Committees.¹⁹ The 2020 NDAA continues with the same initiatives from 2019 plus authorizes an Artificial Intelligence Center and an AI Education Strategy to provide service members guidance in design, coding, and dealing with the ethical issues relating to AI.²⁰ This is a positive direction for congressional oversight of the military and their use of AI and LAWS; something members of Congress should build upon with other legislation beyond the annual NDAAs.

In 2019, bills related to AI were introduced but not one addressed autonomous weapon systems; they instead focused on the commercial and employment aspect of AI and its impact on American society. Topics varied from seeking to balance AI technologies against its potential to impact employment (H.R. 827),²¹ to support “the development of guidelines for the ethical development of artificial intelligence” (H.R. 153).²² Congress also showed interest in establishing a “coordinated Federal initiative to accelerate research and development on artificial

¹⁷ Mac Thornberry, “National Defense Authorization Act for Fiscal Year 2019,” *The House Armed Services Committee*. August 13, 2018. Accessed April 11, 2020. <https://www.congress.gov/bill/115th-congress/house-bill/5515/text>

¹⁸ Thornberry, *ibid*.

¹⁹ *Ibid*.

²⁰ James Inhofe, “National Defense Authorization Act for Fiscal Year 2020,” *The United States Senate*. December 20, 2019. Accessed April 8, 2020. <https://www.congress.gov/bill/116th-congress/senate-bill/1790>

²¹ Darren Soto, “AI JOBS Act of 2019,” *House of Representatives*. January 28, 2019. Accessed on April 12, 2020. <https://www.congress.gov/bill/116th-congress/house-bill/827>

²² Brenda Lawrence. “H.Res. 153 - Supporting the development of guidelines for ethical development of artificial intelligence.” *House of Representatives*. February 27, 2019. Accessed on April 12, 2020. <https://www.congress.gov/bill/116th-congress/house-resolution/153>

intelligence for the economic and national security,” (S. 1558)²³ or the federal government to “improve cohesion and competency in the use of AI by establishing an AI Center of Excellence” (S.1363).²⁴ These are all worthy subjects for public policy, but Congress is missing key legislation that specifically sets restrictions on the development and implementation of LAWS...current trends leave it to the military to decide on the policy.

In some respects, the defense committee reports obligated by the 2019 NDAA will provide needed oversight but may not be enough to satisfy adherence to ethical standards of autonomous technologies with a lethal reach. Whether this is intentional by Congress to allow the free market of AI technology to grow with little interference of regulations or simply deference to the expertise of the military, Congress has a moral responsibility to position themselves as the branch of government with oversight willing to pass restrictive legislation to limit the implementation of autonomous weapons.

The President of the United States in the roles of Commander-in-Chief and Executive Branch head, has a dual responsibility enforcing policy on AI while overseeing the DOD and supporting legislation to regulate LAWS. For their part, recent presidents have shown a concerned interest in AI and convened experts to discuss. In 2016, President Obama tasked the National Science and Technology Council’s (NSTC) Committee on Technology to pen a report on the future of AI and the future of LAWS. The report stated, “Agencies across the U.S. Government are working to develop a single, government-wide policy, consistent with

²³ Martin Heinrich, “Artificial Intelligence Initiative Act.” *The United States Senate*. May 21, 2019. Accessed April 12, 2020. <https://www.congress.gov/bill/116th-congress/senate-bill/1558>

²⁴ Brian Schatz. “S.1363 – AI in Government Act of 2019.” U.S. Senate. May 08, 2019. Accessed April 12, 2020. <https://www.congress.gov/bill/116th-congress/senate-bill/1363>

international humanitarian law, on autonomous and semi-autonomous weapons.”²⁵ In 2018, President Trump convened a summit with at least one hundred senior government officials after which the White House Office of Science and Technology Policy (OSTP) drafted a report summarizing key takeaways and federal priorities. This was followed by Executive Order 13859 in February 2019 titled, “Maintaining American Leadership in Artificial Intelligence.”²⁶ The OSTP report emphasized the Executive branch’s willingness to invest heavily in the future of AI:

The Federal Government’s investment in unclassified R&D for AI and related technologies has grown by over 40% since 2015, in addition to substantial classified investments across the defense and intelligence communities.²⁷

New AI technologies are on the cusp of becoming ubiquitous in nearly every facet of American society. The global reach and potential impact are immense and as Congressional records are reviewed, Representatives and Senators have allowed the National Defense Authorizations Acts (NDAA) to be the legislative vehicles shaping this discussion. Even within the NDAA, Congress did not seriously address this topic until 2019, whereas the military set policy for artificial intelligence and autonomous weapons systems beginning in 2011. The Defense Department has been ahead of Congress with regard to setting policy and considering the moral and ethical concerns for the use of autonomous systems in combat and how to control their development and implementation.

²⁵ Executive Office of the President, National Science and Technology Council’s (NSTC) Committee on Technology. “Preparing for the Future of Artificial Intelligence.” October 2016; 3. https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf

²⁶ Donald Trump. “Executive Order on Maintaining American Leadership in Artificial Intelligence.” *The White House*. February 11, 2019. Accessed May 5, 2020.

²⁷ White House Office of Science and Technology Policy. “Summary Report of The 2018 White House Summit on Artificial Intelligence for American Industry.” May 10, 2018; 5. <https://www.whitehouse.gov/wp-content/uploads/2018/05/Summary-Report-of-White-House-AI-Summit.pdf>

POTENTIAL BIASES AND UNIQUE PERSPECTIVES

Public opinion may not give proof-based responses to moral inquiry, particularly considering the various understandings of the inquiries and the idea of an autonomous weapon framework. However, assessments of public sentiment can start the debate and represent a noteworthy enthusiasm as well as reveal trends related to public conscience concerns. There are ethical and moral questions regarding an acceptable level of bias by the programmer. Human coded outputs and success extensions are preset by flawed human programmers. Programmers' race, ethnicity, age, and preferential background may all contribute to the coding process in which an AI tool is developed.²⁸ Moreover, private companies functioning as stakeholders fund the research and development of AI; serving the interests of those private sectors. In many cases, defense technologies are “spun off” to the civilian sector and many private sectors advanced tech developments are “spun on” to the defense sector.²⁹ This is a disturbing level of unregulated recursion, and the moral implications are profound. As discussed, in 2019 and 2020 NDAA's attempted to expand what the military could do with AI but a complex technical challenge remains...allowing any sort of regulation, law, or policy to be verified and determine whether code is “legal;” that may be near impossible.³⁰ It is also difficult to imagine that organizations would be willing to permit inspection of their code or algorithms as a verification measure.

²⁸ David Danks and Alex John London, “Algorithmic Bias in Autonomous Systems,” *Proceedings of the Twenty-Sixth International Joint Conference on Artificial Intelligence*, 2017, <https://doi.org/10.24963/ijcai.2017/654>)

²⁹ Justin Haner and Denise Garcia, “The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development,” *Global Policy* 10, no. 3 (2019): pp. 331-337, <https://doi.org/10.1111/1758-5899.12713>)

³⁰ Mac Thornberry, “National Defense Authorization Act for Fiscal Year 2019,” *The House Armed Services Committee*. August 13, 2018. Accessed April 11, 2020. <https://www.congress.gov/bill/115th-congress/house-bill/5515/text>

Government responses are often precipitated by public reactions. Therefore, public sentiment towards a lethal autonomous weapon can also shape a potential solution. In a post-pandemic world, lethal autonomy will likely empower authoritarian regimes and it may also intensify the global trend of institutional democratic retreat. While many government systems will be willing to take control of its citizens' behavioral nature, AI-enhanced monitoring systems, and robotic 'soldiers' will be the perfect tools for the despot.³¹ Gaining trust from the citizens will determine how Congress passes or restricts the implementation of autonomous weapons. These factors must be considered while making policy and legislative recommendations for lethal autonomous weapons.

The human tendencies that direct us towards conflict with one another, and our distaste for the inevitable carnage left in the wake of that conflict is indeed a brutal irony. The historical narrative is clear, we will labor and endeavor to create weapons of war that provide both strategic and psychological distance between ourselves and our enemies. Oftentimes, the creation of this technology is driven by goodwill rather than tactical necessity (such was the case with Mr. Gatling). This history is best served as a reminder to all of us that the collective effort to conceive, develop, and deploy these weapons will in all likelihood continue. However, recent surges in technological innovation and the exponential growth in capability that has followed call us to action.

As such, it is unsurprising that those who control and implement these weapons on the battlefield have brought to our attention the necessity to regulate the same. The legislative intent is clear, maintaining positive control over these systems requires human control over them. It is

³¹ Intelligence, Public Confidence and Security," Intelligence and National Security 30, no. 1 (April 2014): pp. 188-189, <https://doi.org/10.1080/02684527.2015.981981>.

also clear that we have fallen behind, and we must adjust our rate of pursuit to avoid the potential consequences that follow.

A DISCUSSION OF CURRENT AND POTENTIAL STAKEHOLDERS

The stakeholders considered for our policy recommendation are as follows: the defense department, the military-industrial complex, our strategic competitors, our geostrategic influence, and perceptions of the United States, foreign and domestic.

THE DEPARTMENT OF DEFENSE AND THE MILITARY INDUSTRIAL COMPLEX

The Department of Defense (DOD) has already made some strategic level decisions with regard to unmanned systems in general. The TEAL group, a think tank focused in defense and aerospace industries, recently released its yearly market entitled, “World Military Unmanned Aerial Systems: Market Profile and Forecast.” Teal suggests:

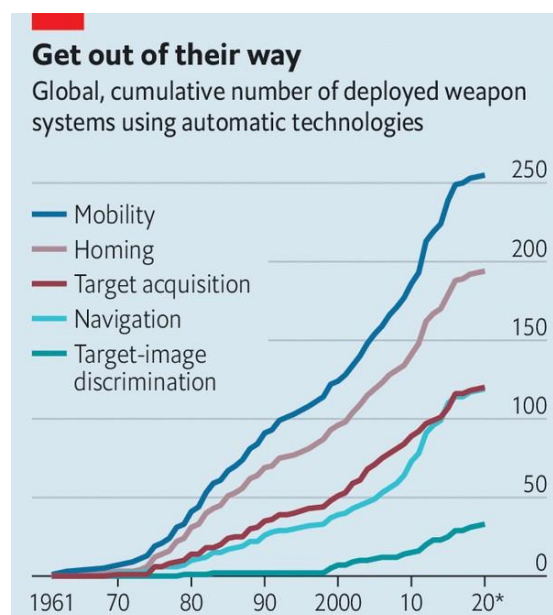
Though the military UAV sector is expected to become increasingly international the United States will continue to dominate...The United States will account for 57 percent of the unclassified research and development (R&D) spending on UAV technology over the next decade and about 32 percent of the procurement. Add in Teal’s estimates of classified U.S. spending and that jumps to 76 percent of R&D and 49 percent of procurement.³²

The spending decisions already made are not insignificant amounts of R&D and procurement. According to the Congressional Budget Office, Research Development Test &

³² Dee Ann Divis, “Military UAV Market to Top \$83B,” Inside Unmanned Systems, April 24, 2018, <https://insideunmannedsystems.com/military-uav-market-to-top-83b/>

Evaluation (RDT&E) spending on AI and LAWS by the DOD in 2018 was \$9.6 Billion and will increase to \$28.1 Billion by 2027 and double seven years later to \$53.2 Billion in 2034.³³ The military will spend an additional \$17 Billion on drones by 2021, maintaining U.S. global leadership.³⁴ As shown in Figure 1, the trend of deployed weapons globally has seen exponential growth in the market over the last 10-20 years.³⁵ There is no reason to suspect this will decrease.

Furthermore, the top four defense contractors (Lockheed Martin, Boeing, Northrop Grumman, and Raytheon) have combined annual revenue of over 200 billion dollars³⁶-except for Boeing, over 90% of that revenue is directly funded by defense contracts. With a heavy lobbyist presence in Washington, any policy that has the potential to impact the bottom line positively or negatively, will be of tremendous importance.



NEAR PEER STRATEGIC COMPETITORS

There is no ambiguity regarding the direction of Russia's future. Putin's Russia has tremendous aspiration-they have already indicated they will not comply with international norms

³³ Philip L. Swagel, "Long-Term Implications of the 2020 Future Years Defense Program," Congressional Budget Office, August 2019. https://www.cbo.gov/system/files/2019-08/55500-CBO-2020-FYDP_0.pdf

³⁴ Justin Haner and Denise Garcia, "The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development," Glob Policy, 10 (2019): 332, accessed April 28, 2020.

³⁵ Heather Roff, "Autonomous weapons and the new laws of war," The Economist, January 19th, 2019. <https://www.economist.com/briefing/2019/01/19/autonomous-weapons-and-the-new-laws-of-war>

³⁶ Sitaline Media Group, "Top 100 for 2019," Defense News, March 9, 2020, <https://people.defensenews.com/top-100/>. March 9, 2020.

to keep humans in the decision-making loop or ban AWS from combat.³⁷ There are indications of ten AI research centers in Russia; annual domestic military spending on AI is \$12.5 million.³⁸ Russia's effective military spending based on purchasing power parity is estimated to be between \$150-180 billion per year, suggesting a decided investment in AI spending.³⁹ Based on secrecy, misinformation, or low-information environment that AI budget is likely much higher, recursively justifying the DOD RDT&E annual budget.⁴⁰

The People's Republic of China has not been secretive in their plans for AI and LAWS dominance-by 2030, the state plans to become the world leader in AI development.⁴¹ China has the highest citizen support of AI at 70%, by far more than any of the top 24 developed countries investing in AI. China has an estimated \$250 billion annual weapons development budget and \$4.5 billion allocated to drones and artificial intelligence. Combine with an aggressive plan to utilize AI and AWS in combat, there is a true threat from China. Is the United States prepared to ignore the international moral and ethical norms in conflict or the threat to American influence?⁴²

AMERICA'S GEOSTRATEGIC INFLUENCE

In order to analyze American geostrategic influence as a stakeholder, several statistics need to be considered. As far back 2001, the US federal price tag for the post-9/11 war was over 6.4 trillion dollars. Over 801,000 people have died due to direct war violence, and several times

³⁷ Justin Haner and Denise Garcia, 334.

³⁸ Ibid, 334.

³⁹ Michael Kofman. "Russian defense spending is much larger, and more sustainable than it seems." *DefenseNews*. May 3, 2019. Accessed April 28, 2020.

⁴⁰ Kofman, Ibid.

⁴¹ Justin Haner and Denise Garcia, 333.

⁴² Ibid, 333.

as many indirectly.⁴³ Approximately 335,000 civilians have been killed as a result of the fighting.⁴⁴ Apart from the financial expenses and casualties, there are 21 million the number of war refugees and displaced persons.⁴⁵ Moreover, the US government is conducting counterterrorism activities in over 80 countries. The idea of ‘influence’ comes with second-order responsibilities; historically, the United States has taken post-war reconstruction responsibilities and prevented large scale decisive action conflict-the last twenty years show this is no longer only the case.

The mass production of lethal autonomous weapons will draw attention to future implications of artificial intelligence; rather than just the algorithms themselves. Advanced lethal autonomous weapons will bring advantages in geostrategic influence, but it may come at the cost of American principles and restricted civil liberties in the US and abroad-there are moral and ethical implications as well. For example, in case of an automation failure, AI tools need to establish trust among the citizens, and building trust is an important key in recommending policy for an open society. Currently, there is significant ambiguity on how much transparency and control are required to establish trustworthy AI in weapon systems. Ethically, political agenda may or may not include benefits and opportunities of lethal autonomous weapons because citizens may develop trust issues with AI; American hegemony may be questionable when weapon systems operate not as intended or applied incorrectly or inappropriately. Over the last century American geostrategic influence has been routinely reinforced by mostly effective decision makers that exist within a hierarchical chain of command. If we adopt and deploy these

⁴³ Net C Crawford, “United States Budgetary Costs and Obligations of Post-9/11 Wars through FY 2020: \$6.4Trillion,” [watson.brown.edu](https://watson.brown.edu/costsofwar/) (Watson Institute Brown University, November 13, 2019), <https://watson.brown.edu/costsofwar/>.

⁴⁴ Kristen Bialik, “How the World Views the U.S. and Its President in 2018 in 9 Charts,” Pew Research Center (Pew Research Center, October 9, 2018), <https://www.pewresearch.org/fact-tank/2018/10/09/how-the-world-views-the-u-s-and-its-president-in-9-charts/>.

⁴⁵ Net C Crawford, “United States Budgetary Costs and Obligations of Post-9/11 Wars through FY 2020: \$6.4Trillion,” [watson.brown.edu](https://watson.brown.edu/costsofwar/) (Watson Institute Brown University, November 13, 2019), <https://watson.brown.edu/costsofwar/>.

systems, we must ask ourselves if we will be, in effect, contracting out our military decision-making apparatus to an algorithm?

Deploying US military supplies and personnel to high-risk areas, and then attempting to reconstitute said areas has proven to be less influential as of late. Moreover, returns on our investment are not perceived as substantial enough to justify the principle. The Middle East, for example, continues to rank extremely low in global studies of political freedom. High rates of unemployment and war widowhood are on the rise in the region.⁴⁶ Adapting engineering standards to AI may be useful in helping to solidify American foreign influence, but engineers and policy makers must equally engage to ascertain the associated risks.

FOREIGN PERCEPTIONS OF AMERICAN INFLUENCE

While foreign perceptions of the United States are generally good, they are trending downward. As it turns out, international perceptions and overall goodwill toward Americans is on the decline. Nevertheless, there is an immense gap between how Americans view the country and how it is viewed externally. Skipping anecdotalism and polemics; a cultural, historical, and political analysis tells us that United States foreign policy is the key perception maker to the rest of the world. Biased and naive domestic realities recursively influence foreign policy and can shape anti-Americanism abroad. Furthermore, United States power and influence are often discussed alongside perceived threats such as global climate change, foreign militant groups and cyber-attacks.⁴⁷

⁴⁶ Max Roser, "Democracy Data Comparison," Our World in Data, March 15, 2013, <https://ourworldindata.org/democracy>.

⁴⁷ Kristen Bialik, "How the World Views the U.S. and Its President in 2018 in 9 Charts," Pew Research Center (Pew Research Center, October 9, 2018), <https://www.pewresearch.org/fact-tank/2018/10/09/how-the-world-views-the-u-s-and-its-president-in-9-charts/>

Including our allies, many foreign citizens and their representatives believe that the global influence of the United States may be a threat to their own sovereignty. How we utilize lethal autonomous weapons will be combined with these perspectives. For example, in Germany and France, the share of people who see U.S. influence as a major threat went up by 14 and 13 percent between 2017 and 2018.⁴⁸ According to this survey, year-after-year increases occurred in Tunisia (11 points), Canada and Argentina (8 points each), South Africa (7 points) and Brazil and Russia (6 points each).⁴⁹ Ten countries in this survey observe U.S. power as a significant risk, including: South Korea (67%), Japan (66%) and Mexico (64%).⁵⁰

METHODOLOGIES AND SOURCE MATERIAL

The methodology used in this research is topic component-oriented, timeline-framed, and evidential. Each of these three subsections is broken into multiple subsets and analyzed to carefully illustrate advantages and shortcomings for potential extractions to be used for the policy recommendation. Our Source material includes qualitative surveys, statistics, and institutional publications.

Finding topic components stands out as the primary task of this research method. This subsection covers all identity drivers, trends, and historic narratives. This includes exploring stakeholders and their possible engagement to the development of lethal autonomous weapons. The drivers identified are both domestic and international. The domestic drivers are the department of defense, military-industrial complex, private technology companies, and potential figures who propose, support, and create laws or policies that govern the land and people of the

⁴⁸ Bialik, Ibid.

⁴⁹ Bialik, Ibid.

⁵⁰ Bialik, Ibid.

United States.⁵¹ The international drivers identified are the allies, near-peer competitors, and any authorities that hold power and control perceptions that directly relate to American geostrategic influence.

We investigated trends in artificial intelligence development and how these historic narratives are framed. This allowed us to evaluate the research and development of AI in the evolution of weapon systems. Historic narratives were considered so that artificial intelligence related to scientific empiricism as a fundamental tenet can be understood. How logic-of-thought entered AI and evolved is significant from an ethic perspective. Historically, artificial intelligence spontaneously operated from an analog (human factor) to digital transformation. However, decades after, ethics and moral codes must bring back the human factor to the latest version of artificial intelligence.⁵² For example, this includes research to identify and develop cognitive tools, progress made in the realm of lethal weapon systems, and verifying the accuracy of procedural and declarative automation.

The next phase comprised our evidential research. This incorporates the forecast of all potential outcomes based on the current doctrine of allies, adversaries, and transnational entities. All offset strategies are selected to assimilate the key areas of artificial intelligence development.⁵³ Areas include autonomous learning systems, human-machine collaborative decision-making, assisted human operations, advanced manned-unmanned systems operations,

⁵¹ Hayley Evans, "Lethal Autonomous Weapons Systems at the First and Second U.N. GGE Meetings," Lawfare.com, October 31, 2019, <https://www.lawfareblog.com/lethal-autonomous-weapons-systems-first-and-second-un-gge-meetings>.

⁵² Antulio J. Echevarria, "The Arms Race (Chapter 7) - The Cambridge History of War," Cambridge Core (Cambridge University Press, 2012), <https://www.cambridge.org/core/books/cambridge-history-of-war/arms-race/3A517C4A58D1BE06E62CD31F4147D176>.

⁵³ Jesse Ellman, Lisa Samp, and Gabriel Coll, "Assessing the Third Offset Strategy," www.csis.org (CSIS International Security Program, March 13, 2017), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/170302_Ellman_ThirdOffsetStrategySummary_Web.pdf?EX01GwjFU22_Bkd5A.nx.fJXTKRDKbVR.

network-enabled autonomous weapons, and high-speed projectiles.⁵⁴ All public and private transactional entities from industry to academia were accounted for. The technical dimension of LAWS and alternative views in the foreseeable future are documented in terms of meaningful human control. Various compliances with international humanitarian law (which mostly require a direct link between the human operator's decision and the outcome of the attack) were scrutinized. Regarding the military-political context, public opinion, and innovation limitations were recognized so that foreign technology and capabilities are considered. In addition, military intellectual property, data transfer, information sharing, and technology sharing with allies were cross-checked. Field survey results were used to scale up an understanding of public perception for strategic decisions.

In the observation method phase, weapon autonomy characteristics are assessed. These assessments expose ethical innovation and its validity under the context of autonomous complexity. We also encompass multidimensional observation on the autonomy of the target, target function capabilities, human-machine-control relationships, and issues associated with performance and safety. Additionally, precision, tangibility, and complexity of the system in defense usage are considered. Moreover, increasing normative pressure from within civil society regarding the importance of maintaining meaningful human control over weapon systems are explored.

A combination of these subject matters as discussed above are mapped to properly make a recommendation into the future of autonomy in weapon systems.

⁵⁴ Ellman, et al. Ibid.

SOME POTENTIAL LIMITATIONS TO OUR RECOMMENDATION

EXISTING SECURITY CLASSIFICATIONS

Our most advanced technological developments, especially those related to our overall military disposition, are extremely sensitive in nature. Many programs, such as those contracted by DARPA or Lockheed Martin's SkunkWorks,⁵⁵ hold unknown levels of classification above Top Secret (TS).⁵⁶ Notably, the U.S. defense black budget request for Fiscal Year 2020 saw a significant increase to \$85 Billion.⁵⁷ This bloated budget could create a significant opportunity for weapons manufacturers to conduct long term research and development on otherwise advanced weapons systems, including LAWS. These systems may already be light-years beyond what we currently think is possible given our current understanding of the technology that drives both AI and its merger into LAWS. This presents quite a challenge to our research, insofar as the promotion of policies and informed recommendations on existing known technologies may decrease our ability to address emerging issues across an otherwise narrow spectrum. The inherent challenge that stands before us rests on our ability to intuitively discern the evolution of these technologies as they stand five to ten years down the proverbial road. Identifying sources such as Andrew Swab's *Briefing Paper No. 72* will help build context around how the black budget system functions, thereby providing our team with invaluable insight, and present us with

⁵⁵ A highly advanced research and development think-tank. The intent of SkunkWorks is to work on white paper technical and engineering problems with a high degree of autonomy, with little to no oversight or commercial/government bureaucracy. See: <https://www.lockheedmartin.com/en-us/who-we-are/business-areas/aeronautics/skunkworks.html>

⁵⁶ To include but not limited to: Sensitive Compartmented Information (SCI) or Special Access Programs (SAP).

⁵⁷ Andrew J. Swab. "Black Budgets: The U.S. Government's Secret Military and Intelligence Expenditures." Briefing Paper No. 72. Harvard Law School. May 2019. https://scholar.harvard.edu/files/briefingpapers/files/72_-_swab_-_black_budgets.pdf

the opportunity to further examine and ultimately formulate how LAWS will be utilized in the future.

Considering the historic rise and exponential progress of computational power in general, it may indeed be the case that one or more of our recommendations will have already been the topic of some discussion in various classified committee and subcommittee meetings and the like. Perhaps, a recommendation may have even been implemented behind closed doors as mentioned previously. In fact, the security classification of emerging AI and LAWS technologies may impart its classification onto the policy decisions that support it. Our team, unaware of these potential decisions, would be unable to formulate further policy or legislation based on said securely classified information.

Regardless of the classified nature of source material, meaningful legislation remains absent, thus it does not allow for our policy to build upon an existing framework. Our research will identify the existing bills introduced to the various subcommittees, and since no bills dealing directly with AI and LAW have been passed into law, there is an inherent limitation to legislation. By default, the policy must dictate how to regulate the technology, technology that at this point remains wholly unregulated. This is opposed to the retooling and improvisation of any existing technology.

THE LEGITIMATE MILITARY CAPACITY OF NEAR PEER COMPETITORS

Just as our policy team “doesn’t know what we don’t know” with regard to classified American policy, the developmental efforts put forth by our adversaries abroad are equally mysterious. A robust policy recommendation regarding LAWS would include a vigorous analysis of our adversary’s capabilities. While there are certainly scholarly articles and

investigative reports regarding the development of AI and LAWS by our great power adversaries, hard data regarding their actual military capacity is difficult to delineate. It may be the case that this policy analysis will ultimately be forced to make recommendations based on the “best-guesses” of experts of experienced analysts, scholars and public officials. Even in terms of this policy recommendation, our potential competitors are getting a vote.

Our recommendations also exist within a particular realm of government where sovereignty with regard to preference reigns supreme. Even when nations come together in an attempt to create guidelines and binding legislation, there is usually at least some disagreement over who, what, and how portions of the policy will be implemented. Often and most regrettably, few decisions are actually made, and collaborative agreements are put off for quite some time. . Unfortunately, this creates boundaries for our team as we attempt to identify what limitations or policy prescriptions the international community is willing to entertain or adopt, and how expansive or limited our final recommendation should be in order to maintain the desired hegemony. Especially as we simultaneously attempt to construct a policy that will fit squarely within these agreed upon guidelines.

There is a worrisome correlation between the actions of the U.S., Russia, and China. All three countries are allocating enormous slices of their annual military budgets towards AI and LAWS. If all three routinely inject tens of billions of dollars into this sector, then it is safe to say AI and LAWS are certainly poised to shape the future of warfare.

OUR PRIMARY RECOMMENDATIONS

MAINTAIN THE STATUS QUO

Our primary recommendation at this time is to maintain the status quo as we continue to lead the rest of the world in overall AI and LAWS capability. First and foremost, maintaining ethical continuity and transparency should remain atop our priority list. The Department of Defense's intent is easily discerned; an ethical human authority must remain "in the loop". Ultimately, this authority must be held accountable for any decision deemed responsible for the termination of a human life. We believe this principle is representative of a strong, stable foundation upon which future policy and/or legislation should be built.

Our next priority must be to incentivize domestic and international AI market participation. Our current AI ecosystem promotes cooperation between government and university systems conducting high level research. However, it also encourages open innovation, the independent study of AI outside of our educational institutions, and close partnerships within the private sector. Continuing to allow market forces and knowledge exchange to drive our AI industry will ensure stability as we endure this international security dilemma. This informal, flexible and undogmatic approach to innovation is, arguably, the root cause for the resilience of the United States' AI development trajectory. Its defining features are technology diffusion through knowledge networks, combined with intense contests among competing ideas.⁵⁸

⁵⁸ Ernst, Dieter. "Competing in Artificial Intelligence Chips: China's Challenge amid Technology War." 2020.

INCENTIVIZE MARKET PARTICIPANTS

The private sector and military industrial complex, through military contracts, are already moving forward with research and development. The exponential growth of the autonomous weapons market has been referred to by our near peer competitors as “inevitable”-there is little reason to assume the DOD should consider reversing course given the global projections that reference the spending and acquisition of this technology. If that is the case, the best option is to induce the military industrial complex to manufacture AI and LAWS that can be measured, publicly evaluated, and rewarded for technology that adheres to the Law of War.

Market incentives can be useful to stimulate the moral and ethical development of these systems. Given current DOD directives that human decision making within the OODA loop is expected to remain for the foreseeable future...an incentive for the military industrial complex should be to develop and implement autonomous weapons that do not produce collateral damage. Likewise, there must also be market disincentives for businesses that fail to build weapons that operate within the conduct of just war. The DOD should provide options for government contract incentives, performance incentives, and corporate tax deductions to defense contractors. This can and must be measured with discrete data obtained through rigorous and thorough testing obtained during the testing and evaluation phases of development. It must be determined prior to deployment that an autonomous weapon succeeds in not only hitting its target, it must also not engage persons and/or objects that are *not* its target. It must successfully discriminate. The data must be collected by military personnel, an independent third-party auditor, and reviewed by those personnel with expertise in legal, ethical, and technological expertise. This adds to the expense for those transnational organizations that develop this technology, but it also embraces an ethical future for AI and LAWS; it is reasonable and necessary.

Hundreds of companies within the defense and technology industry stand to make billions of dollars in revenue from autonomous weapons systems and there will be a desire to push the envelope of what is possible-incentives are an ethical form of control. At least in the United States, human control of these weapons should be expected to remain and so far, the military industrial complex has shown they are adhering to that directive. In fact, Lockheed Martin's adage is "The Future of Autonomy Isn't Human-less, It's Human More." BAE Systems' approach is framed as, "Human+."⁵⁹

Even given these conditions, there is a danger that development will ultimately lead to "a global arms race in which [LAWS] become mass-produced, cheap and ubiquitous..."⁶⁰ The burden to prevent an arms race must fall on the government, and in turn the must restrict manufacture and development. One disincentive might be to hold individuals within these companies liable for war crimes if their autonomous systems kill innocent lives as a result of an avoidable programming error. Realistically, that might cause some companies, executives, and engineers to reconsider their involvement...if that's the case they will not win the development contract.

Incentives must be designed to also lead to further innovation, allow the market to freely develop, but also control the operation and implementation. Allowing the top five: Lockheed Martin, Boeing, Raytheon, Northrop Grumman, BAE Systems, or any new technology startup to develop the service appropriately is a wise choice-the U.S. maintains its technological hegemony and continues to push for ethically and morally sound judgment in development. Market-driven

⁵⁹ Frank Slijper. "Slippery Slope. The arms industry and increasingly autonomous weapons." PAX for Peace. November 11, 2019. <https://www.paxforpeace.nl/publications/all-publications/slippy-slope>; 19.

⁶⁰ Slijper, 10.

incentives need to be realistic, including a benefit which can be rewarded in the near-term, and one that exceeds the potential profits from mass production-one that rewards moral values.

EXPAND OVERSIGHT - LEGISLATION AND THE NSCAI

Oversight and expertise are the keys to ensuring the advancement of new technologies developing within reasonable left and right limits. A proper system of checks and balances is healthy for any representative democracy, and it maintains control over an emerging sector with the potential for existential change. Currently, the National Security Commission on Artificial Intelligence (NSCAI), the necessary federal legislation, and congressional oversight are all vital to the continued development of LAWS...ultimately, they are simply not as robust as necessary to address our concerns.

Improving the NSCAI through updated staffing and structure will enhance our national security, ensure the future of LAWS is given the proper attention, and help secure a moral and ethical future. First convened in March of 2019, the NSCAI was established by Section 1051 of the 2019 NDAA.⁶¹ The 15 current commissioners are a diverse group of technical experts from Silicon Valley, Ph.Ds., engineers, CEOs, and professors from top universities and research institutes.⁶² While they are required to submit an annual report to Congress but there is no consideration for open source public input. Moreover, we argue that the Commission should be given the latitude to act as an authority, enacting policy changes, and allowed to retain the authority necessary to produce guidelines, advise future recommendations, define proper

⁶¹ The National Security Commission on Artificial Intelligence. "FY 19 NDAA Section 1051." The United States of America. Accessed on April 24, 2020. <https://www.nscai.gov/about/about/fy19-ndaa-section-1051>

⁶² The National Security Commission on Artificial Intelligence. "FAQ." The United States of America. Accessed on April 24, 2020. <https://www.nscai.gov/about/faq>

standards for intelligence-based algorithms, and provide legal oversight for those individuals and organizations, domestic or otherwise, that would threaten the safety of the American public or its technological hegemony. We also recommend that the Commission should expand to include experts from defense companies, theoretical experts from universities and think tanks, ethicists, and legal and constitutional specialists. Finally, the NSCAI is a temporary organization-it will submit its final report in October 2021; to truly be a voice for change they must be a permanent advisory board under the National Security Council.

As previously discussed, there is little to no federal legislation beyond the NDAAAs...congressional oversight and input into the ethical and political standards of AI and LAWS is limited at best, and routinely nonexistent at worst. Current oversight primarily extends to select members of Congress that are tasked with nominating NSCAI Commissioners. Congress needs to be able to rely on the NSCAI, along with military, ethical and legal experts, and other regulatory agencies in order to draft proper legislation. This will provide the proper authority necessary in order to create a comprehensive act that specifically focuses on the development and application of autonomous weapons systems. Additionally, existing legislation which has been introduced should be moved out of their respective committees, debated, and passed into law. The best current example is S. 1558, referred to as the “AI Initiative Act,” it will create coordinated efforts across agencies and set up an Advisory Committee.⁶³ This is the most encouraging pending legislation to date and will finally include benchmarks, standards, and introduce regulations on AI development. While AI and LAWS based legislation will most likely hit roadblocks, especially given the technological unknowns, the influence of the military, and

⁶³ Martin Heinrich, “Artificial Intelligence Initiative Act,” May 21, 2019. Accessed October 25, 2019. <https://www.congress.gov/bill/116th-congress/senate-bill/1558/text>

deep pockets of the lobbyists representing the military industrial complex, it is the responsibility of Congress to make laws that protect its citizens and buttress its citizens against an unknown future.

A BRIEF SET OF POTENTIAL ALTERNATIVES

Any technological development struggles when there are not only alternatives but competing technological paradigms. Even if an alternative could be more productive, both researchers and policymakers tend to follow whatever paradigm is ahead of the other. In this situation, once the wrong paradigm pulls ahead, it may be very hard to discern its potential benefits from the possibilities offered up by the alternative option. Here, alternatives thus leave us with three choices: demand narrow development, develop with caution and accelerate the development

DEMAND WEAK, OR EVEN COMPLETELY RESTRICT, DEVELOPMENT

In this case, demanding weak development may keep the weapon intelligence research focused and do what is ethically right. However, it may reduce the speed at which relevant technologies advance. In addition, implementing harsher policies on states may create an undesired competitive paradigm. To constitute an alternative, transitional organizations may or may not always find it useful. From the moral background, this is the most beneficial option.

Again, for the future, the political channel may dismiss additional opportunities in the global market in this route. For instance, transitional organizations that figure their own global position benefit most by AI directed everywhere scalable.⁶⁴ A narrow development making

⁶⁴ Thomas, Mike. "Six Dangerous Risks of Artificial Intelligence." Built In, January 14, 2019. <https://builtin.com/artificial-intelligence/risks-of-artificial-intelligence>.

corrected assignments, tool development for contending organizations may shrink exploration opportunities.⁶⁵ Decision making by the machines will still be unanswered, at least within the United States-desired accountability may or may not be achieved.

DEVELOP WITH CAUTION

In the event that any significant military force pushes ahead with AI weapon advancement, a worldwide arms race is unavoidable. The end state after unlikely to differ from traditional arms races. In contrast to atomic weapons, the materials needed to develop AI are inexpensive and easily acquired, and the military may be forced to mass-produce automated weapons within a shortened time frame.

Simultaneously, Russia and China have not made any statement to limit development. The United States should prepare for a time when leaked developmental source code becomes available on the open source or underground markets, and could very well end up in the hands of terrorists or autocrats who desire to control their people. Cases of misuse, such as targeted ethnic cleansing and systematic state destabilization, the military may find itself in a deadlock. In this way, developing with caution will not be helpful for humankind. There are numerous manners by which AI development can make combat zones more secure for personnel, particularly for regular citizens; without constructing lethal devices. However, developing with caution at this point will only increase the gap between the United States and the rest of the world.

ACCELERATE DEVELOPMENT

⁶⁵ Mazzucchelli, Lou. "Caution! AI Consequences Ahead - An Introduction: Cutter Consortium." Accessed May 5, 2020. <https://www.cutter.com/article/caution-ai-consequences-ahead-%E2%80%94-introduction-505036>.

It can't be denied that lethal autonomous weapons *will* heavily influence world dominance in the near future. Accelerating development ensures we remain ahead in the race and also provides additional geostrategic flexibility. However, the weapon development may put the world power balance in a dilemma-alliances and business relations may see drastic shifts because of the sudden upgrade in military capability; the impact is both economic and political. This may complicate the law of war and lead to further inquiries and interpretations of the United States' intentions abroad-it may even be seen as purposefully manipulative.

CONCLUSION

"The moral elements are among the most important in war. They constitute the spirit that permeates war as a whole. They will not yield to academic wisdom. They cannot be classified or counted. They have to be seen or felt." -Carl von Clausewitz⁶⁶

As we conclude our proposal, we ask our readers to thoughtfully consider the following summation. The future of AI is indeed uncertain, yet given its evolutionary momentum we must assume that one day humanity may not be forced to endure the psychophysiological burdens of combat. Examining whether or not this burden acts as a meaningful deterrent to war between conflicting nations is worthy of further consideration. If we determine this to be of consequence, then perhaps our most important task is the pursuit and exploration of how this transfer of responsibility might impact the decisions that will shape our global society's future.

Unfortunately, this is a task whose true significance has yet to be fully realized. However, as humanity continues its long march down the labyrinthine path leading us through the hellish realm of War, the extreme realities of the human condition are laid bare. Thoughtful and prudent reflection of the potential unintended costs associated with such a historically unprecedented

⁶⁶ Carl Vol Clausewitz, *On War* (Princeton: Princeton University Press, 2008), 108.

transfer, should undoubtedly be placed atop our collective priority list.

History has demonstrated that mankind is constantly attempting to put more distance between warring adversaries. Again, range (or proximity) is one of the many rules that governs the conduct of physical combat. It also serves as a conduit, and adherence to its principles is timeless. It unites our modern elite struggling atop the steep ridges of Tora Bora, with those ancient warriors that grappled within a Grecian phalanx. Unmistakably real and unforgiving, once measured, it forever stains the pages of our history books. It is the ink that illustrates and demarcates those invisible borders which define the parameters of our global society. Similarly, moral and ethical rulesets have forever governed how and why we wage our wars. Concepts such as chivalry, which are hard to define, express the feelings of combatants that they belong to a caste, that their encounter in arms is highly traditional, ceremonial, and respected. Its traditions inform us that an opponent is entitled to all honor and respect, that your enemy, though he is your enemy, is at the same time a brother in the same noble family of knights-at-arms.⁶⁷ These moral elements exist within an intangible but irrefutably human spectrum. They, and the principles that drive them forward into our modern conscience, work as interdependent and reinforcing parts of a coherent system, providing confidence to those parties engaged in conflict with one another. Therefore, it is imperative that we seek to carefully balance our intentions and manage our expectations as we continue to investigate the ramifications of future policy decisions relative to this topic. We insist that any decisive action undertaken under the umbrella of future United States AI/LAWS policy reflect the ideals and principles responsible for guiding us into the present position of authority that we currently find ourselves in.

⁶⁷ J.W. Garner, *Air Power and War Rights* (London: Longman's Green and Company, 1924) 109-110.

APPENDIX A

A BRIEF CHRONOLOGY OF ARTIFICIAL INTELLIGENCE, LETHAL AUTONOMOUS WEAPONS SYSTEMS, AND RELEVANT RECOMMENDATIONS, POLICIES, AND LEGISLATION

NOV 2012 – Depart of Defense Directive (DODD) 3000.09 is published-it is entitled “Autonomy in Weapon Systems.”⁶⁸ It is the first effort by the Department of Defense’s to formally delineate official policy.

Paragraph 4.a states, “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.”⁶⁹

Paragraph 4.b states, “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 law of war, applicable treaties, weapon system safety rules, and applicable rules of engagement (ROE).”⁷⁰

MAR 2014 – The topic of autonomous weapon systems is brought up for the first time at the Convention on Certain Conventional Weapons (CCW). “The United States, rejected a legal prohibition and a political declaration, saying more research and discussion is necessary.”⁷¹

DEC 2016 - The United Nations established a Group of Government Experts (GGE) on “emerging technology in the area of lethal autonomous weapons systems.”⁷²

NOV 2017 - The first GGE collaboration on LAWS is held in Geneva. “The United States...indicates that it is too early to support a prohibition.”⁷³

APR 2018 – The Secretary of Defense Jim Mattis briefed to the Senate Armed Services Committee that, “Long-term strategic competition, not terrorism, is now the primary focus of U.S. national security.”⁷⁴

APR/AUG 2018 – The second GGE collaboration series on LAWS is held in Geneva. “The United States did not want to consider tangible outcomes.”⁷⁵ Other senior officials claim further, “that leadership in advanced technology, especially artificial intelligence, cyberoperations, hypersonics, and robotics, is essential for ensuring U.S. success in a geopolitical contest with China and Russia.”⁷⁶

⁶⁸ Carter, Ibid.

⁶⁹ Carter, Ibid.

⁷⁰ Carter, Ibid.

⁷¹ Michael Klare, “U.S., Russia Impede Steps to Ban ‘Killer Robots,’” *Arms Control Association*. October, 2018. Accessed October 14, 2019. <https://www.armscontrol.org/act/2018-10/news/us-russia-impede-steps-ban-%E2%80%98killer-robots%E2%80%9999>

⁷² Kelley M. Saylor, “Defense Primer: U.S. Policy on Lethal Autonomous Weapon Systems,” *Congressional Research Service*. March 27, 2019. Accessed October 14, 2019. <https://fas.org/sgp/crs/natsec/R43838.pdf>.

⁷³ Eduardo Soares, Tariq Ahmad, Ruth Levush, and Gustavo Guerra, “Regulation of Artificial Intelligence: The Americas and the Caribbean,” *Library of Congress*. July 1, 2019. Accessed October 14, 2019. <https://www.loc.gov/law/help/artificial-intelligence/americas.php#us>.

⁷⁴ James Mattis, “Summary of the 2018 National Defense Strategy of the United States of America,” *Department of Defense*. 2018. Accessed October 14, 2019.

⁷⁵ Klare, Ibid.

⁷⁶ Klare, Ibid.

JUL 2018 – The White House issues guidance for the 2020 fiscal year that the funding priority for artificial intelligence research and development is second behind only quantum computing.⁷⁷

AUG 2018 – The National Security Commission on Artificial Intelligence (NSCAI) is founded.

FEB 2019 – President Donald Trump issued an executive order entitled, “Executive Order on Maintaining American Leadership in Artificial Intelligence.”⁷⁸

MAR/AUG 2019 – The third GGE series is held in Geneva. The United States’ primary contribution was a report entitled, “Humanitarian benefits of emerging technologies in the area of lethal autonomous weapon systems.”⁷⁹ It concludes:

“Emerging technologies in the area of lethal autonomous weapons systems could be used to create entirely new capabilities that would increase the ability of States to reduce the risk of civilian casualties in applying force. Rather than trying to stigmatize or ban such emerging technologies in the area of lethal autonomous weapon systems, States should encourage such innovation that furthers the objectives and purposes of the Convention.”

MAY 2019 - The United States adopts the OECD AI Recommendations;⁸⁰ it includes a

series of principles and recommendations for the development of artificial intelligence.

OCT 2019 - The DoD, through the Defense Innovation Board publishes, “AI Principles: Recommendations on the Ethical Use of Artificial Intelligence by the Department of Defense.”

⁷⁷ Mick Mulvaney, “FY 2020 Administration Research and Development Budget Priorities.” *The White House*, July 13, 2018. Accessed October 14, 2019. <https://www.whitehouse.gov/wp-content/uploads/2018/07/M-18-22.pdf>.

⁷⁸ Donald Trump, “Executive Order on Maintaining American Leadership in Artificial Intelligence,” *The White House*, February 11, 2019. Accessed October 14, 2019. <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>.

⁷⁹ The United States of America, “Humanitarian benefits of emerging technologies in the area of lethal autonomous weapon systems.” *Group of Governmental Experts*, October 15, 2019. Accessed October 14, 2019. <https://geneva.usmission.gov/2019/03/26/u-s-statement-on-laws-potential-military-applications-of-advanced-technology/>

⁸⁰ OECD, “OECD Principles on AI,” *OECD*. Accessed October 14, 2019. <https://www.oecd.org/going-digital/ai/principles/>

APPENDIX B

A BRIEF HISTORY OF TECHNOLOGICAL DISCREPANCY AND OUTCOMES IN COMMERCE, INDUSTRY, POLITICS, AND WAR

1849 - Austria defeats Italy at the Battle for the Republic of San Marco. Austria is credited for causing turmoil amongst both the civilian and military occupants by using unmanned balloons to drop explosives on the city. Military historians generally consider this the first use of what we would consider drone warfare.

1939-1945 - The Axis fails to match Allied development of mid-century technologies such as radar, precision bombsights, convoy operations, computerized codebreaking, and ultimately applied atomic energy. Minus the atomic bomb, these “soft” weapons of war ultimately prevailed over advancements in armor and other operational methods.

1950s-1977 - The Cold War was the primary catalyst responsible for developing a decentralized, distributed computer network of connected science labs that ultimately took the form of ARPANET and the beginning of the World Wide Web. The tremendous commercial and industrial application would not be realized in the United States (primarily) and the Western Hemisphere (broadly) until the late 1990s.

1980-1990 - Discrete-time test systems and expert frameworks (such as the present-day IBM Watson venture) permitted business to foresee and break down dependent encounters. This is the first real incursion into big data—when the recorded organization of information became important. Information and knowledge management became a higher priority than creating human-like frameworks.

1990-2000 - Deep Blue, the intelligence that played chess superior to people, was developed during this period. However, at the time the innovation was not relevant to other issues. Some other systems developed during this time: Bayes was generally utilized in against spam and digital Markov chains anticipated criminal structure and conduct, web indexes created choice trees to foresee client info, discourse and image processing using recognition was no longer difficult.

However, one thing was missing: all-inclusiveness. Practically all frameworks created during this period explained just one undertaking but they could not adjust to new practices, datasets, and rules. Stronger AI research stayed almost abandoned until mid-00s.

2000-2010 - A resurgence of strong AI related research occurred during this period.

2010-2020 - Deep learning, machine learning, and big data implications have become device oriented. Tech companies include machine learning algorithms in their products and services.

Some anecdotal instances of note: Facebook's chat bot shuts down after developing its own language and Amazon's facial recognition software matched 28 U.S. congress people with criminal mugshots. Apple's 'Face ID' is defeated by Vietnamese security firm Bkav using a facial mask. Also, IBM's once famous "Watson for Oncology" was cancelled after \$62 million of investment due to repeated unsafe treatment recommendations.

APPENDIX C

GLOSSARY OF TERMS, ABBREVIATIONS, AND ACRONYMS

AI	Artificial Intelligence
ARPANET	Advanced Research Projects Agency Network
AWS	Autonomous Weapons System
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
CCW	Convention on Certain Conventional Weapons
GGE	Group of Governmental Experts
LAWS	Lethal Automated Weapons System
NDAA	National Defense Authorization Act
NSTC	National Science and Technology Council
NSCAI	National Security Council on Artificial Intelligence
OECD	Office of Economic Cooperation and Development
OODA	Observe, Orient, Decide, Act
R&D	Research and Development
RDT&E	Research, Development, Testing, and Evaluation
ROE	Rules of Engagement
SAMS	School of Advanced Military Studies
SAP	Special Access Program
SCI	Sensitive Compartmentalized Information
S&T	Science and Technology
TRADOC	Training and Doctrine Command
TS	Top Secret
UAS	Unmanned Aerial Surveillance
USAF	United States Air Force

REFERENCES

- Bialik, Kristen. "How the World Views the U.S. and Its President in 2018 in 9 Charts." Pew Research Center. Pew Research Center, October 9, 2018.
<https://www.pewresearch.org/fact-tank/2018/10/09/how-the-world-views-the-u-s-and-its-president-in-9-charts/>
- Boyd, John. "Patterns of Conflict," *Defense and the National Interest*. February 27, 2007. Accessed November 1, 2019.
[http://www.projectwhitehorse.com/pdfs/boyd/pattern s%20of%20conflict.pdf](http://www.projectwhitehorse.com/pdfs/boyd/pattern%20of%20conflict.pdf)
- Bugge, Axel. "U.N.'s Guterres urges ban on autonomous weapons," *Reuters*. November 5, 2018. Accessed December 9, 2019. <https://www.reuters.com/article/us-portugal-websummit-un/u-n-s-guterres-urges-ban-on-autonomous-weapons-idUSKCN1NA2HG>
- Cade, Metz. "Hold 'Em or Fold 'Em? This A.I. Bluffs with the Best." *The New York Times*. July 11, 2019. Accessed November 1, 2019. <https://www.nytimes.com/2019/07/11/science/poker-robot-ai-artificial-intelligence.html>
- Carter, Ash. "Department of Defense Directive 3000.9." *Department of Defense*. July 21, 2018. Accessed October 14, 2019.
<https://www.esd.whs.mil/portals/54/documents/dd/issuances/dodd/300009p.pdf>
- Clausewitz, Carl Vol. *On War*. Princeton: Princeton University Press, 2008.
- Conn, Ariel. "FLI Podcast: Why Ban Lethal Autonomous Weapons?" *The Future of Life Institute*. April 2, 2019. Accessed December 9, 2019.
<https://futureoflife.org/2019/04/02/fli-podcast-why-ban-lethal-autonomous-weapons/?cn-reloaded=1>
- Crawford, Net C. "United States Budgetary Costs and Obligations of Post-9/11 Wars through FY 2020: \$6.4Trillion." watson.brown.edu. Watson Institute Brown University, November 13, 2019. <https://watson.brown.edu/costsofwar/>
- Deptula, Dave. "Air Force Unmanned Aerial System (UAS) Flight Plan 2009-2047," *Headquarters, U.S. Air Force*. July 23, 2009. Accessed November 1, 2019.
https://fas.org/irp/program/collect/uas_2009.pdf
- Divis, Dee Ann. "Military UAV Market to Top \$83B." *Inside Unmanned Systems*, April 24, 2018. <https://insideunmannedsystems.com/military-uav-market-to-top-83b/>
- Echevarria, Antulio J. "The Arms Race: Qualitative and Quantitative Aspects." Chapter. In the *Cambridge History of War*, edited by Roger Chickering, Dennis Showalter, and Hans van de Ven, 4:163–80. Cambridge History of War. Cambridge: Cambridge University Press, 2012. doi:10.1017/CHO9781139021203.009.
- Ellman Jesse, Lisa Samp, and Gabriel Coll. "Assessing the Third Offset Strategy." *www.csis.org*. CSIS International Security Program, March 13, 2017. <https://csis->

prod.s3.amazonaws.com/s3fs-public/publication/170302_Ellman_ThirdOffsetStrategySummary_Web.pdf?EXO1GwjFU22_Bkd5A.nx.fJXTKRDKbVR

- Ernst, Dieter. "Competing in Artificial Intelligence Chips: China's Challenge amid Technology War." Centre for International Governance. 2020.
https://www.cigionline.org/sites/default/files/documents/Competing%20in%20Artificial%20Intelligence%20Chips%20-%20Dieter%20Ernst_web.pdf
- Evans, Hayley. "Lethal Autonomous Weapons Systems at the First and Second U.N. GGE Meetings." Lawfare.com, October 31, 2019. <https://www.lawfareblog.com/lethal-autonomous-weapons-systems-first-and-second-un-gge-meetings>
- Executive Office of the President. "Preparing for the Future of Artificial Intelligence." *National Science and Technology Council's (NSTC) Committee on Technology*. October 2016. Accessed on October 23, 2019
https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf
- Garner, J.W. *Air Power and War Rights*. London: Longman's Green and Company, 1924.
- Gibson, John H. "FY 2018-FY 2022 National Defense Business Operational Plan." *Chief Management Office*. April 9, 2018. Available at: <https://cmo.defense.gov/Portals/47/Documents/Publications/>
- Haner, Justin and Garcia, Denise, "The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development," *Glob Policy*, 10 (2019): 331- 337, accessed April 28, 2020, <https://onlinelibrary.wiley.com/doi/full/10.1111/1758-5899.12713>
- Heinrich, Martin, "Artificial Intelligence Initiative Act." *The United States Senate*. May 21, 2019. Accessed October 25, 2019. <https://www.congress.gov/bill/116th-congress/senate-bill/1558/text?q=%7B%22search%22%3A%5B%22artificial+intelligence%22%5D%7D&r=27&s=2>
- Inhofe, James M. "S.1790 - National Defense Authorization Act for Fiscal Year 2020." *House of Representatives*. June 11, 2019. Accessed on October 24, 2019.
<https://www.congress.gov/bill/116th-congress/senate-bill/1790/text?q=%7B%22search%22%3A%5B%22%5C%22artificial+intelligence%5C%22%22%5D%7D&r=60&s=4#toc-HADD425B5A89645C6A72086BB5A5917E1>
- Kenia, Elsa. "China May Soon Surpass America on the Artificial Intelligence Battlefield." *National Interest*. February 21, 2017.
<https://nationalinterest.org/feature/china-may-soon-surpass-america-the-artificial-intelligence-19524>

- Klare, Micheal. "U.S., Russia Impede Steps to Ban 'Killer Robots.'" *Arms Control Association*. October, 2018. Accessed October 14, 2019.
<https://www.armscontrol.org/act/2018-10/news/us-russia-impede-steps-ban-%E2%80%98killer-robots%E2%80%99>
- Klimentyev, Mikhail. "For Superpowers, Artificial Intelligence Fuels New Global Arms Race." *Wired*. September 8, 2017. Accessed October 31, 2017
- Kofman, Michael. "Russian defense spending is much larger, and more sustainable than it seems." *DefenseNews*. May 3, 2019. Accessed April 28, 2020.
<https://www.defensenews.com/opinion/commentary/2019/05/03/russian-defense-spending-is-much-larger-and-more-sustainable-than-it-seems/>
- Lawrence, Brenda. "H.Res. 153 - Supporting the development of guidelines for ethical development of artificial intelligence." *House of Representatives*. February 27, 2019. Accessed October 25, 2019. <https://www.congress.gov/bill/116th-congress/house-resolution/153?q=%7B%22search%22%3A%5B%22artificial+intelligence%22%5D%7D&s=2&r=10>
- Lipinski, Daniel. "H.Res. 2202 – GrAITR Act." *House of Representatives*. April 10, 2019. Accessed October 25, 2019. <https://www.congress.gov/bill/116th-congress/house-resolution/153?q=%7B%22search%22%3A%5B%22artificial+intelligence%22%5D%7D&s=2&r=10>
- Mattis, James. "Summary of the 2018 National Defense Strategy of the United States of America." *Department of Defense*. 2018. Accessed October 14, 2019.
- Mulvaney, Mick. "FY 2020 Administration Research and Development Budget Priorities," *The White House*. July 13, 2018. Accessed October 14, 2019.
<https://www.whitehouse.gov/wp-content/uploads/2018/07/M-18-22.pdf>
- The National Security Commission on Artificial Intelligence. "FAQ." The United States of America. Accessed on April 24, 2020. <https://www.nsc.ai.gov/about/faq>
- The National Security Commission on Artificial Intelligence. "FY 19 NDAA Section 1051." The United States of America. Accessed on April 24, 2020.
<https://www.nsc.ai.gov/about/about/fy19-ndaa-section-1051>
- OECD. "OECD Principles on AI." *OECD*. Accessed October 14, 2019.
<https://www.oecd.org/going-digital/ai/principles/>
- Office of the Under Secretary of Defense. "Unmanned Systems Integrated Roadmap FY2011-2036." *Defense Technical Information Center*. October 2011. Accessed November 1, 2019. <https://apps.dtic.mil/docs/citations/ADA558615>

- Parkin, Simon. "Killer robots: The soldiers that never sleep." *BBC News*. July 16, 2016. Accessed October 31, 2019. <https://www.bbc.com/future/article/20150715-killer-robots-the-soldiers-that-never-sleep>
- Preston, Stephen. "Department of Defense Law of War Manual." *Office of General Counsel, Department of Defense*. December 2016. Accessed November 1, 2019. <https://dod.defense.gov/Portals/1/Documents/pubs/DoD%20Law%20of%20War%20Manual%20-%20June%202015%20Updated%20Dec%202016.pdf?ver=2016-12-13-172036-190>
- Roff, Heather, "Autonomous weapons and the new laws of war," *The Economist*, January 19th, 2019. <https://www.economist.com/briefing/2019/01/19/autonomous-weapons-and-the-new-laws-of-war>
- Roser, Max. "Democracy Data Comparison." *Our World in Data*, March 15, 2013. <https://ourworldindata.org/democracy>
- Sayler, Kelley M. "Defense Primer: U.S. Policy on Lethal Autonomous Weapon Systems." *Congressional Research Service*. March 27, 2019. Accessed October 14, 2019. <https://fas.org/sgp/crs/natsec/R43838.pdf>
- Schatz, Brian. "S.1363 – AI in Government Act of 2019." *U.S. Senate*. May 08, 2019. Accessed on October 24, 2019. <https://www.congress.gov/bill/116th-congress/senate-bill/1363?q=%7B%22search%22%3A%5B%22artificial+intelligence%22%5D%7D&r=1&s=1/>
- Schmitt, Michael N. and Liis Vihul editors. *Tallin Manual 2.0 on the International Law Applicable to Cyber Operations, Second Edition*. Cambridge University Press, New York, NY: 2018.
- Senate Secretary. "National Defense Authorization Act for Fiscal Year 2013." *The United States Senate*. December 4, 2012. Accessed October 24, 2019. [https://congressional-proquest-com.ezp-prod1.hul.harvard.edu/congressional/result/pqpresultpage.gispdfhitspanel.pdflink/\\$2fapp-bin\\$2fgis-billtext\\$2f3\\$2f3\\$2f1\\$2f0\\$2fbills-112hr4310pp.pdf/entitlementkeys=1234%7Capp-gis%7Cbilltext%7C112_hr_4310_pp](https://congressional-proquest-com.ezp-prod1.hul.harvard.edu/congressional/result/pqpresultpage.gispdfhitspanel.pdflink/$2fapp-bin$2fgis-billtext$2f3$2f3$2f1$2f0$2fbills-112hr4310pp.pdf/entitlementkeys=1234%7Capp-gis%7Cbilltext%7C112_hr_4310_pp)
- Siteline Media Group. "Top 100 for 2019." *Defense News*. March 9, 2020, <https://people.defensenews.com/top-100>
- Slijper, Frank. "Slippery Slope. The arms industry and increasingly autonomous weapons." *PAX for Peace*. November 11, 2019, <https://www.paxforpeace.nl/publications/all-publications/slippy-slope>
- Smith, Mark. "Is 'killer robot' warfare closer than we think?" *BBC News*. August 25, 2017. Accessed October 31, 2019. <https://www.bbc.com/news/business-41035201>

Speyer, Lea. Israeli Made “Suicidal” Drone Doubles as Missile.” *Breaking Israel News*. June 13, 2004. Accessed October 31, 2019. <https://www.breakingisraelnews.com/16429/israeli-made-suicidal-drone-doubles-missile/>

Soares, Eduardo, et. al. “Regulation of Artificial Intelligence: The Americas and the Caribbean.” Library of Congress. July 1, 2019. Accessed October 14, 2019. <https://www.loc.gov/law/help/artificial-intelligence/americas.php#us>

Soto, Darren. “AI JOBS Act of 2019.” *House of Representatives*. January 28, 2019. Accessed October 25, 2019. <https://www.congress.gov/bill/116th-congress/house-bill/827/text?q=%7B%22search%22%3A%5B%22artificial+intelligence%22%5D%7D&r=6&s=2>

Sub-committee on Research and Technology & Subcommittee on Energy. “Artificial Intelligence” With Great Power Comes Great Responsibility.” *Hearing before One- Hundred and Fifteenth Congress*. June 26, 2018. Accessed on October 30, 2019. http://media.proquest.com/media/hms/PFT/1/sZ8Z7?_s=Cw6ed1G1C2nlxKeKh0VebKdlDpQ%3D

Swab, Andrew J. “Black Budgets: The U.S. Government’s Secret Military and Intelligence Expenditures.” Briefing Paper No. 72. Harvard Law School. May 2019. https://scholar.harvard.edu/files/briefingpapers/files/72-swab-black_budgets.pdf

Swagel, Phillip L. “Long-Term Implications of the 2020 Future Years Defense Program.” Congressional Budget Office. August 2019. https://www.cbo.gov/system/files/2019-08/55500-CBO-2020-FYDP_0.pdf

Tass. “Putin notes importance of developing AI technology for quick decisions,” Russian News Agency, May 30th, 2019. <https://tass.com/science/1060846>

The United States of America. “Humanitarian benefits of emerging technologies in the area of lethal autonomous weapon systems.” *Group of Government Experts*. October 15, 2019. Accessed October 14, 2019. <https://geneva.usmission.gov/2019/03/26/u-s-statement-on-laws-potential-military-applications-of-advanced-technology/>

Thornberry, Matt. “National Defense Authorization Act for Fiscal Year 2018,” *The House Armed Services Committee*. December 12, 2017. Accessed October 25, 2019. <https://www.congress.gov/bill/115th-congress/house-bill/2810?q=%7B%22search%22%3A%5B%22lethal+autonomous+weapon+system%22%5D%7D&s=3&r=7>

Tom Lantos Human Rights Commission. “Artificial Intelligence: The Consequences for Human Rights.” *Hearing before One-Hundred and Fifteenth Congress*. May 22, 2018. Accessed on October 30, 2019. http://media.proquest.com/media/hms/PFT/1/KcNt5?_s=EtD%2Fu%2BjIT8Gox9hE0BqJhanOOHg%3D

- Truman, Harry S. "Truman Quotes." *Truman State University*. Accessed December 9, 2019. <https://www.truman.edu/about/history/our-namesake/truman-quotes/>
- Trump, Donald. "Executive Order on Maintaining American Leadership in Artificial Intelligence." *The White House*. February 11, 2019. Accessed October 14, 2019. <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>
- United States Department of Defense. "About the Department of Defense." *DOD Website*. Accessed December 9, 2019. <https://archive.defense.gov/about/>
- Walzer, Michael. *Just and Unjust Wars*. London: Allen Lane, 1978.
- Winter, Chris. "Killer robots': autonomous weapons pose a moral dilemma." *DW.com*. November 14, 2017. Accessed October 31, 2019. <https://www.dw.com/en/killer-robots-autonomous-weapons-pose-moral-dilemma/a-41342616>
- White House Office of Science and Technology Policy. "Summary Report of The 2018 White House Summit on Artificial Intelligence for American Industry." May 10, 2018. Accessed on October 23, 2019. <https://www.whitehouse.gov/wp-content/uploads/2018/05/Summary-Report-of-White-House-AI-Summit.pdf>
- Thomas, Mike. "Six Dangerous Risks of Artificial Intelligence." *Built In*, January 14, 2019. <https://builtin.com/artificial-intelligence/risks-of-artificial-intelligence>
- Mazzucchelli, Lou. "Caution! AI Consequences Ahead - An Introduction: Cutter Consortium." *Caution! AI Consequences Ahead - An Introduction | Cutter Consortium*. Accessed May 5, 2020. <https://www.cutter.com/article/caution-ai-consequences-ahead-%E2%80%94-introduction-505036>.