

Artificial Intelligence: Expected to Win; Ready to Fail

A Monograph

by

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14. ABSTRACT Artificial intelligence (AI) is increasing the speed of warfare, adding complexity to the battlefield, and extending the lethality of military capabilities. Near peer adversaries have already taken drastic steps in developing, integrating, and training with AI in order to gain the military advantage against the United States. This research emphasizes that whichever military best integrates and employs AI as an enabler to its strategic aim and operational objective will dominate the battlespace. The study provides insight to the current problems facing the Marine Corps with integrating, trusting, and employing new technologies. AI technology exceeds the normal parameters of an antiquated acquisition cycle, often scares those who must rely on it for fear of lost control, and operates outside the normal acceptable levels of morality and risk decisions a commander is usually willing to make. The study aims to recommend a conceptual framework for how the Marine Air Ground Task Force (MAGTF) must accept, adopt, and use AI as an enabler across all warfighting functions in preparation for a future head-to-head conflict with the People's Liberation Army (PLA) reunifying Taiwan, defending the Belt Road Initiative (BRI), or expanding its influence in support of the nine-dash line claims.					
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Abstract

Artificial Intelligence: Expected to Win; Ready to Fail, by Maj Robert B. Monday, US Marine Corps, 48 pages.

Artificial intelligence (AI) is increasing the speed of warfare, adding complexity to the battlefield, and extending the lethality of military capabilities. Near peer adversaries have already taken drastic steps in developing, integrating, and training with AI in order to gain the military advantage against the United States. This research emphasizes that whichever military best integrates and employs AI as an enabler to its strategic aim and operational objective will dominate the battlespace. The study provides insight to the current problems facing the Marine Corps with integrating, trusting, and employing new technologies. AI technology exceeds the normal parameters of an antiquated acquisition cycle, often scares those who must rely on it for fear of lost control, and operates outside the normal acceptable levels of morality and risk decisions a commander is usually willing to make. The study aims to recommend a conceptual framework for how the Marine Air Ground Task Force (MAGTF) must accept, adopt, and use AI as an enabler across all warfighting functions in preparation for a future head-to-head conflict with the People's Liberation Army (PLA) reunifying Taiwan, defending the Belt Road Initiative (BRI), or expanding its influence in support of the nine-dash line claims.

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Acronyms

A2AD	Anti-Area Anti-Denial
AI	Artificial Intelligence
BRI	Belt and Road Initiative
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
DOD	Department of Defense
EABO	Expeditionary Advanced Base Operations
HFT	High Frequency Trading
JAIC	Joint Artificial Intelligence Center
JFMCC	Joint Force Maritime Component Command
LOE	Lines of Effort
MAGTF	Marine Air Ground Task Force
PLA	People's Liberation Army
PLAN	People's Liberation Army Navy

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Introduction

Some people spend their life wondering if they made a difference. Marines don't have that problem.

— Ronald Reagan

Instead of attacking strength, the goal is the application of our strength against selected enemy weakness in order to maximize advantage. This tack requires the ability to identify and exploit such weakness.

— *MCDP 1, Warfighting*

Technology is developing exponentially and fast. The opportunity presents the warfighter something never seen before—machine enabled capabilities. The world is witnessing a paradigm shift, it is living a fundamental change with the introduction of Artificial Intelligence (AI). AI is defined as “any artificial system that performs tasks under varying and unpredictable circumstances, without significant human oversight, or that can learn from their experience and improve their performance . . . they may solve tasks requiring human-like perception, cognition, planning, learning, communication, or physical action.”¹ The idea and research initiating AI begins in 1956, but in 2010 the convergence of three major developments occurs: “the availability of big data sources, improvements to machine learning approaches, and increases in computer processing power” that make AI so attractive to human endeavors and military warfare.² The research focus is on the Marine Air Ground Task Force (MAGTF)’s operational readiness to employ AI against China. The Chinese People’s Liberation Army’s (PLA) modernization plan and new focus looking external as a means to demonstrate its “growing capabilities; improve its tactics, techniques, and procedures; enhance [its] image and influence abroad, and further [its]

¹ Daniel S. Hoadley and Nathan J. Lucas, *Artificial Intelligence and National Security* (Washington, DC: Congressional Research Service, April 2018), 1.

² Executive Office of the President, National Science and Technology Council, Committee of Technology, *Preparing for the Future of Artificial Intelligence* (Washington, DC: The White House, October 2016), 6, accessed April 1, 2019, https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf.

diplomatic objectives” is problematic³ This research also brings attention to the Marine Corps the concern of missed opportunities, loss of critical time and space, and the expected conflict in with Chinese forces by 2040.⁴

Marines fight not just for the American people, but also to stabilize the world in times of crisis.⁵ Throughout history, the Marines have many firsts and continue cementing their legacy. The first amphibious raid Marines executed was on Fort Nassau in 1776. The Battle of Derna in 1805 is where Marines earned the nickname “Leathernecks.” The 1847 Battle of Chapultepec, the 1918 Battle of Belleau Wood where Marines earned the fighting nickname of Teufelhunden, and the Battle of Iwo Jima in 1945 still live within the Marines today. The Chosin Reservoir in 1950 where Marines overcame 8 to 1 odds against the Chinese Army, the street fighting during the Battle of Hue in 1968, and the success in modern warfare during Operation Desert Storm in 1991 encapsulate the historical triumphs of Marines overcoming unwavering odds and prevailing.⁶

In a recent interview with the National Geospatial Intelligence Agency, the former Director of Marine Corps Intelligence, Brigadier General Dimitri Henry, references a term known as “algorithmic warfare,” and explains it “is to pull coherent data and information out so that a human being can actually think about it and render some type of decision.”⁷ Dr. Peter Layton, a Royal Australian Air Force Reserve Group Captain and Visiting Fellow at the Griffith Asia

³ US Department of Defense, “China Military Power: Modernizing a Force to Fight and Win” (Report, Defense Intelligence Agency, Washington, DC, January 2019), 19, accessed April 2, 2019, https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.

⁴ Anthony H. Cordesman and Steven Colley, “Chinese Strategy and Military Modernization in 2015” (Report, Center for Strategic and International Studies, Burke Chair in Strategy, Washington, DC, October 2015), 130, accessed December 17, 2018, https://csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/151010_Cordesman_Chinese_Mil_Bal_Full_Book_0.pdf.

⁵ US Marine Corps, “Who We Are: Marine Corps Traditions,” accessed April 2, 2019, <https://www.marine.com/who-we-are/our-legacy.html>.

⁶ US Marine Corps, “Who We Are: Marine Corps Traditions,” accessed April 2, 2019, <https://www.marine.com/who-we-are/our-legacy/battles-through-time.html>.

⁷ Geointeresting, “Episode 26: Director of Intelligence, United States Marine Corps, Brig. Gen. Dimitri Henry” (Podcast, 2017), accessed September 9, 2018, https://soundcloud.com/nga_geoint/episode-26-director-of-intelligence-united-states-marine-corps-brig-gen-dimitri-henry.

Institute, Griffith University, expresses that algorithmic warfare “will have a broad, all-pervasive effect, progressively becoming omnipresent in warfighting.”⁸ Layton goes on to highlight defense forces who embrace machine learning successfully may be more effective and efficient.⁹ In the 2012 US Marine Corps Science and Technology Strategic Plan, under the Collaborative planning and synchronized execution Science and Technology Objective, Marines look to “automate processes wherever possible using AI.”¹⁰ Marines thinking about the problem and not getting bogged down with tedious work sifting through exponential amounts of information looking for aggregate and targetable data is the ultimate goal.

According to *Marine Corps Vision and Strategy 2025*, the “dilemma facing the Marine Corps is that it must maintain the ability to wage successful campaigns against large conventionally-armed states and their militaries, against widely dispersed terrorists, and everything in between—generally at great distances from our shores.”¹¹ The priority for the Marine Corps is the Indo-Pacific region, which is also the most dispersed area in the world. During the 2018 US Marine Corps Forces, Pacific hosted Pacific Amphibious Leadership Symposium, New Zealand Air Commodore Andrew Clark states, “The Pacific is a really big area [and] . . . amphibious operations . . . is a difficult area.”¹² Marines understand and prepare for dispersed [amphibious] operations and quite frankly are comfortable with doing more with less.

⁸ Peter Layton, *Algorithmic Warfare: Applying Artificial Intelligence to Warfighting* (Canberra, Australia: Air Power Development Centre, March 2018), 5.

⁹ Ibid.

¹⁰ US Marine Corps, *Marine Corps S&T Strategic Plan: Leading Edge Technology for the Marines of Tomorrow* (Washington, DC: Government Printing Office, January 2012), accessed April 2, 2019, https://www.hqmc.marines.mil/Portals/160/Docs/USMC%20S_T%20Strat_Plan_2012_Final_31_%20Jan.pdf.

¹¹ US Marine Corps, *Marine Corps Vision and Strategy 2025* (Washington, DC: Government Printing Office), 13, accessed March 14, 2019, <https://www.hqmc.marines.mil/Portals/142/Docs/MCVS2025%2030%20June%5B1%5D.pdf>.

¹² LCpl Adam Montera, “New Zealand Defence Force Participates in Amphibious Discussions at PALS,” US Marine Corps Forces, Pacific, May 24, 2018, accessed March 28, 2019, <https://www.marforpac.marines.mil/News/News-Article-Display/Article/1533006/new-zealand-defence-force-participates-in-amphibious-discussions-at-pals/>.

Space and time constraints are to be expected, but Marine Corps limitations with resources and experience operating and training in a contested environment are concerning.

Technology is great, especially with new assets like the F-35 which expand operational reach with combat power and information gathering. Unfortunately, the Marine Corps is feeling the negative effects of data saturation and coming to the point of culmination with processing. The ability to process more using only humans with an end strength not exceeding the already Congressionally approved 185,000, the Marine Corps will need to focus on efficiency and speed.¹³ In a memorandum to the Department, the Deputy Secretary of Defense reinforced what studies have shown in that Department of Defense (DOD) “must integrate AI and machine learning more effectively across operations to maintain advantages over increasingly capable adversaries and competitors.”¹⁴ Secretary Work adds that “Although we have taken tentative steps to explore the potential of artificial intelligence, big data, and deep learning, I remain convinced that we need to do much more, and move much faster, across DOD to take advantage of recent and future advances in these critical areas.”¹⁵

A major friction point with AI enabled military operations is trust. Will a MAGTF commander trust AI to garner its full benefit to gain the decisive edge in accelerated decision making? Knowledge and training, both classroom and live fire events, are fundamental to the MAGTF being proficient with AI. Twentynine Palms, the home of the Marine Corps Air Ground Combat Center is the best location for the MAGTF to learn, train, and explore AI while operating within Multi-Domain Operations. During a recent live fire training exercise, the commanding officer of 3rd Battalion, 4th Marines, 7th Marine Regiment said, “The training areas we have at

¹³ Jeff Schogol, “No Trump Buildup in Marine Corps FY18 Budget,” *Marine Corps Times*, May 23, 2017, accessed March 20, 2019, <https://www.marinecorpstimes.com/news/your-marine-corps/2017/05/23/no-trump-buildup-in-marine-corps-fy18-budget/>.

¹⁴ Robert O. Work, “Establishment of an Algorithmic Warfare Cross-Functional Team (Project Maven)” (Memorandum, Deputy Secretary of Defense, April 26, 2017).

¹⁵ *Ibid.*

Twentynine Palms are the best in the Marine Corps . . . complex terrain forces unit leaders to make complex decisions.”¹⁶ The environment is spectacular for maneuver units, but an emphasis must be placed on adding more complexity to live fire exercises using AI and machine learning—against a thinking enemy. Forcing infantry battalions to operate within a contested information environment while defending and countering AI capabilities the MAGTF expects to face is paramount. Red Team and scenario design must include elements requiring battalions to rely on AI or risk failing to accomplish the mission. Commanders who understand and embrace technology, especially AI, are the leaders who will create opportunities for their Marines to maneuver in a dispersed, contested fight.

In 2010, DOD formally established US Cyber Command as a sub-unified command assigned to United States Strategic Command.¹⁷ On February 15, 2018, US Cyber Command hosted a Cyberspace Strategy Symposium at the National Defense University to discuss with leaders and partners inside and outside of the government challenges facing cyberspace operations.¹⁸ At this symposium, long overdue conversations regarding the integration of cyberspace operations into the joint force identified and emphasized developing solutions to “identify, validate, nominate, and approve cyber targets in the same manner as we do for conventional strikes.”¹⁹ Leaders attending realized “a level of comfort is growing among senior leaders and commanders based on operational experience. Education and expectation management are key as cyber forces and capabilities bring credible options. To deliver all-domain

¹⁶ Kelly O’Sullivan, “Marines Conduct Live-Fire Exercise in Johnson Valley,” US Marine Corps. Air Ground Combat Center, August 4, 2018, accessed March 3, 2019, <https://www.29palms.marines.mil/Articles/Article/1615726/marines-conduct-live-fire-training-exercise-in-johnson-valley/>.

¹⁷ US Cyber Command, “US Cyber Command History,” accessed April 2, 2019, <https://www.cybercom.mil/About/History/>.

¹⁸ US Cyber Command, “USCYBERCOM, 2018 Cyberspace Strategy Symposium Proceedings” (Symposium, National Defense University, February 15, 2018), 1, accessed April 2, 2019, <https://www.cybercom.mil/Portals/56/Documents/USCYBERCOM%20Cyberspace%20Strategy%20Symposium%20Proceedings%202018.pdf?ver=2018-07-11-092344-427>.

¹⁹ *Ibid.*, 5.

integrated effects synchronized in timing and tempo as required by commanders, the Services must integrate the concepts of cyberspace operations into how they organize, train, and equip the force.”²⁰ Cyberspace operations and AI capabilities are two different vectors, but conceptually they both represent the newest technologies soon to be organic to the MAGTF. The nine years it takes senior leaders to recognize and respond to the cyberspace operational gap for the joint force cannot be replicated with AI integration.

Google and Uber log thousands of hours of error-free driving. However, in March 2018 an Uber self-driving (fully autonomous) car collided with a pedestrian and killed her. Bryant Walker Smith, a University of South Carolina law professor who studies autonomous vehicles “suggests a failure by Uber’s automated driving system” caused the collision.²¹ He suggests, “The victim is obscured by darkness, but . . . [AI] should have detected her and classified her as something other than a stationary object.”²² Experts agree testing autonomous technology shows driverless cars to be safe. But, Timothy Carone, a driverless car expert, explains “Driving a car can seem like a rote process, but it is not . . . we make complex decisions and value judgments continually when we are behind the wheel.”²³ Interestingly, the investigation into the March 2018 Uber accident leads Tempe Police Chief Sylvia Moir to assert “It’s very clear it would have been difficult to avoid this collision in any kind of mode (autonomous or human-driven) based on how she came from the shadows right into the roadway.”²⁴ Accidents with AI are going to happen, just as they do with humans behind the controls. AI will mature, but only after repetition. The fear of

²⁰ US Cyber Command, “USCYBERCOM, 2018 Cyberspace Strategy Symposium,” 5.

²¹ Dara Kerr, “Was Uber’s Driverless Car Crash Avoidable? Experts Say Yes,” CNet, March 23, 2018, accessed September 28, 2018, <https://www.cnet.com/news/was-ubers-driverless-car-crash-avoidable-some-experts-say-the-self-driving-car-should-have-braked/>.

²² Ibid.

²³ Ibid.

²⁴ Ibid.

uncontrollable reactions by AI can be mitigated with live training and practice—again, not much different from humans.

This research is limited in scope and focused primarily on strategy and conceptual thinking with AI being introduced and employed within the Marine Corps because of classification restrictions and service strategy still in draft format. Organized into seven sections: the introduction, literature review, Chinese modernization, AI strategy, morality and ethics in war, findings, and conclusion, this monograph strives to highlight the operational necessity for Marines to educate, embrace, and integrate AI faster and to a greater extent at the tactical level.

Literature Review

We can only see a short distance ahead, but we can see plenty there that needs to be done.
— Alan Turing

China is already at a period with AI and automation that will very soon surpass many of its human endeavors. AI is viewed as an opportunity to be used and exploited to give the MAGTF an advantage in accomplishing its military objectives. The problem with this technology is that it remains mostly in the research and development stages. Employment decisions rely solely on theoretical concepts and unfinished testing that create gaps in understanding and leave unanswered questions for mitigating risk. Current policy with DOD mandates a human will always be in the loop. Secretary Carter rams the point home during a force of the future event at New York City when he says, “when there’s artificial intelligence or autonomous systems, you get this idea that they’re going to be weapons of war out there that nobody’s controlling. That’s not the way we do things. We will always have a human being in the loop—a human being making decisions about the use of force on behalf of the United States.”²⁵ The diagram below

²⁵ Ash Carter, Secretary of Defense, “Remarks by Secretary Carter at a Force of the Future Event at The City College of New York in New York City” (Transcript, Department of Defense, November 1, 2016), accessed April 2, 2019, <https://dod.defense.gov/News/Transcripts/Transcript-View/Article/993211/remarks-by-secretary-carter-at-a-force-of-the-future-event-at-new-york-city-col/>.

illustrates and justifies Secretary Carter’s statement. The 2018 DOD AI Strategy aims to “seek opportunities to use AI to reduce unintentional harm and collateral damage” and therefore underpins the directive that human-out-of-the-loop is not authorized for military operations.²⁶

Semi-Autonomous	Human-Supervised	Autonomous
Human <i>in</i> the Loop	Human <i>on</i> the Loop	Human <i>out</i> of the Loop
The machine stops and waits for human approval before continuing after each task is accomplished.	Once activated, the machine performs a task under human supervision, and will continue performing the task until the operator intervenes.	Once activated, the machine performs its task without any assistance on the part of the human operator, who neither supervises the operation nor has an ability to intervene.

Figure 1. Autonomy Concepts and Definitions. Andrew Ilachinski, *AI, Robots, and Swarms Issues, Questions, and Recommended Studies* (Arlington, VA: CNA Analysis and Solutions, 2007), 146-151.

The use of AI to many is a foreign concept and to some a futuristic capability that solves the world’s problems. No matter how AI is viewed, it is here and will be deeply woven into human activities. The MAGTF has no choice but to be ready for a robust, faster thinking, and more capable China because China is arguably already ahead with AI. China operates within its own legal framework and ethical boundaries which differ drastically from the western standard. This willingness to operate outside the international norm is risky but gives time back to the developers and operational commander who train with and employ the technology. The Chinese government monitors its own people using AI, which is widely known—“China has now opened AI’s Pandora’s Box: an unconstrained and unlimited surveillance laboratory across Xinjiang, a province with a larger population than 22 of the European Union’s 28 member states.”²⁷ The

²⁶ US Department of Defense, *Summary of the 2018 Department of Defense Artificial Intelligence Strategy: Harnessing AI to Advance Our Security and Prosperity* (Washington, DC: Government Printing Office, 2019), 8, accessed April 2, 2019, <https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEG>.

²⁷ Zak Doffman, “Why We Should Fear China’s Emerging High-Tech Surveillance State,” *Forbes*, October 28, 2018, accessed April 2, 2019, <https://www.forbes.com/sites/zakdoffman/2018/10/28/why-we-should-fear-chinas-emerging-high-tech-surveillance-state/#456915164c36>.

point here is that if China monitors its citizens using AI, its ethical considerations towards foreigners can be expected to be at a much lower threshold, if any measurement at all.

DOD's initial answer for AI is the Third Offset Strategy. The strategy is defined as "an effort to focus on DOD's innovation efforts on preserving and revitalizing its conventional deterrence capability by adapting to the countermeasures to key U.S. capabilities that near-peer competitors have built up in recent years and are continuing to develop."²⁸ The five key areas within the strategy focus are: "autonomous learning systems, human-machine collaborative decision-making, assisted human operations, advanced manned-unmanned systems operations, and network-enabled autonomous weapons and high-speed projectiles."²⁹ These five areas, identified by Secretary Carter are valuable avenues of innovation to "see what germinates," and not a determination of what will work.³⁰ Secretary Carter's comments at the time are clear in that the United States is trying to figure out what AI is and how it can be used. Regardless of its characterization, the Third Offset Strategy's goal for the military services is to identify threats and capabilities needed to maintain technological superiority over a near-peer competitor.³¹ The strategy emphasizes using AI to give US forces greater range and a more distributed capability, but also harder to target and resistant to a crippling blow.³²

Getting military services to take advantage of Third Offset capabilities is the next challenge. Retired Marine Lieutenant General Robert Schmidle, the former Principle Deputy Director of the Office of Cost Assessment and Program Evaluation, amplifies this concern when he states "DOD must then figure out how to integrate new capabilities, and the new operational

²⁸ Jesse Ellman, Lisa Samp, and Gabriel Coll, "Assessing the Third Offset Strategy" (Report, Center for Strategic and International Studies, Washington, DC, March 2017), 2, accessed March 22, 2019, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/170302_Ellman_ThirdOffsetStrategy_Summary_Web.pdf.

²⁹ Ibid., 3.

³⁰ Ibid.

³¹ Ibid., 7.

³² Ibid.

concepts those new capabilities demand and allow for, into existing military service cultures that are not always particularly receptive to change.”³³ The Marine Corps is challenged with limited resources, but also presented with opportunities not available to the bigger sister services. In 2017, the Marine Corps’ overall budget was only 14.6 percent of the Department of the Navy’s Defense Budget.³⁴ Interestingly, although small, the Marine Corps budget exceeds the national defense spending for Brazil, Iran, Turkey, and South Korea.³⁵ The point here is even with a small budget and limited resources, the Marines dominate most countries with its size and capabilities. Benefiting from being the smallest service, the Marine Corps unifies easier under one strategy allowing for better interoperability and greater enhancement of emerging technologies. Change is easier in smaller increments giving the Marines an advantage with AI integration.

DOD quickly learns the speed of technological development is not conducive to current operating and planning models used by the military. The typical acquisition cycle is constrained by a five-year window from identifying and validating a requirement to an operational unit receiving that end item for use and employment. The cycle is extensive and absolutely too slow. The process is completely unacceptable if the United States is to remain competitive and capable of reaching the goals laid out within the Third Offset Strategy. The Center for Naval Analysis recommends DOD adapt quickly and develop ways to take risks within the acquisition process.

³³ Ellman, Samp, and Coll, “Assessing the Third Offset Strategy,” 9.

³⁴ A better visual representation of the data associated to the Navy’s Fiscal budget is hosted on their Navy live website. Department of the Navy, “Department of Navy Fiscal Year 18 Budget: Restore, Innovate, Compete,” *The Official Blog of the US Navy*, May 23, 2017, accessed March 18, 2019, <http://navylive.dodlive.mil/2017/05/23/department-of-navy-fiscal-year-18-budget-restore-innovate-competel/>.

³⁵ Dr Nan Tian, Dr Aude Fleurant, Pieter D. Wezeman, and Siemon T. Wezeman, *Trends in World Military Expenditure, 2016* (Sweden: Stockholm International Peace Research Institute, 2017). SIPRI released a fact sheet in April 2017 that illustrates their analysis of global military expenditures.

The stakes are too high to be held back by bureaucratic processes tied to outdated policy restrictions and guidelines.³⁶

Ethical and moral actions in warfare remain critically important to American policymakers and military commanders because the United States always takes the moral high ground. The separation between a human error and machine error are viewed very differently. An interesting fact when considering the problem of using autonomous solutions for military applications comes from a review of the percentages of fratricides occurring in recent wars. In 2003, 17 percent of US casualties were from fratricide.³⁷ The man-in-the-loop or the man-on-the-loop keeps the Marine Corps in control of the system which is directed by policy but should also make trust building quicker and easier. If a human remains in the loop, should the Marine Corps expect an increase in percentages? Fratricide will, by the very nature of warfare, happen in conflict. The Marine Corps keeping Marines in control of AI safeguards against an increase in fratricide; in fact, with AI enabled capabilities the inverse is expected where human errors decrease machine learning and more accurate decision making.

Reverting back to self-driving cars, a study shows that autonomous vehicles are five times more likely to be involved in an accident when compared to conventional cars. AI enabled cars follow the rules of the road.³⁸ Important to know is that these self-driving cars are never at fault, it is that the machine learning is still learning. The incidents support the argument that continued refinement is necessary and adopting learned behavior when reacting with human actions is required. What designers did not plan for is how self-driving vehicles operate when challenged with opposing human drivers, especially bad ones. No algorithm can anticipate with

³⁶ Larry Lewis, "Insights for the Third Offset: Addressing Challenges of Autonomy and Artificial Intelligence in Military Operations" (Report, Center for Naval Analysis, Arlington, VA, September 2017), v, 8, accessed February 5, 2019, https://www.cna.org/cna_files/pdf/DRM-2017-U-016281-Final.pdf.

³⁷ Larry Lewis, "Redefining Human Control: Lessons from the Battlefield for Autonomous Weapons" (Occasional paper, Center for Autonomy and AI, Center for Naval Analysis, March 2018), iv, accessed January 23, 2019, https://www.cna.org/cna_files/pdf/DOP-2018-U-017258-Final.pdf.

³⁸ Ibid.

100 percent certainty what a human will do at any given time. The numbers of variables presented are just too great. Maintenance problems, a squirrel running into the road, bad brakes, etc. are just some of the many challenges a driver must deal with and react to while driving.

Machine learning will learn and apply responses to these situations, errors, and trouble codes, but the car only applies its adaptive learning to its own system. There is and will always be risk that cannot be anticipated. This dilemma is no different from what a human driver faces driving to and from work every day. Accidents occur even with the best drivers. A comprehensive approach focusing on the process instead of the outcome is key, meaning “human control should be addressed not just as part of the final engagement decision, but as a broader set of military doctrinal functions distributed across the wider targeting cycle.”³⁹ Using AI within these concepts puts acceptable mitigation and supervision against mistakes. The legal authority for the final engagement decisions remains in the hands of a human operating in the man-in-the-loop or man-on-the-loop system.

The stock market is using AI and has been for many years. Speed and efficiency equate to money earned and improper or poor algorithms result in a major loss. The speed of success in Wall Street is “the ever-greater emphasis on speed in the new, technology-driven financial structure is what some have labeled an arms race, or a ‘race to zero’: ‘the new trading frontier is nanoseconds—billionths of a second. And the twinkle in technologists’ (unblinking) eye is picoseconds—trillionths of a second.”⁴⁰ At first the technology within the stock market operated with limited oversight and constraints allowing the inevitable to occur—data saturation and system malfunction. On May 6, 2010, improper information inputted into a High Frequency Trading (HFT) algorithm not capable of maneuvering inside of a volatile market caused a flash crash. At

³⁹ Lewis, “Redefining Human Control,” 26.

⁴⁰ Andrew J. Keller, “Robocops: Regulating High Frequency Trading After the Flash Crash of 2010,” *Ohio State Law Journal* 73, no. 6 (2012): 1463, accessed October 31, 2018, https://kb.osu.edu/bitstream/handle/1811/71570/OSLJ_V73N6_1457.pdf.

the time traders realized the effects of what was occurring and responded using stub quotes. Traders mandated by formal obligation continued trading, but developed creative measures, [stub quotes] to stabilize the system and prevent a catastrophic failure. Traders effectively reduced “bids in shares of a stock to the lowest possible value (\$0.01), and the asks to the maximum possible value (\$99,999.99), making the bids and asks so unattractive that no rational trader would take the market maker up on these quotes.”⁴¹ The connection between military applications and the flash crash is surprising, but relevant. High functioning and strategically important systems in finance were beginning to introduce new technology with legacy processes without having fully tested (or realized) the convergence of the two. Traders continued maneuvering in the chaos because of mandated obligations (missions). Traders understand the system (machine) enough to recognize and respond to the malfunction. This type of quick thinking and ability to adjust while maintaining the necessary tempo with HFT is exactly what DOD expects Marines to do with AI and human + machine capabilities. The flash crash and human involvement is also exactly why DOD and the Marine Corps will keep a man-in-the-loop or man-on-the-loop systems.

In May 2017, DOD issued DODD 3000.09 to “establish DOD policy and assign responsibilities for the development and use of autonomous and semi-autonomous functions in weapon systems, including manned and unmanned platforms.” The 2018 National Defense Strategy identifies a major goal to “build a more lethal force” that includes investing in command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and advanced autonomous systems.⁴² These two investment goals intertwine within Marine Corps requirements and the future support to the decision cycle. The end state with C4ISR is to

⁴¹ Keller, “Robocops,” 1474.

⁴² US Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: Government Printing Office 2018), 7, accessed March 5, 2019, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

“prioritize developing resilient, survivable, federated networks and information ecosystems from the tactical level up to strategic planning. Investments prioritize capabilities to gain and exploit information, deny competitors those same advantages, and enable the U.S. to provide attribution while defending against and holding accountable state or non-state actors.”⁴³ The United States is investing in “military application of autonomy, artificial intelligence, and machine learning, including rapid application of commercial breakthroughs, to gain competitive military advantages.”⁴⁴ It is all strategy and all conceptual.

A recent report published by the Congressional Research Service in April 2018 strengthens AI’s significant implications for national security and calls attention to the current efforts by the Defense Advanced Research Projects Agency and the Intelligence Advanced Research Projects Agency. These agencies are moving fast with research and development efforts and support to specific service requirements, but the concern with them moving so fast is the risk in duplication with two or more military services working the same line of effort (LOE) without cross-talking or sharing best practices. The Office of the Assistant Secretary of Defense for Research and Engineering maintains some oversight within DOD for AI and autonomous systems initiatives and should be the responsible office for knocking down virtual walls within DOD, but the bureaucracies and independent service procurement processes create friction and limit control. Regardless, a unified strategy with comprehensive and clear goals will keep the services focused on the correct LOE.

⁴³ US Department of Defense, *Summary of the 2018 National Defense Strategy*, 6.

⁴⁴ *Ibid.*, 7.

AI Strategy

We must anticipate the implications of new technologies on the battlefield, rigorously define the military problems anticipated in future conflict, and foster a culture of experimentation and calculated risk-taking.

— *Summary of the 2018 National Defense Strategy of the United States of America*

In 2018, DOD delivered its first AI strategy with a strategic approach towards guiding US efforts in accelerating the integration and adoption of AI. Within this strategy, the five areas of focus are:

- Delivering AI-enabled capabilities that address key missions;
- Scaling AI’s impact across the DOD through a common foundation that enables decentralized development and experimentation, engaging with commercial;
- Cultivating a leading AI workforce;
- Engaging with commercial, academic, and international allies and partners;
- Leading in military ethics and AI safety.⁴⁵

DOD established the Joint Artificial Intelligence Center (JAIC) as the focal point within the Department designed to “accelerate the delivery of AI-enabled capabilities, scale the Department wide impact of AI, and synchronize DOD AI activities to expand Joint Force advantages.”⁴⁶ The JAIC leads the effort to build a culture within DOD that embraces experimentation and rewards appropriate risk-taking. Disrupting the norm within military culture is not easy, but “doing so is imperative for implementing and adopting AI—which requires running experiments daily, iterating based on user feedback, measuring results, and continuously adapting.”⁴⁷ The JAIC is

⁴⁵ US Department of Defense, *Summary of the 2018 Department of Defense Artificial Intelligence Strategy*, 7-8.

⁴⁶ *Ibid.*, 9.

⁴⁷ *Ibid.*, 14.

also the DOD's advocate for establishing the global standard and AI guidelines for military use to ensure all operations are ethical and in accordance with the law of war.⁴⁸

In Section 8 of the Presidential Executive Order on Maintaining American Leadership in Artificial Intelligence, signed February 11, 2019, President Trump directs “an action plan to protect the United States advantage in AI and AI technology critical to United States economic and national security interests against strategic competitors and adversarial nations.”⁴⁹ The reason this executive order is important is because AI strategy within the United States remains on the same path—the political aim is driving the military objectives. However, this order is two years behind China announcing its detailed plan to lead in AI.⁵⁰ The CEO of the Allen Institute for Artificial Intelligence, Oren Etzioni, expresses concern the executive order is “too little, too late.”⁵¹

Published in 2016, the Marine Corps established how it will operate in the 21st century with the release of the *Marine Corps Operating Concept*. Its purpose is to “describe in broad terms how the Marine Corps will operate, fight, and win in 2025 and beyond; and shape our actions as we design and develop the capabilities and capacity of the future force.”⁵² The Marine Corps remains laser focused on its core missions, but continues looking forward on ways to better enable units “to maneuver more rapidly and deeply throughout the battlespace.”⁵³ To maneuver

⁴⁸ Ibid., 15.

⁴⁹ US President, *Executive Order on Maintaining American Leadership in Artificial Intelligence* (Washington, DC: The White House, February 11, 2019), accessed April 4, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>.

⁵⁰ Emily Birnbaum, “Trump Signs Executive Order to Boost AI Technology,” *The Hill*, February 11, 2019, accessed April 4, 2018, <https://thehill.com/policy/technology/429465-trump-signs-executive-order-boosting-artificial-intelligence>.

⁵¹ Ibid.

⁵² US Marine Corps, *Marine Corps Operating Concept: How an Expeditionary Force Operates in the 21st Century* (Washington, DC: Government Printing Office, September 2016), 4, accessed April 1, 2019, <https://www.mccdc.marines.mil/Portals/172/Docs/MCCDC/young/MCCDC-YH/document/final/Marine%20Corps%20Operating%20Concept%20Sept%202016.pdf?ver=2016-09-28-083439-483>.

⁵³ Ibid., 22.

more rapidly and deeper, the Marine Corps will “exploit man-machine and artificial intelligence interface to enhance performance.”⁵⁴ The guidance and direction is clear, the Marines will embrace technology to enable the freedom of movement on the battlefield. In written testimony to the Congressional Defense Committees, General Neller, Commandant of the Marine Corps, gives the update on the posture of the Marine Corps where he expands on experimentation and wargaming to validate capability development and investment strategies. Neller highlights balancing the MAGTF with future capabilities “leveraging cyber, information, and artificial intelligence.”⁵⁵

The Marine Corps is in the process of a three-phase experimentation plan known as Sea Dragon 2025. The Marine Corps Warfighting Lab completed the first phase focusing on “augmenting an infantry battalion with experimental equipment, developing an analytically-based wargaming process, and leveraging commercial technological advances through our Advanced Naval Technical Experiment series.”⁵⁶ The plan covers a three year period and includes other efforts centered around “MAGTF hybrid logistics, operations in the information environment, and Expeditionary Advanced Base Operations (EABO).”⁵⁷ Sea Dragon 2025 is the path to refining the Marine Corps’ capability development, force structure, and strategy to modernize the force.⁵⁸

⁵⁴ Ibid.

⁵⁵ General Robert B. Neller, *Statement as Delivered to Congressional Defense Committees on the Posture of the United States Marine Corps* (Washington, DC: Government Printing Office, April 20, 2018), 4, accessed April 4, 2019, <https://www.hqmc.marines.mil/Portals/142/CMC%20PB19%20Posture%20Written%20Testimony%20vFinal.pdf?ver=2018-04-20-110550-363>.

⁵⁶ Ibid.

⁵⁷ Ibid.

⁵⁸ Ibid.

Morality and Ethics in War

One of the toughest dilemmas facing the Marine Corps and its use of AI is morality and ethics. Using AI to support lethal decisions and weaponizing it introduces hard questions on constraints and restraints placed on and within the Service to protect against indiscriminate killing of non-combatants and unnecessary collateral damage. The question arises of whether AI is trusted to the point that operators at each level of warfare (tactical, operational, and strategic) are effective against an adversary with no limits or ethical standards in relation to warfare. The argument is not what is right or wrong, the argument is about what is acceptable in conflict and within the international community. In modern warfare, the line between combatant and non-combatant is blurred. At times the ability to distinguish between the two is almost undefinable simply because nation states and non-nation states take advantage and exploit the laws of war. Atrocities like those committed in the former Yugoslavia or in Rwanda are clear to anyone who read or studied them. Men, women, and children in those countries fell victim to horrific war crimes by those who made the conscious and deliberate decision to ignore right versus wrong.

Diplomatic and military pressure exerted on the malign actor (North Korea, Syria, and Yemen for example) is normally enough for illegal actions to stop. The impacts of strategic bombings and/or economic sanctions by the international community in response to gross disregard of morality normally ends unlawful and immoral actions. If political or economic pressure fails, the action in and of itself, with precise bombing and lethal strikes directed towards an adversary to end immoral actions is determined to be just and warranted. Innocent civilians are always at risk of being killed, but with mitigated risk and just cause the military actions are accepted as proportionate and for the greater good.

The discussion of proportionality is critical in determining AI acceptance on the battlefield. “Even when non-combatants and combatants are inextricably mingled, or even when the idea of a distinction between them is denied, there remains the separate obligation imposed by

proportionality.”⁵⁹ With proportionality and just actions, there is no reason AI cannot be morally accepted into MAGTF operations at every range of conflict. The topic of non-combatant immunity is acceptable for the Marine Corps as it moves towards more human + machine integrated operations because non-combatant immunity is not an absolute in conflict. Viewing AI separately or differently than another warfighting capability currently used by the MAGTF in conflict regarding intent, legality, morality, and ethics is wrong. AI is another enabler for the warfighter and is no different than how the MAGTF employs its operations using intelligence, cyber, and space.

AI is not another domain, but a capability added to the commander’s options for achieving his or her military objective. Concerns about AI are often centered on the inability to distinguish friend from foe for fear of innocent civilians being killed. Do not be mistaken, any death of an innocent non-combatant is truly bad, but when it happens as an accident during an operation deemed necessary and just by competent authorities, the collateral effect is to be accepted. “It is occasionally lawful to kill the innocent not by mistake but with full knowledge of what one is doing, if this is an accidental effect: for example, during the justified storming of a fortress or city.”⁶⁰ Again, this is not to say the Marine Corps should not worry about the collateral effects of its operations so long as the good outweighs the bad. Rather, the Marine Corps must embrace the principle of double effect and acknowledge that in modern warfare AI is a necessity for the United States to maintain its global dominance.

The amount of information, data collection, quantum computing, interconnected societies, and the speed of change are too fast for the human mind. As the Marine Corps moves closer to indoctrinating itself with AI capabilities, its decision makers must accept acts carried out

⁵⁹ James Turner Johnson, “Contemporary Just War,” in *The Ethics of War: Classic and Contemporary Readings*, eds. Gregory M. Reichberg, Henrick Syse, and Endre Begby (Malden, MA: Blackwell Publishing, 2006), 668.

⁶⁰ Francisco de Vitoria, “On the Law of War,” in *Vitoria Political Writings*, ed. Anthony Pagden and Jeremy Lawrance (Cambridge: Cambridge University Press, 1991), 315.

with foreseeable bad consequences. The consequences are permissible so long as the “act (which must itself be morally neutral) is undertaken for the sake of good effects; the bad consequences are merely foreseen and not intended—they are wanted neither as the means to the result aimed at nor as the end itself; and the bad consequences are not disproportionate to the good aimed at.”⁶¹ The Marine Corps without or delayed AI integrated across the warfighting functions will slowly drift further behind its Chinese opponent.

Chinese Modernization

Actions taken over the past fifteen to twenty years confirm that China is aggressively pursuing and following through with a fundamental change in strategy. This new, grand strategy ties back to 2004 when Chinese President Hu Jintao outlined the PLA’s “Historic missions of the Armed Forces in the New Period of the New Century.”⁶² The new missions Hu outlined ensure China’s “sovereignty, territorial integrity, and domestic security.”⁶³ But, as economic factors drove Chinese expansion, its foreign policy shifted to include external influence. In 2012, President Xi Jinping building upon the Hu era focused on “expanding the scope and ambition of PLA modernization, clearly affirming the PLA’s overseas role and providing the institutional framework to enable substantial military growth beyond the PLA’s traditional security threats.”⁶⁴ In 2015, under the control of Xi Jinping, the PLA transformed and reorganized into a completely new joint construct with theater commands and a consolidation of fifteen departments into four. This reorganization also established a PLA Rocket Force, Strategic Support Force, and a Joint

⁶¹ David Fisher, *Morality and War: Can War Be Just in the Twenty-First Century* (Oxford: Oxford University Press, 2011), 86.

⁶² US Department of Defense, “China Military Power,” 4.

⁶³ Ibid.

⁶⁴ Ibid.

Logistics Support Force. The Chinese are “preparing for military struggle in all strategic directions.”⁶⁵

The Chinese strategy is an active defense.⁶⁶ It is a strategic defense, but an operational offense once “Beijing has determined that an adversary has damaged or intends to damage China’s interests at the strategic level.”⁶⁷ Xi Jinping sees the PLA as critical to the Chinese national interests. He sets three benchmarks—“becoming a mechanized force with increased informatized and strategic capabilities by 2020, a fully modernized force by 2025, and a worldwide first-class military by midcentury.”⁶⁸ This grand strategy drives China’s Anti-Area Anti-Denial (A2AD) strategy which directs three LOEs. The first LOE “emphasizes degrading an opponent’s technological advances in an effort to level the playing field. The second LOE “is a military strategy that prioritizes striking first in a conflict to seize the initiative. And, the third LOE is geographically focused and “centers on controlling China’s periphery, especially the western Pacific Ocean.”⁶⁹

The Pacific theater is where globalization and geopolitics clash. This area of the world is deemed one of the most strategic and influential regions, especially for the United States and it’s roughly 1.2 trillion dollars of trade transiting it annually.⁷⁰ China’s goals, however, are the reunification of Taiwan and deny foreign force projection. China is increasingly challenging the US naval preeminence in this region, threatening the region with A2AD capabilities, and increasingly leveraging freedom of maneuver within the gray space. China’s reorganization and

⁶⁵ Ibid.

⁶⁶ Matthew R. Costlow, *Gunboat Diplomacy in the South China Sea* (Ann Arbor, MI: Nimble Books, 2013), 37.

⁶⁷ US Department of Defense, “China Military Power,” 23.

⁶⁸ Ibid.

⁶⁹ US Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China* (Washington, DC: Government Printing Office, 2017), 22.

⁷⁰ Patrick M. Cronin and Robert D. Kaplan, “Cooperation from Strength: U.S. Strategy and the South China Sea,” in *Cooperation from Strength: The United States, China and the South China Sea*, ed. Patrick M. Cronin (Washington, DC: Center for a New American Security, 2012), 7.

more capable maritime forces presents the MAGTF with two employment opportunities. When deployed with the Joint Force Maritime Component Command (JFMCC) or executing the EABO concept throughout the littorals, the MAGTF will be challenged by modernized Chinese capabilities.

The United States continues to protect the international norms with freedom of navigation operations and commitment to the defense of Taiwan. At the 18th Party Congress in 2012, President Hu emphasized, “We should enhance our capacity for exploiting marine resources, resolutely safeguard China’s maritime rights and interests, and build China into a maritime power.”⁷¹ In 2015, China announced the navy’s new Offshore Defense and Open Seas Protection strategy that contains the People’s Liberation Army Navy’s (PLAN) extension of its operational reach beyond the first and second island chains in support of Chinese interests.⁷² The inevitable confrontation of Chinese strategy and US commitment to the Pacific ensuring the freedom of navigation and access to the global commons, creates a high probability at some point in the next twenty years of tensions escalating to the point of conflict. If conflict occurs, there is almost certainty the MAGTF will be called upon to support the JFMCC or EABO operations.

The adaptive and evolving Chinese strategy in preparing for conflict with the United States is well projected with many indications and warnings confirming that the Chinese are literally doing exactly what they layout as their path to success.⁷³ The Obama Administration, as well as the Trump Administration, make it very public on the strategic shift to focus on the Pacific. This competition and race for strategic dominance is not surprising since the United States has been through this before. The arms race between the Chinese and Japanese in the late 1800s and the nuclear buildup of deterrent forces by the United States in response to the Soviet

⁷¹ US Department of Defense, “China Military Power,” 63.

⁷² Ibid., 64.

⁷³ Stephen J. Flanagan and Michael E. Marti, eds., *People’s Liberation Army and China in Transition* (Washington, DC: National Defense University, 2003), 321.

Union are two historical examples to compare against when assessing the next twenty years of Chinese and US competition. The US *National Defense Strategy* articulates “the reemergence of long-term strategic competition, rapid dispersion of technologies, and new concepts of warfare and competition that span the entire spectrum of conflict require a Joint Force structured to match this reality,” but how the services respond to meet the demand is to be seen.⁷⁴

China will dominate the narrative or force a reaction of a US ally possibly resulting in the invocation of a Mutual Defense Treaty or formal agreement. There are positive signs that the Pacific fight is expanding, potentially in favor of US national interests with actions taken by its coalition partners executing freedom of navigation operations. Freedom of navigation operations are basic and rudimentary, but they cement the international norm and indirectly message the Chinese. The US policy dictates that the United States will “deter adversaries from aggression against our vital interests; and maintain favorable regional balances of power in the Indo-Pacific, Europe, the Middle East, and the Western Hemisphere,” but how the United States responds to operations in the gray zone is the concern.⁷⁵ The United States expands further in formally stating that “China is leveraging military modernization, influence operations, and predatory economics to coerce neighboring countries to reorder the Indo-Pacific region to their advantage.”⁷⁶ Chinese actions run counter to the world order and therefore the United States will use its strategic approach in countering Chinese influence in the Pacific.⁷⁷

The United States finds itself grossly extended with resources committed throughout the world. China took advantage of the United States’ lack of strategic foresight and appropriately aligned policies. The PLA’s power projection is seen in annual military exercises and

⁷⁴ US Department of Defense, *Summary of the 2018 National Defense Strategy*, 1.

⁷⁵ *Ibid.*, 4.

⁷⁶ *Ibid.*, 2.

⁷⁷ *Ibid.*, 4.

operations.⁷⁸ The PLA Air Force participated in four exercises in 2015 focusing on the first island chain “through the Bashi Channel, the northernmost passage of the Luzon Strait, and through the Miyako Strait closer to Japan.”⁷⁹ China is restarting the production of the world’s largest transport aircraft that when delivered and operational will give the PLA global reach.⁸⁰ The PLA is expanding its participation in UN peacekeeping operations and in 2015 conducted its first noncombatant evacuation operation in Yemen.⁸¹ China’s military efforts also tie directly to its “Belt and Road Initiative” (BRI) enhancing its presence abroad and enabling the PLA to “play a more prominent role.”⁸² Why does all this matter? It is further validation that a future flash point between competing strategies and narratives is bound to happen in the near or mid-term.

The advantage in Asia naturally falls to China because it controls the media and ensures all messages and policies are in synch and coordinated. The standardization and arguably the erosion of events surrounding Taiwan and in the South China Sea seems to almost always play into the hands of China. The reclamation of its manmade islands is projected as a territorial issue supported by the nine-dash line claim. These islands are also protected and patrolled by its Coast Guard, but backed by the PLAN. US allies and partners in the Pacific may soon lose faith in the United States’ ability to protect them from Chinese expansion because their success in the gray zone is gaining territory. Besides limited freedom of navigation operations, US activities in the South China Sea have had no strategic impact on the Chinese. The continued development of the contested islands continues. During a rally marking the PLA’s 90th anniversary, President Xi Jinping stated, “we absolutely will not permit any person, any organization, any political party—

⁷⁸ US Department of Defense, “China Military Power,” 33.

⁷⁹ US Department of Defense, “China Military Power,” 33.

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Ibid.

at any time, in any form—to separate any piece of Chinese territory from China.”⁸³ From the top down, China’s policy, supported by a powerful narrative, allows it to maneuver outside the boundaries of the United Nations Convention on the Law of the Sea.⁸⁴

Overlaying with its nine-dash line policy and grand strategy, the guidance and implementation of its “two transformations” program following the 9th Five-Year Plan (1996 to 2000) continues to show how China is gaining the military advantage. This particular five year plan focused on “using information and mechanization to transform the PLAN, along with the rest of China’s military, from a posture that is personnel-intensive to one that is technology-intensive.”⁸⁵ In 2004 Chinese state and military media made their case that China must go beyond “survival interests” and began protecting “development interests.”⁸⁶ This narrative is yet another example for how China defends its actions in the region and argues its military is only defending the country’s national interests and economic rights. China is following through with new requirements “for the new platforms China is putting into service with the PLAN, but also for C4ISR capabilities to support their monitoring and—in a worst-case scenario—targeting foreign platforms on, under, and above the sea.”⁸⁷ China is aggressively looking forward into the near and far future and is developing, acquiring, and deploying an operational and networked force capable of the far sea fight. The PLAN will be integrated with the most technological and capable equipment, knowing a modern and capable navy gives China a potential competitive edge on the

⁸³ CAPT Dale Rielage, “Coast Guard: Wrong Tool for the South China Sea,” *Proceedings* 143, no. 9 (September 2017), accessed March 2, 2019, <https://www.usni.org/magazines/proceedings/2017/september/coast-guard-wrong-tool-south-china-sea>.

⁸⁴ Zach Cooper and Gregory Poling, “America’s Freedom of Navigation Operations Are Lost at Sea,” *Foreign Policy*, January 8, 2019, accessed March 4, 2019, <https://foreignpolicy.com/2019/01/08/americas-freedom-of-navigation-operations-are-lost-at-sea/>.

⁸⁵ Andrew S. Erickson and Michael S. Chase, “Informatization and the Chinese People’s Liberation Army Navy,” in *The Chinese Navy: Expanding Capabilities, Evolving Roles*, eds. Phillip C. Saunders, Christopher D. Yung, Michael Swaine, and Andrew Nien-Dzu Yang (Washington, DC: National Defense University, 2011), 249.

⁸⁶ *Ibid.*, 248.

⁸⁷ *Ibid.*

United States and its regional allies. The level of intensity China is exhibiting in its modernization should, again, come to no surprise as China understands “in the information age, information has become one of the main sources of combat power.”⁸⁸

There is a logical path and connection with Chinese informatization goals that ties to “autonomous operations and notions of speed, accuracy, security, and continuity of communications” within those concepts.⁸⁹ China is spending a great amount of intellectual capital on unmanned aerial and combat vehicles as well as training its forces under conditions of informatization. Chinese military forces train for a conflict in a contested environment using modeling, simulation, and joint operations against a realistic opponent. China is training and preparing for a fight in the information domain against a thinking adversary while also ramping up its maritime capability. However, China still has the same strategic, operational, and tactical challenges facing the United States; modernization and informatization are difficult and continue to become more and more complex with new technology. Concern of information overload, degraded communications, and command and control are just some of the major hurdles China is working to overcome. That said, as the PLAN “is seeking increased automation and data links,” it is training to the new standard in preparation for the future fight with the United States.⁹⁰

The modernization efforts and accomplishments are not because China is intellectually superior, it is because of their economic strength. The BRI is the backbone to military expansion and capability development. The relationship with Russia is relatively minor, but also concerning because Russia succeeds in non-kinetic warfare. Military experts expect the Chinese to challenge US dominance over the Indian Ocean and Western Pacific by 2040.⁹¹ As highlighted by one military analyst in 2011:

⁸⁸ Erickson and Chase, “Informatization and the Chinese People’s Liberation Army Navy,” 251.

⁸⁹ *Ibid.*, 252.

⁹⁰ *Ibid.*, 273.

⁹¹ Cordesman and Colley, “Chinese Strategy and Military Modernization,” 130.

China's active defense strategy has a maritime component that aligns with the PRC's 1982 naval maritime plan outlined by then-Vice Chairman of the Military Commission, Liu Huaqing. This naval strategy delineated three stages. In the first stage, from 2000 to 2010, China was to establish control of waters within the first island chain that links Okinawa Prefecture, Taiwan and the Philippines. In the second stage, from 2010 to 2020, China would seek to establish control of waters within the second island chain that links the Ogasawara island chain, Guam and Indonesia. The final stage, from 2020 until 2040, China would put an end to U.S. military dominance in the Pacific and Indian Oceans, using aircraft carriers as a key component of their military force. Recent Chinese military developments, rhetoric, and actions reflect implementation of this maritime strategy, on pace with the projections to seek control of the first island chain.⁹²

The United States remains committed in “sustaining Joint Force military advantages, both globally and in key regions, and deterring adversaries from aggression against our vital interests.”⁹³ The South China Sea is and will always be one of the most important seas lines of communication for the United States. China will attempt to reunify Taiwan, the establishment of control within the South China Sea, or the expansion of BRI efforts that brings the JFMCC, JFACC, and MAGTF into conflict. PLA modernization and AI capabilities are aimed to disrupt, delay, degrade, destroy, and manipulate the military capabilities of the United States.

Findings

The basic concept of AI is not new. The difference today is that technology moves at an exponential speed while at the same time becoming increasingly available to our adversaries. The separation between military and off-the-shelf capabilities is narrowing. Technology behind AI is dominating the civilian sector and industrial base. It may be self-driving cars, algorithms developed to predict outcomes, and solutions to respond such as collision avoidance. Or, it may be remote-controlled drones delivering goods from Amazon to your front door. They all rely on some level of AI and at the same time are completely accepted by everyone as the new norm. AI is everywhere, but the adaptation and integration into the MAGTF across the force operating at the tactical level is relatively slow. This is not to say that speed is more important than getting it

⁹² Cordesman and Colley, “Chinese Strategy and Military Modernization,” 130.

⁹³ US Department of Defense, *Summary of the 2018 National Defense Strategy*, 4.

right; rather, the goal for introducing AI into MAGTF operations is to remain at a pace ahead of China. The fear of the unknown with legal and moral constraints dominates critical time and constrains the MAGTF from progressing forward fast enough to ensure the first time it trusts and employs AI technology is not while executing EABO. Machine learning only improves with more experimentation and practice. Marines trusting AI and being comfortable operating with it only gets more refined with additional practice and live training.

AI within the Marine Corps, outside of the Marine Corps Warfighting Lab, exists only at the conceptual level. Sea Dragon 25 is the immediate answer to the problem, but the size of unit for which it tests is not conducive to meet the demands of the MAGTF as a whole. The most Marines typically understand about AI is what they read and what they use in their daily lives. What Marines do not fully grasp is how and why AI is so important to the mission against the Chinese. This study reinforces the theory that the capabilities of AI enable the MAGTF across all warfighting functions. When AI is fully embraced and woven into policy and operating procedures, the MAGTF will maintain its advantageous position in the maritime domain. The findings of this study determine that AI is changing the battlefield with capabilities surpassing human endeavors and enabling China to potentially gain an operational advantage. The research questions indicate that for AI to be successful in MAGTF operations, training and integration within live training environments needs to occur at a much greater capacity. The Marine Corps must accept the mitigated risk as it relates to morality and ethics with man-in-the-loop and man-on-the-loop AI capabilities. Maintaining the operational and tactical edge in maritime dominance will be challenged by the new Chinese modernization strategy.

The section on morality and ethics in war reinforces the validity of the research questions. The distinction between just and unjust actions in conflict has not changed nor should it be viewed any differently with the use of AI enabling capabilities. The principle of double effect where the bad consequences are foreseen, but not intended must be accepted by the MAGTF. Risks are mitigated by keeping the man in the process and allowing human control of

the human + machine team. DOD will continue to mandate a human being in control of all AI actions as a guarantee to protect the United States against any unjust decisions.

The Chinese strategy and focus on the reunification of Taiwan, BRI LOE, and military modernization and expansion is a major concern for the United States and its strategic partners. Chinese reorganization, industrial base support, and A2AD defenses enable the PLA to become a serious contender for the United States in the Pacific. The two strategies will clash at some point. The Marine Corps is going to be involved because it has a piece of the JFMCC, JFACC, and EABO mission sets. The research shows that China does not hold itself to the same standards that the United States or international community does with morals and ethics. Although not as refined as the United States in military and joint operations, the Chinese are making up for that disparity with the reorganization of its military and practice operating in the gray zone. The PLA strives for and arguably holds the tactical edge inside the information domain because they view it as the dominant domain in current military warfare.

The parallels with HFT and the stock market give validation to the concept that having humans in the loop and knowledgeable of the overall system is key. During the flash crash, HFT algorithms failed and started to catastrophically effect the market. The traders realized the potential damage and adopted work around procedures to mitigate the risk in order to continue trading. The temporary solution gave the traders time and space for developers to create a revised algorithm. Systems in conflict will be saturated, fail, or not deliver as designed. The more experienced and trained an operator, the more critical the human + machine team becomes to the unit.

The reference and tie-in between AI and cyber is more similar than most think. It is taking cyber professionals in the military to be comfortable enough to reach a point of discussion of pushing cyber processes to a lower level. The problem is the time it took to reach this point is nine years. China is moving along the same path as the US military in identifying non-kinetic capabilities, but the research is showing the Chinese momentum and employment is greater than

the American military. This is not a critique on the United States because China has no care for violating the international norm or morality and ethics concerns. The lessons learned from the entire Doctrine, Organization, Training, Materiel, Leadership Education, Personnel, and Facility process with cyber should carry over into AI.

Conclusion

The research focused on determining if the MAGTF is ready to integrate, trust, and employ AI in order to meet the future demands of the Marine Corps, especially against the Chinese. AI is a paradigm shift for militaries willing to fully embrace and trust its capabilities. AI is new and still very much in the development phases, but the Marine Corps' approach to research, development, and adoption as programs of record are too slow. The speed of the change of technology is drastically different from 1950s. AI today is so inextricably linked into everyday living that many people do not notice or realize machines often thinking for them. Society is already trusting and employing AI, why should the military be any different. The time for the Marine Corps to take more aggressive steps in testing, training, and employing AI capabilities is now. The Marine Corps Warfighting Lab's efforts in support of Sea Dragon 2025 only scratch the surface because the impact in the MAGTF is only with the unit chosen for the experiment. More realistic training needs to be applied at Twentynine Palms, improving the scenarios to include a thinking enemy who employs AI. Creating an environment where decisions occur in nanoseconds will prepare and ensure MAGTF commanders use AI.

Clearing the bridge of morality for AI and autonomous actions in conflict is difficult, but should be easier now that AI is so well inculcated within society and everyday living. The principle of double effect applies and should be enough to validate necessary actions using AI. If the MAGTF remains trapped in a never-ending decision cycle regarding if AI is moral or not, the Chinese retain the advantage and will saturate the Marine Corps with faster processes and quicker decisions. The time and space between the US and Chinese capabilities is widening. The Marine

Corps must take bold steps in accepting mitigated risk and AI as moral because a human remains in the loop. AI is a new enabler for the MAGTF that is no different than any other kinetic or non-kinetic capability.

The research agrees with those analysts who estimate the MAGTF will be in some form of conflict against the Chinese within twenty years. The BRI efforts, reunification of Taiwan, and the nine-dash line all give credence to China's outward looking philosophy. The MAGTF being what it is, a maritime force capable of projecting power in all domains is planned as part of the JFMCC, JFACC, and EABO concepts of employment. The case study on Chinese modernization and actions in the Pacific showcase the MAGTF's future opponent is not slowing down, rather it is making huge leaps forward in building robust non-kinetic capabilities geared towards striking the Marine Corps vulnerabilities across all warfighting functions.

Highlighting the necessity for new technology, the FY18 Marine Corps Agency Financial report states "History has proven that new technologies and processes often create strategic inflection points that ultimately lead to changes in the character of warfare. We stand at another of those points today, and our capabilities—both human and technical—must evolve accordingly."⁹⁴ Strategically, the Marine Corps understands that to keep pace with future challenges, it must change its approach using best practices to quickly focus on "greater speed, agility, and efficiency in the face of a rapidly changing operating environment."⁹⁵ The best answers for AI may be outside the DOD and deep within the commercial industry. Google's departure from DOD's Project Maven is the result of employees urging the company to reconsider while others protested.⁹⁶ The divergence between the military and industrial base

⁹⁴ US Marine Corps, *Fiscal Year 2018 Agency Financial Report* (Washington, DC: Government Printing Office, 2018), 29.

⁹⁵ *Ibid.*

⁹⁶ Kyle Wiggers, "Google Will End Project Maven Military Contract in 2019," *VentureBeat*, June 1, 2018, accessed April 5, 2019, <https://venturebeat.com/2018/06/01/google-will-end-project-maven-military-contract-in-2019/>.

needs to be remedied because the whole of government approach is required for AI to be competitive against the Chinese.

The strategic vision with AI is clear, but unless the Marine Corps expands its integration and training efforts while also holding maneuver units accountable for the employment of AI in live training, the trust, lessons learned, and experience will not happen. Machine learning is the same as human learning, both require repetition. The more the MAGTF trains with AI, the more the Marines become comfortable with it. The more Marines are comfortable with AI, the more they trust and understand it which then creates a recipe for ensuring victory against the Chinese.

Future research is recommended for developing a detailed approach to establish new training standards that include realistic AI capabilities. The capabilities should already be in the testing phases and ready to employ within a closed system at places like Twentynine Palms. These AI capabilities should also be attacked by an adversary testing how well Marines understand the capabilities and develop adhoc processes in response. Essentially doing what the traders did on Wall Street in response to the algorithm failure with HFT. The more complex and chaotic the scenario the more realistic it will be for what analysts anticipate Marines will experience when fighting against China.

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