Artificial Intelligence in the Future Operating Environment

Why every Marine needs to understand emerging technologies in the era of great power competition

by GySgt David Nass

What is Artificial Intelligence (AI)? "Frontier technologies," which generally includes AI, bio-technology, quantum computing, 5G, and next generation hardware, will drastically affect the future Marine Corps. It is important to focus on AI because, in many ways, it is the glue among all these emerging technologies. The DOD defines AI as "the ability of machines to perform tasks that normally require human technology—whether digitally or as the smart software behind autonomous physical systems."[1] While the ideas for AI date back as far as 1956, AI has seen significant advances in the last fifteen years. Underpinned by immense advances in computer processing power (reference Moore's Law), AI uses algorithms and high-speed computing to analyze and process large amounts of data in order to recognize patterns, draw conclusions, make a prediction, or take an action. A basic example may help to differentiate between AI's current capabilities and theoretical capabilities. Currently, a computer can be "trained" to recognize a tank in an image or video by feeding it thousands of pictures of tanks. By "learning" the visual cues of a tank, the computer is then able to identify any tank in a new picture the computer has not seen. A second example

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is a self-driving car from Tesla, which will use AI to constantly scan the data of millions of previously driven miles and situations to make the right decision when presented with a red light, pedestrian, or erratic human driver.[2]

Exponential growth of AI technologies and applications, coupled with rapidly falling costs of computing power and global connectivity, will inevitably increase the speed of technological disruption across every segment of both government and private industry. This includes those industries once controlled exclusively by governments and their militaries. Recent advancements include:

• A flight simulation AI program created on a $35 Raspberry Pi computer now routinely beats the world's best human pilots.[3]

• Numerous companies manufacture earbuds that allow for near realtime language translation. One set with the
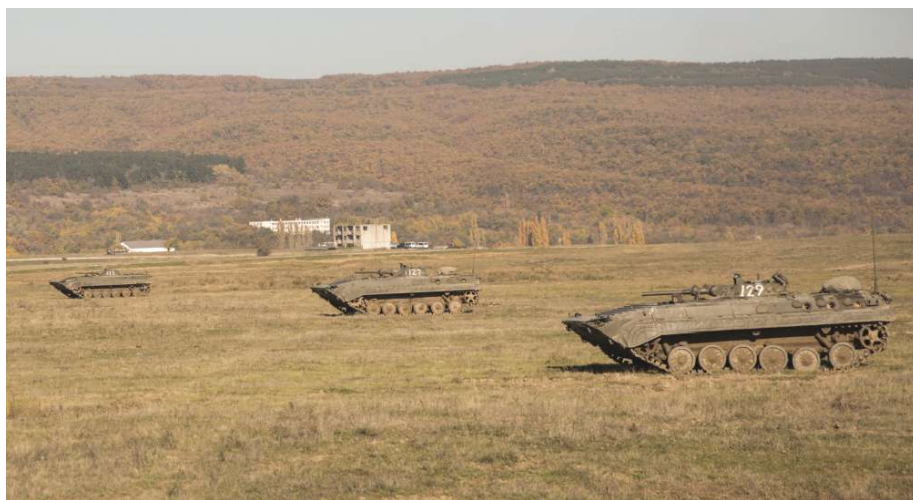
A high-speed computer, programmed with the right algorithm, can "learn" to recognize a picture of a tank or fighting vehicle but requires vast amounts of imagery (data) to "learn" from. (Photo by Cpl Justin Updegraff.)

ability to translate over 40 languages can be purchased on Amazon for a cost of just over $200.[4]

• In the summer of 2019, Chinese company DJI unveiled the Manifold 2 hardware adapter for its drone lines that enables a user to fly the drone autonomously, analyze motions, and utilize computer vision to identify objects in the screen—all for a cost of $1,300.[5]

Friendly Use of AI

The Marine Corps' *Force Design 2030* identifies, "the individual/force element which shoots first has a decisive advantage."[7] While AI will eventually affect every area of the military, every Marine should view AI as a means to become *more efficient and lethal*. Using AI to gain efficiency will give Marines more time to conduct the tasks in each MOS that require the most focus, have the highest risk, or lead to an overall reduced cognitive load. Higher lethality will ensure we have a clear understanding of the battlefield and are able to strike first where needed.

We ask more of a Marine today than at any point in the past. Much of this is because of the increase in technology, communications, and complexity of our systems and processes. By taking a detailed look at each of our MOS, we could identify activities that are the most time intensive and focus AI on these areas to become *more efficient*.

• Using AI-driven predictive maintenance on our aircraft and vehicles, we could identify when a small maintenance task should be conducted or parts stockpiled in advance to prevent a long-duration deadline.

• Autonomous drones, vehicles, and ships could move supplies and equipment quicker than manned platforms, reducing risk for our Marines and decreasing the time needed to resupply our front line troops.

• Autonomous human performance software and wearable solutions could identify sleep, nutrition, and activity patterns that lead to peak cognitive performance and prevent injuries. In his book *Ghost Fleet*, P.W. Singer envisions a future where service members wear "vis glasses," giving them a holo-

Effective artificial intelligence and machine learning require humans to write code and upload data. (Photo by Cpl Brandon Martinez.)

graphic display of heart rate, sleep levels, and nutrition. Service members are prompted to eat or take a supplement to maintain peak focus and performance while fatigued.[8]

Artificial intelligence will also make us *more lethal* by improving the find, fix, finish, exploit, analyze, and disseminate process.

• Autonomous image recognition from a satellite, aircraft, or ground sensor will decrease the time to identify, recognize, and confirm an enemy element, allowing our future long range precision fires to have first strike lethal effects.

• Across a broad spectrum of mission sets where Marines are conducting irregular warfare, language processing and artificial intelligence can scrape social media and local news sources to sense local sentiment for or against U.S. initiatives, identify malign actors, and geo-locate potential targets.

• AI-enabled information operations can create and disseminate messaging to a wide audience in numerous languages.

Adversary Use of AI

While AI and emerging technologies as a whole will make Marines more efficient and lethal, one of the biggest reasons every Marine must understand these technologies is to understand what our adversaries may be doing to us. The same technologies we are developing are also being developed by great power competitors. In 2018, China released its "Next Generational Artificial Intelligence Development Plan," with the stated objective of achieving world-leading AI theories, technologies, and applications by 2030.[9] Viewed from a solely friendly capability lens, Marines only need to understand the AI technologies in their specific MOS. If viewed from the lens of the adversary, however, every Marine, either deployed or in garrison, must understand the full scope of adversary capabilities.

In addition to discussing the need to strike first, *Force Design 2030* also identified that forces "able to operate inside an adversary's long-range precision fire weapons engagement zone are more operationally relevant."[10] While forward deployed in an EABO, Marines unaware of the imagery intelligence capabilities of our adversaries may park a vehicle or forget to camouflage supplies that allow our adversaries to quickly identify a forward Marine position. In the worst case scenario, this allows the enemy to strike first, using any number of current or future long-range weapons systems. In a non-kinetic situation, the enemy now knows

where we are operating and is able to move additional intelligence assets to monitor and identify our activities without us knowing.

Both China and Russia are exporting digital surveillance technologies. China is at the forefront of facial identification and has been using it internally for many years. Now, they are exporting their facial recognition hardware with AI software to countries around the world.[11] These technologies will be used by our adversaries to monitor or identify our activity abroad. A Marine Raider who posts a picture on Facebook and then travels to southwest Asia or central Africa could be easily identified, allowing our adversaries to identify a MARSOC footprint in an otherwise unknown country or region. The same digital social media and open source scraping tools we can use to our advantage will be used against both our garrison and deployed Marines to identify locations, pictures, associates, capabilities, and vulnerabilities.

Partner and Host Nation Use of AI

The third focus area is partner and host nation use of AI. As Marines deploy forward, we are almost always in a combined or partnered environment, working closely with allies, coalition members, or training a local national partner nation force. As AI technologies advance and become increasingly affordable, our allies and partners will be using them on a daily basis. As the world's premiere fighting force, our allies and partners expect us to be experts in intelligence, technology, and warfighting. To advise and assist these partner forces, we must understand the technological environment we are working in. If a partner force is using an AI technology and we do not know the capabilities, they may use it in a manner that compromises a mission, creating added risk to our force.

Not only will the partnered or allied militaries we work with have these technologies but so too will the host nation infrastructure we operate in. How will our most junior Marines react to sharing the roadway with a self-driving car or encountering a medical or store delivery robot while on a foot patrol?

How will these developments shape rules of engagement and information operations? Moreover, will our Marines be able to recognize both the hardware and software of an AI system that will exist in everyday life and could be utilized, hacked, or compromised by our adversaries?

Two Recommendations for the Future

Train and Educate the Force. Training and educating the force on how AI and other emerging technologies work must be included in everything from entry level schools to pre-deployment certification exercises. This training and education should allow Marines to master friendly technology, teach partner nation technology, and understanding any adversary technology capability our Marines will encounter on a MEU, deployment, contingency mission, or during an EABO.

Our middle- to upper-level leaders must understand both the opportunities and threats of AI and other frontier technologies. Since many leaders did not have these technologies earlier in their careers, they may be reluctant to accept or employ them on the modern battlefield. Middle- to upper-level leaders should not hesitate to schedule and attend executive AI courses or conferences. These courses and conferences will allow commanders and senior enlisted leaders to drill down on AI and data science into the many subcategories of AI including computer vision, machine and deep learning, and natural language processing. They will also educate commanders on the critical aspects of AI ethics, AI limitations, and potential for error. This knowledge will help our leaders make important decisions for their command. When subordinate leaders are seeking per-

mission for an AI technology, senior leaders will know what questions to ask to ensure the technology is used appropriately.

Education of our small unit leaders must be a continuum throughout their careers. As technology becomes more and more complex, spiral learning will be critical to ensure that our Marines and small unit leaders comprehend and master future technologies. Just like our senior leaders, our small unit leaders must also be educated on the ethical implications of using AI systems or autonomous weapons as well as understanding how or where AI systems may fail or provide unreliable information. Our small unit leaders must also understand their role in educating the force as a whole so that every Marine understands how their small actions could be detected by our enemy or used against us in the future.

Lastly, our training must also imitate our future operating environment. Just as a degraded communications environment has become a standard element of training, we must implement the other

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types of technologies our adversaries may have. As our Marines prepare and train to operate inside the weapons engagement zone of our enemies in an EABO setting, they should face an adversary appropriate for those likely deployments. Marines should be challenged in an environment where the enemy may have the ability to conduct the find, fix, finish, exploit, analyze, and disseminate process faster than we can, where the enemy can quickly control the narrative through information, where the local population or host nation forces are using advanced technologies, and where Marines are challenged by autonomous enemy and partner nation systems—forcing them to make appro-

What level of access to our information systems can we share with allies and partner nation forces? *(Photo by Cpl Brandon Martinez.)*

priate decisions. Future training at the lowest levels should include:

- Robust red cells with the experience and expertise to incorporate near peer competitor technologies into adversary's capabilities.
- Host nation forces equipped with advanced technologies such as drones, autonomous vehicles, or social media scraping computer applications.
- Electronic and visual signals management. Require units to fly drones over their field formations to provide small unit leaders with the knowledge of how easily their force could be recognized by adversary space or unmanned aerial systems.
- A robust identify management program. Educate every Marine on how their online presence could be used against them for facial recognition, predictive analysis of likely decisions, or identifying individual preferences for intelligence targeting.

Ground-Up Innovation. In his 2017 work *AI Superpowers: China, Silicon Valley, and the New World Order,* author and technologist Kai-Fu Lee asserts that most AI breakthroughs will not come out of computer science labs or tech firms but from "down-to-earth, profit-hungry entrepreneurs teaming up with AI experts to bring the transformative power of deep learning to bear on real-world industries."[12] In order to truly find the technologies that give our force the most lethality and most efficiency, we must create a culture of innovation, encouraging our small unit leaders to become "AI entrepreneurs" and develop bottom up AI uses and initiatives.

In 2008, *MCO 3900.17* was signed, defining the Marine Corps Urgent Needs Process (UNS) and formalizing an avenue for the warfighter to fill an urgent capability gap.[13] The UNS was used countless times by our warfighters to get the right technology and equipment for their mission. Continuing this agility and flexibility into the AI age, we must create and encourage Marines to brainstorm and design ideas for our force to use future technologies to improve our efficiency and lethality. These ideas may not fill a critical gap like the UNS but instead provide an opportunity and enable the Marine Corps to connect the ground operator to academia or industry expert, resulting in a better Marine Corps tomorrow. These initiatives, in addition to current MARSOC, Marine Corps, DOD, and United States Government programs will help us educate the force, develop future agile and innovative leaders, and maintain the competitive advantage against any adversary.

Notes

1. Department of Defense, *Summary of the 2018 Department of Defense Artificial Intelligence Strategy,* (Washington, DC: 2018).

2. Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order,* (Boston, MA: Houghton Mifflin Harcourt, 2018).

3. Nicholas Ernest, David Carroll, Corey Schumacher, Matthew Clark, Kelly Cohen, and Gene Lee, "Genetic Fuzzy based AI for Unmanned Combat Aerial Vehicle Control in Simulated Air Combat Missions," *Journal of Defense Management,* (Hyderabad: Omics International, 2016).

4. Information regarding WT2 Language Translator Device is available at https://www.amazon.com.

5. Information on Manifold 2 is available at https://www.dji.com.

6. Thomas Malone, *Superminds: The Surprising Power of People and Computers Thinking Together,* (New York, NY: Little, Brown and Co, 2018).

7. Headquarters Marine Corps, *Force Design 2030,* (Washington, DC: March 2020).

8. P.W. Singer, *Ghost Fleet,* (Boston, MA: Houghton Mifflin Harcourt, 2015).

9. Graham Webster, Rogier Creemers, Paul Triolo, and Elsa Kania, "China's 'New Generation Artificial Intelligence Development Plan'," *New America,* (August 2017), available at https://www.newamerica.org.

10. Ibid.

11. Alina Polyakova and Chris Meserole, "Exporting Digital Authoritarianism: The Russian and Chinese Models. Foreign Policy at Brookings Institution," *Brookings,* (August 2019), available at https://www.brookings.edu.

12. Ibid.

13. Headquarters Marine Corps, *MCO 3900.17,* (Washington, DC: October 2008).

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