2022 LtGen Bernard E. Trainor Military Writing Award Winner: First Place

Robo-Call (For Fire)

Overcoming PRC A2/AD degradation of naval air support through lethal autonomous weapons

by Capt W. Stone Holden

>Capt Holden is a Marine Officer currently assigned to USSOUTHCOM where he has worked in security cooperation and collections management billets as well as managing a variety of projects implementing cutting-edge technological solutions to address the range of threats in the AOR. He previously served in the INDOPACOM AOR with 3d Mar and Combat Logistics Battalion 3, where he deployed in support of the PACOM Augmentation Team Philippines and aboard the USNS SACAGAWEA in support of Task Force KOA MOANA 17 to support a range of partner nation engagements across the Pacific.

Marines across the Corps are working to adjust the tools and capabilities in their arsenal in the face of historic challenges, as demonstrated by the changes of *Force Design 2030*.[1] The threat landscape is changing with the rise of China as a peer competitor, the resurgence of Russian aggression, and the proliferation of technologies that put capabilities in the hand of a wide range of actors.[2] These new threats demand an adjustment of time-honored tactics and operational tenants to remain lethal. Lethal autonomous weapons (LAWs) have the potential to reshape some battlefield fundamentals. These "killer robots" are defined by the DOD as "a weapon system that, once activated, can select and engage targets without further intervention by a human operator."[3] Perhaps their greatest impact will be seen when they are integrated into unmanned aerial systems (UAS) and loitering munitions (LMs). This combination possibly holds the key to giving Marines the edge in achieving combined arms effects in some of the most challenging operations that the future holds.

One of the most pressing scenarios shaping Marine Corps investments and planning is the possibility of a conflict with the People's Republic of China (PRC) in the first or second island chains of the Western Pacific.[4] Planning documents envisage a tough fight, characterized by widely dispersed battlespaces among isolated islands, supporting Expeditionary Advanced Basing Operations. The Marines have a deep historical understanding of the challenges this will present, as the Pacific campaign of World War II stands as a well-known testament to the difficulty of conducting such a fight. Much of the terrain is punishing jungle, the distances make timely support and relief of forces a critical consideration, and the dispersion of the potential areas of conflict mean that many assets traditionally supporting a maneuver force may be out of range to assist. Further complicating this conflict is the 21st-century arsenal of weapons that the PRC has invested in to deny the United States an ability to bring traditional power projection to a conflict like this without significant risks, usually referred to as anti-access/

Air support is an essential element to successful combined-arms amphibious operations, but A2/AD systems create a dangerous gap in support. *(Photo by MSgt Michael Schellenbach.)*

area denial capabilities (A2/AD). Systems like DF-21D anti-ship missiles, anti-submarine weapons, and densely integrated air defense systems threaten to strip the Marines of the future of a key ingredient to their success: air superiority projected from naval platforms.[5] The PRC is keenly aware of the reliance of U.S. forces on air support. It can be guaranteed that they will do everything in their power to deny that to Marines in the event of a conflict, primarily by putting naval assets at risk if employed. Suppose the Navy cannot safely move assets into a range that provides fire and air support. In that case, the Marines will be forced to find other ways to compensate for this degradation of available airpower to support operations.

The Marine Corps fights in a way that is dependent on the ability of their aviators to provide support to ground maneuver forces. These air platforms are essential in producing the combined-arms effects, which are a key tenant of Marine Corps warfighting philosophy, enshrined in the most foundational doctrine.[6] Combined arms involves using different weapon systems and capabilities to offset the inherent weaknesses of each platform while putting the adversary in the horns of a dilemma. An enemy soldier facing direct fire may have the option to remain behind cover, but if the safety of that cover is taken from them by using indirect fires as well, then an adversary only has the choice to stay in place and die or move and die. The mutually supporting nature of combined arms, when applied successfully, allows an adversary to choose *how* he accepts his fate, not *if*. Air power is a staple of this not just for the Marines but for the modern U.S. military in general. During operations in Iraq and Afghanistan during the 2000s, it was common for tens of thousands of close air support sorties to be flown annually. This figure does not even take into account the tens of thousands of ISR, refueling, airlift, and personnel recovery sorties that were required as part of support to that.[7] If the Marine Corps is unable to guarantee the airpower, which is so important for creating the combined-arms effects that underpin their warfighting style, it will be a significant challenge in a future conflict. There must be a way to mitigate the potential loss of this capability.

The ability of China to push back the naval platforms that would typically provide this air support certainly has its limits. It is unlikely that the PRC could effectively deny the vast spaces of the Pacific to all U.S. naval assets. Furthermore, seized or expeditionary airstrips on U.S.-controlled islands could act as unsinkable aircraft carriers, but this course of action also poses unique risks and considerations. Not all potential areas will have the landmass to support a modern airstrip or will be in range of one. Additionally, the Marines will need to either maintain facilities that they currently hold or have access to, establish expeditionary facilities, or seize those that can support their air assets. This will be a tall order without air support and, once completed, may not be a truly permanent solution. Any such expeditionary airstrip will be a major target for the PRC, especially given their increased capabilities in intelligence, surveillance, and reconnaissance, which will allow them to detect such facilities or the presence of U.S. aircraft at them. While the United States still has a technological lead on long-range sensing, the PRC launched over 70 space assets in 2020 alone with over 250 total satellites in orbit by 2022.[8] Many of these are assessed to be dual-use civil-military, with many of the same sensing capabilities now extending into the Pacific, which have aided the United States in executing actions against distant adversaries for so long.[9] Furthermore, if an island or airstrip needs to be taken from enemy control before establishing a location for air support, there is still a significant period during the maneuver actions where there is a gap in air capabilities. That gap could well mean the difference between successfully taking the area or being pushed back, and it must be compensated for. Seizing and holding existing airstrips or creating expeditionary airstrips will be a critical element of any operation in a conflict of this type, but the growing capabilities of the PRC to sense and act against those facilities means there are significant drawbacks.

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Emerging technologies hold the potential to greatly enhance the capabilities of the forces which can adopt them most effectively, most quickly. LAWs are one such technology (or more accurately, combination of technologies) that potentially hold the solution to this gap. This technology involves a combination of advanced robotics (air, ground, or maritime) and broad artificial intelligence (AI). The Second Nagorno-Karabakh War in the Fall of 2020 offers a glimpse of the potential benefits these types of systems can provide. Azerbaijan, having lost the first conflict with Armenia in 1994, invested heavily into UAS technologies and LMs in the lead-up to the war.[10] The Azeries used their UAS and LMs to compensate for a lack of traditional airpower and achieved impressive combined-arms effects against well-entrenched personnel, armor, and logistical support of the Armenians.[11]

Three of the most important systems used were the Bayraktar TB2 (Turkish), the Harop, and the Orbiter (LMs made by Israeli companies) were integrated into the battle plans and allowed Azerbaijan to compensate for a small conventional air force at a fraction of the cost or support required.[12] These UAS and LMs provided a significant advantage over the Soviet-styled capabilities of their adversaries and demonstrated some key advances of UAS technology when paired with broad AI capabilities. The Azeris used LMs produced

Experimentation with UAS and other forms of lethal autonomous weapons (LAWs) now may hold the key to future Marines maintaining air support in areas denied to traditional assets by adversary A2/AD. *(Photo by SSgt Jordan E. Gilbert.)*

by Israel and Turkey with devastating effects on the battlefield. Part of their effectiveness was a limited AI interface which allowed a human-in-the-loop or human-out-of-the-loop relationship with the weapons, providing a level of control but also relieving personnel of monitoring the weapons full time until a target was identified.[13] Once fired, the munitions would loiter over a designated zone until targets matching pre-set parameters were identified, which notified a human controller who could decide to engage. This early type of AI integration to weapon systems was incredibly effective.[14] In addition to the immediate battlefield success, the combat application provided invaluable long-term training in the AI systems and algorithms. These underpin the weapons' ability to accurately identify and engage targets while proving the value of attritable systems which used technological advances in AI to act as LAWs.[15] The opportunity to train AI algorithms in a conflict and to apply changes to make the capabilities more robust will only enhance their capabilities in the future.

The Marine Corps should begin developing, testing, and integrating LAW UAVs and LMs to help maintain the ability of maneuver units to conduct long-range precision strikes in areas that may be potentially denied to traditional aircraft. While the algorithms and technologies that underly the capabilities witnessed in Nagorno-Karabakh are still relatively new, the sustained rate of technological change means that these capabilities will likely mature in a relatively short timeframe.[16] UAS and LM LAWs would help mitigate the potential degradation of the U.S. ability to project air support from naval platforms and provide maneuver units with the ability to conduct precision fires at a relatively low cost in terms of manpower and equipment. Israeli Harop systems are designed to be fired from a launcher, similar to a HIMARs, and travel a thousand kilometers or nine hours to a target or loitering. Much of the flight can be preprogrammed and requires much less hands-on support from an operator than a traditional UAS platform because of its automated functions. If it is not expended, it can be recovered and reused. The Orbiter LMs have similar recovery capabilities but are smaller and cheaper.[17] The combination of portability, cost-effectiveness, and low manpower requirements are all areas that the Marine Corps is notorious for emphasizing when developing new capabilities.

Whether the Marines move to develop and integrate these capabilities, adversaries are already making strides. While the Israeli and Turkish systems demonstrated in the Nagorno-Karabakh War are commercially produced systems, other nations are working towards their own platforms. The PRC is moving ahead in the development of systems with these capabilities and has shown a sharp interest in the technologies which underpin LAWs themselves, such as AI. Defense writer Christian Brose has documented the PRC's efforts toward developing AI, a fundamental element of effective LAWs. His analysis examines some of the benefits the PRC enjoys in the race for AI, derived from their top-down authoritarian structure. This concentration of power allows them to marshal resources, direct private and government collaboration, and access data from the world's most populous country without the democratic concerns over privacy and human rights.[18] The Chinese military is already actively experimenting with AI-based technologies, seeking to integrate them into their overall defense strategy at every echelon while gathering data that will refine these initial AI efforts along the way.[19] The PRC has accelerated AI development under President Xi Jinping, directing efforts

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to clarify AI development and implementation policies, including military applications.[20] The 2015 policy "Made in China 2025" clearly codified the acceleration and described the plan to make China a leader in advanced technologies (foundational to AI) by 2030. In 2017, the PRC issued its "Next Generation Artificial Intelligence Development Plan," explicitly laying out a path to the national development of AI in a dedicated policy document.[21] This plan included a raft of government support, including research subsidies, venture capital, incubators for technology, and the creation of special zones for the development of AI.[22] The PRC has conducted tests of swarms of autonomous UAVs, and Chinese weapons manufacturers have advertised systems with LAW capabilities, such as the machinegun-armed Blowfish A3 helicopter UAS by Ziyan.[23] These systems are coming to a battlefield near you, with the potential to reshape the pace and conduct of fighting.

While the United States does not currently have a prohibition against LAWs, they also do not publicly acknowledge to fielding any yet.[24] A variety of Defense Advanced Research Projects Agency, DOD, and other government programs at the publicly available level have invested in the technological foundations that are required for LAWs such as AI and a wide range of unmanned systems.[25] The Marine Corps has a unique mission that will require the types of advantages provided by LAWs, compensating for highly contested airspace, increasing the organic lethality of maneuver units, and helping to bridge the gap between going ashore in the islands of the Pacific and establishing enough control to allow friendly aircraft to begin supporting operations. Perhaps the Marines need a few good *killer robots* to support a few good men in their next fight

Notes

1. Mark Cancian, "Analyzing the Biggest Changes in the Marine Corps Force Design 2030 Update," *Breaking Defense*, June 14, 2022, https://breakingdefense.com/2022/06/analyzing-the-biggest-changes-in-the-marine-corps-force-design-2030-update/#:~:text=FD%202030%20structures%20the%20Marine,simple%20to%20maintain%20and%20sustain.

2. Office of the Director of National Intelligence, *2022 Annual Threat Assessment of the U.S. Intelligence Community* (Washington, DC: March 2022).

3. Department of Defense, *Directive 3000.09, Autonomy in Weapon Systems* (Washington, DC: November 2012).

4. Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China: 2021* (Washington, DC: November 2021).

5. Ibid.

6. Headquarters Marine Corps, *MCDP 1, Warfighting* (Washington, DC: 1997).

7. Anthony H. Cordesman and Marrisa Allison, "The U.S. Air War in Iraq, Afghanistan and Pakistan," *The Center For Strategic and International Studies*, October 14, 2010, https://csis-website-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/100610_AfPak-Air.War.Stats.pdf.

8. Defense Intelligence Agency, *Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion* (Washington, DC: March 2022).

9. *Military and Security Developments Involving the People's Republic of China: 2021.*

10. International Crises Group, "The Nagorno-Karabakh Conflict: A Visual Explainer," *CSIS*, March 8, 2022, https://www.crisisgroup.org/content/nagorno-karabakh-conflict-visual-explainer.

11. John F. Antal, *Seven Seconds to Die: A Military Analysis of the Second Nagorno-Karabakh War and the Future of Warfighting* (Philadelphia: Casemate, 2022).

12. Ibid.

13. Ibid.

14. Ibid.

15. Christian Brose, *The Kill Chain: Defending America in the Future of High-Tech Warfare* (New York: Hachette Books, 2020).

16. Congressional Research Service, "Artificial Intelligence and National Security," November 2020, https://crsreports.congress.gov/product/pdf/R/R45178/10.

17. *Seven Seconds to Die*.

18. *The Kill Chain Defending America in the Future of High-Tech Warfare* (New York: Hachette Books, 2020).

19. Army Mad Scientist, "How China Fights," *The Convergence Podcast*, December 9, 2021, https://5e1729439f1d05-67192808.castos.com/podcasts/5043/episodes/47-how-china-fights-with-ian-sullivan-kevin-pollpeter-amanda-kerrigan-peter-wood-elsa-kania-andrea-kendall-taylor-and-doowan-lee.

20. Elsa Kania, "China's Artificial Intelligence Revolution," *The Diplomat*, July 27, 2017, https://thediplomat.com/2017/07/chinas-artificial-intelligence-revolution.

21. Scott Kennedy, "Made in China 2025," *Center for Strategic and International Studies*, June 1, 2015, https://www.csis.org/analysis/made-china-2025; and China State Council, "New Generation Artificial Intelligence Development Plan," *Digichina*, August 1, 2017, https://digichina.stanford.edu/work/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017.

22. Emily Parker, "How Two AI Superpowers—the U.S. and China—Battle for Supremacy in the Field," *The Washington Post*, November 2, 2018, https://www.washingtonpost.com/outlook/in-the-race-for-supremacy-in-artificial-intelligence-its-us-innovation-vs-chinese-ambition/2018/11/02/013e0030-b08c-11e8-aed9-001309990777_story.html.

23. The Kill Chain; and Patrick Tucker, "SecDef: China Is Exporting Killer Robots to the Mideast," *Defense One*, November 5, 2019, https://www.defenseone.com/technology/2019/11/secdef-china-exporting-killer-robots-mideast/161100/.

24. "Artificial Intelligence and National Security."

25. Ibid.