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14. ABSTRACT

As the Marine Corps shifts to the Pacific to meet national strategic goals, Marine artillery will undergo significant changes as it integrates with the Navy to counter the Anti-Access/ Area-Denial (A2/AD) threat posed by China in the Western Pacific arena. To better integrate the Navy-Marine Corps team to execute emerging concepts such as Expeditionary Advanced Base Operations (EABO) and Distributed Operations (DO) in a contested littoral environment, the Marine Corps will have to evolve the way it trains artillery. As the Marine Corps embraces more technologically advanced weapon systems in its Long Range Precision Fires (LRPF) program, it has the opportunity to relocate the Marine Corps Artillery Detachment at Fort Sill to better facilitate the integration and partnership necessary with the Navy to address the challenges and capabilities inherent in the emerging weapons platforms the Marine Corps is adopting to counter the new challenges the US is facing.

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Artillery; Training; Marine Corps Artillery Detachment at Fort Sill; Long Range Precision Fires (LRPF); Anti Access/ Area Denial (A2/AD)

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MASTER OF MILITARY STUDIES

GO WEST YOUNG MAN:
WHERE WE TRAIN ARTILLERY
DETERMINES HOW WE TRAIN ARTILLERY

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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Executive Summary

Title: Go West Young Man: Where We Train Artillery Determines How We Train Artillery

Author: Major Joshua D. Mills, United States Marine Corps

Thesis: As its mission pivots to the Pacific, the Marine Corps needs to relocate the Marine Corps Artillery Detachment at Fort Sill to better facilitate the integration and partnership necessary with the Navy to address the challenges and capabilities inherent in the emerging weapons platforms the Marine Corps is adopting to counter the new challenges the US is facing.

Discussion: The United States Marines Corps and the United States Army have trained and deployed their artillery alongside each other for well over 100 years; and while the US has been enmeshed in combat operations in the Middle East for the last two decades, the global security environment has evolved. In this new, complex security environment, China has emerged as the primary competitor that would challenge the US's primacy by upending the existing world order. China's goal is to displace the US's preeminence by establishing itself as the Indo-Pacific regional hegemony through the use of predatory economics and military coercion. However, while the US now faces a burgeoning superpower that it is trained and equipped to face on a conventional battlefield, China has developed its Anti-Access/ Area Denial (A2/AD) defense in depth to counter the U.S.'s inherent military advantages. Over the last several years, the Navy and Marine Corps have developed several concepts intended to defeat or counter the A2/AD threat posed by China, as well as undertaken efforts to develop and acquire a land-based anti-ship missile system to provide Long Range Precision Fires (LRPF). This paper explores the changes that Marine artillery must undergo to train its personnel to employ a new LRPF weapon system that requires coordination and complete integration with the Navy to execute emerging concepts intended to counter the A2/AD threat.

Conclusion: Despite decades of historical employment, the continuation of training Marine Corps artillery alongside the Army at Fort Sill, Oklahoma limits the developing needs of the Marine Corps as an institution. Moving the training and education location of the Marine Corps Artillery Detachment at Fort Sill westward could help solve the issue of the separation in training between the Marine Corps and its Navy partner that is needed for LRPF in today's complex security environment.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

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Preface

The Marine artillery community has had to go through some relatively significant changes over the last few years, as the Marine Corps realigns to its role in the Pacific. These changes are not simply due to a new weapon system, but a combination of various factors in a rapidly changing world, such as advances in technology, the globalization of the world's economies, and the rapid dissemination of information in today's communication environment. I firmly believe that to be successful, Marine artillery will have to embrace these changes, incorporating them into both their weapon systems and the way the institution trains its current and future artillerymen. This paper explores the opportunity to institute education and training changes at the ground-level at the artillery "schoolhouse" as the Marine Corps begin to develop and adopt new weapon systems to address the changing role of Marine artillery to meet the strategic goals of the Nation.

I would like to thank Dr. Craig Swanson, Ph.D. and LtCol Patrick Eldridge for the guidance and assistance throughout the development of this paper. I would also like to think LtCol Brad Pennella (retired) for his mentorship and far-ranging discussions. Additionally, I would like to thank several of my peers in the artillery community, specifically Major Mathew Browning, Major Jonathan Busch, Major Kirk Steinhorst, and Captain Kyle Gannon. Your professionalism and resident knowledge have helped shape the discussions to germinate and develop the ideas in this paper; I am constantly amazed that I get to count myself as one of your peers. Lastly, I would like to thank my family, who have always been the bedrock of my career, regardless of the many challenges that come with this profession.

INTRODUCTION

For nearly three-quarters of a century, the United States has enjoyed its status as the dominant superpower on the global stage, especially after establishing primacy and unipolarity with the fall of the Soviet Union in 1991. However, according to the United Sates' 2018 *National Defense Strategy*, the US has experienced a "period of strategic atrophy" and has emerged from a two-decade conflict into a complex security environment defined by rapid technological change and challenges from adversaries in every operating domain.[1] In this incredibly complex security environment, competitors have emerged that would challenge the US's primacy, upending the existing world order by taking advantage of the emerging information society, the persistent process of economic globalization, and the subsequent realignment of international relations and power. As its mission pivots to the Pacific, the Marine Corps needs to relocate the training provided by the Marine Corps Artillery Detachment at Fort Sill to better facilitate the integration and partnership necessary with the Navy and to address the challenges and capabilities inherent in the emerging weapons platforms the Marine Corps is adopting to counter the new challenges the US is facing.

As a key element of the US's maritime power projection, the Marine Corps has had to adapt its mission and doctrine to address the unique difficulties that are inherent to the conflict in the littoral areas of the island chains in the South China Sea. It has also evolved its Force Structure and incorporated more advanced weapons systems.[2] Continuing the collocation of Marine artillery training with the Army at Fort Sill, Oklahoma places limitations on the

[1] US Department of Defense, *Summary of the National Defense Strategy* (Washington, DC, 2018).
[2] Commandant of the Marine Corps. *Commandant's Planning Guidance.* 17 July 2019.
38th Commandant's Planning Guidance CPG > United States Marine Corps Flagship > Electronic Library Display (marines.mil).

developing needs of the Marine Corps. To fully embrace the challenges of a strategic shift of focus, the Marine Corps will also have to undergo a paradigm shift in its education and training process, especially with the tactics and weapons systems designed to deter China's predatory and coercive conduct in the Indo-Pacific arena. This paper will specifically address three issues that the Marine artillery community will have to consider in dealing with an emergent peer-level threat in China. First, this paper will proceed by detailing how the Marine Corps is transitioning weapon systems and the requirements for training inherent to those new platforms. Second, it will then discuss how the new weapon system will require a shift away from the historical employment of artillery that will accompany the challenges associated with the Commandant's vision for the Marine Corps' mission in the Pacific. And finally, this paper will define the requirement to develop, train, and fully integrate observation, fire direction, battle tracking, and approval authorities with the Navy as the Marine Corps embraces its new role.

PAST

Since the close of the Cold War, the US has embraced a sense of entitlement regarding its unipolarity and foreign policy. While the United States was enmeshed in a two-decade conflict in the Middle East, a new player emerged, challenging US primacy. While engaged in the longest continuous stretch of armed conflict in US history, the military solidified a sense of Jointness that has guided combat operations.[3] While this sense of Jointness is a requirement on today's

[3] Office of the Joint Chiefs of Staff, *Joint Operations, JP 3-0* (Washington, DC: Headquarters US Marine Corps, October 22, 2018), ix.
JP 3-0 codifies the Department of Defense's intent for US Armed Forces to operate in a joint effort as an element of national power in conjunction with other agencies. While the Joint Military Operations Historical Collection may offer a better history of Joint Operations, the 2018 updates of JP 3-0 recognize the emergent strategic environment that is fluid, with continually changing alliances, partnerships, and national and transnational threats that rapidly emerge, disaggregate, and reemerge that the Joint Force is now forced to operate in.

battlefield, it has reinforced a certain way of training that has not evolved in decades, especially regarding artillery.

The United States Marines Corps and the United States Army have trained their service's new artillerymen alongside each other at Fort Sill, Oklahoma since 1917, with combined officer training since 1970.[4] This partnership has benefited both services, as both services have conducted similar missions and utilized the same equipment, with minor exceptions. Combined training in preparation for Joint Operations has only been reinforced over the last two decades of operations in the Middle East. Throughout Operations Iraqi Freedom and Enduring Freedom (OIF and OEF), the Army and Marine Corps have been operating in almost the same capacity, not just in the way they employ artillery, but as each service supports Counter Insurgency (COIN) missions.

Up until the mid-1990s, Marine Corps artillery and Army artillery employed the exact same cannon assets, from the larger self-propelled howitzers down to the smaller 105mm towed howitzers. However, in 1994, the Marine Corps divested itself of the larger self-propelled artillery pieces in an effort to be more expeditionary. This resulted in the Marine Corps being entirely reliant on towed artillery, first with the M198 and now the M777 howitzers. As towed artillery and self-propelled artillery assets possessed almost identical ranges with which they could engage targets, roughly 22 km with conventional munitions and 30 km with rocket-assisted projectiles, the lighter towed artillery pieces served the need of the expeditionary-minded Marine Corps. Similarly, over the years, technological advances have enabled both the Marine Corps and the Army to extend the range and improve the accuracy of their cannon assets to provide a form

[4] Jonathan Bush, "On Target: The Future of Field Artillery Officer Basic Training." *Leatherneck Magazine* (14 May 2014).
https://www.sandboxx.us/blog/on-target-the-future-of-field-artillery-officer-basic-training/

of ranged precision fires with the Excalibur projectile, a GPS guided 155mm round with a range exceeding 40 km.[5]

Figure 1	Source: Military-Today.com
M777A2	Copyright: Public domain

Figure 2	Source: Military-Today.com
M109A6	Copyright: Public domain

The earliest divergence in artillery assets between the Army and the Marine Corps in recent history came in the form of a new weapon system in the early 1980s. The Army adopted the Multiple Launch Rocket System (MLRS) in 1982, a tracked, self-propelled rocket artillery asset with an initial range of roughly 32 km. This asset, developed during the Cold War, gave extended range to Army artillery to engage an armor-heavy adversary with the US's newly developed Dual-Purpose Improved Conventional Munitions (DPICM).[6] The Army followed up the acquisition of the MLRS with a lighter, wheeled asset called High Mobility Artillery Rocket

[5] Raytheon Missiles and Defense, "Excaliber Projectile," accessed February 28, 2021. https://www.raytheonmissilesanddefense.com/capabilities/products/excalibur-projectile.
The M982 Excalibur projectile is a 155mm round fully qualified in multiple systems, including the M777 and the M109 series. Initially fielded in 2007, its initial range was similar to conventional munitions at 23 km, but continued development and updates have extended the range to well beyond 40 km currently advertised.

[6] Headquarters US Marine Corps, *Fire Support Coordination in the Ground Combat Element, MCTP 3-10F* (Washington, DC: Headquarters US Marine Corps, April 4, 2018), 5-33.
Improved Conventional Munitions (ICMs) are base ejection projectiles containing a number of submunitions. Submunitions are ejected through the base of the projectile and scattered in the target area. The dual-purpose improved conventional munition (DPICM) is effective against lightly armored vehicles and very effective against personnel. On impact, each submunition detonates a shaped charge that can pierce 2.75 inches of rolled steel.

System (HIMARS) in the late 1990s, which the Marine Corps adopted in limited numbers in 2002.[7] One of the benefits of these two systems is that HIMARS has interchangeable ammunition pods with the MLRS, forming the MLRS Family of Munitions (MFOM), which has quickly expanded in utility, precision, and range, reaching out to 150 km. This has provided both the Army and the Marine Corps a much-needed Long-Range Precision Fires (LRPF) weapon that has extended the stand-off and reach of US Forces on the conventional battlefield. With the development in precision guidance systems for the munitions, similar to the Excalibur projectile, these systems have readily been adopted into the COIN operations of OIF and OEF to reduce collateral damage considerations for the past 20 years.

Figure 3 Source: US Army
M270 MLRS Copyright: Public domain

Figure 4 Source: US Army
M142 HIMARS Copyright: Public domain

[7] Wikipedia, "M142 HIMARS," accessed January 18, 2021. https://en.wikipedia.org/wiki/M142_HIMARS.
While there are more expansive documents detailing the technical requirements and employment methods of HIMARS, this website has an overview of operational history, which seems to be lacking elsewhere. The Marine Corps adopted the HIMARS system to cover gaps in a fire support asset that could range the deep fight in 2002, however, the asset was not fielded until 2005, and not operational till 2008, over 25 years after the Army obtained the capability.

While the US now faces a burgeoning superpower that it is trained and equipped to counter, China has developed its Anti-Access/ Area Denial (A2/AD) defense in depth to neutralize the US's inherent military advantages. China's use of A2/AD and its ascension by capitalizing on globalization has made large-scale conflict questionable owing to perception and the risk to force posed by large operations due to the proliferation of advanced anti-ship and anti-air capabilities.[8] The unconventional threat posed by A2/AD presents a serious problem for a Marine Corps that is entrenched in conventional tactics that were reinforced over the last 20 years of operational history.

A2/AD is a maritime strategy designed to deny an adversary's naval forces Freedom of Movement in a battlespace. A2/AD projection is a series of overlapping capabilities across multiple domains like Air, Land, Sea, Electronic Warfare, Artificial Intelligence, Cyber, and Space, with the sole aim of imposing maximum attrition on the adversaries' warfighting capability in all spectrums.

Figure 5 Image Courtesy: The Economist
Article: C3SIndia.com

[8] Franz-Stefan Gady, "No More Easy Victories for the U.S. Military?" *The Diplomat* (02 July 2015). https://thediplomat.com/2015/07/no-more-easy-victories-for-the-u-s-military/
Advances in technology and tactics have allowed peer and non-peer actors to counter the US's military supremacy. "China, Iran, and other potential adversaries have also developed air and missile defenses, electronic warfare systems, and other active countermeasures to prevent U.S. strike systems and the PGMs they launch from reaching targets. Passive countermeasures such as making weapon systems mobile and hardening or deeply burying important facilities threaten to further degrade the effectiveness of U.S. precision strikes."

PRESENT

Over the last decade, there has been a growing recognition that China, under the Chinese Communist Party (CCP), has initiated a new age of great-power competition that has not been seen since the bipolarity of the Cold War.[9] China has experienced decades of economic prosperity, and as stated in *China's National Defense in the New Era*, "China has grown from a poor and weak country to be the world's second largest economy."[10] This claim is difficult to dispute, as China has successfully expanded its influence by pairing its economic prosperity with a whole-of-nation approach, heavily incorporating its military. Through a combination of its state-run economic development and military coercion efforts, "China has undertaken a number of 'prestige projects' to demonstrate China's stature as a great power."[11] Ultimately, China's goal is to displace the US's preeminence by establishing itself as the Indo-Pacific regional hegemony through the use of predatory economics and military coercion.

China's National Defense in the New Era codifies the CCP's strategic goals in conjunction with aggressive anti-US rhetoric. While the CCP states "the pursuit of peace,

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[9] Office of the Secretary of State, *The Elements of the China Challenge* (Washington, DC, November 2020), 1-2. As it has ascended, China has engaged in activities calculated to fall below the threshold of provoking armed conflict with the US. These actions include several examples of claiming sovereignty of disputed waters from both Japan and the Philippines, failing to meet its obligation to the World Trade Organization (WTO) on several occasions, intellectual-property theft, industrial dominance along with predatory development programs, and debt-trap diplomacy as it attempts to gain control of much-needed resources for its plateauing economy.

[10] The State Council Information Office of the People's Republic of China, *China's National Defense in the New Era* (Beijing, July 2019), 7.
This is the first edition of this document. As it was published in multiple languages, its target audience is not only the people of China but the international community as well. It is part of China's attempt to build transparency while establishing itself as a leader in Asia and globally.

[11] Thomas G. Mahnken, "Secrecy & Stratagem: Understanding Chinese Strategic Culture." *The Lowy Institute for International Policy* (November 2011), 2-3.
www.lowyinstitute.org › sites › default › files › pubfiles.
Over the last twenty years China has initiated, several "prestige projects" to demonstrate its stature as a great power. These include not only the more recent manufacturing-based Made in China 2025 Program and the One Belt, One Road Initiative, but the construction of the Three Gorges Dam (the largest dam in the world), the 2008 Beijing Olympic games, completion of the Beijing air terminal (the largest air terminal in the world), the development of a jumbo jet to rival the Boeing 747 / Airbus A380, and the pursuit of a manned space program with the goal.

stability and development" are China's priorities, they also underscore the US's "unilateral policies" as an effort to "undermined global strategic stability."[12] This anti-US rhetoric is a clear attempt to build pro-China sentiment by undermining the United States' efforts, not only in the Indo-Pacific but globally. As China has expanded economically through its One Belt, One Road (OBOR) Initiative, it has harnessed the People's Liberation Army (PLA) in coordination with these programs to make in-roads diplomatically in Africa, the Middle East, and even Europe with military attaches, military-to-military exercises, and humanitarian relief efforts.[13]

While *China's National Defense in the New Era* codifies the CCP's national strategy, the US's response has been developing for well over a decade. China's expanding influence was noted in the 2008 *National Security Strategy (NSS)*, but the 2018 *NSS* provides the Marine Corps with more over-arching guidance for the way forward. The most recent *NSS* coupled with the *Military and Security Developments Involving the People's Republic of China 2019* published by the Office of the Secretary of Defense (OSD) and *The Elements of the China Challenge* formulated by the Office of the Secretary of State in 2020 provide even more insight into the established end state for the Marine Corps.[14] These three documents outline examples of China's problematic conduct as seen by the United States, especially as China's centrally controlled, planned economy can be leveraged and augmented with its rapidly modernizing military. More

[12] The State Council Information Office of the People's Republic of China. *China's National Defense in the New Era* (Beijing, July 2019), 2.
[13] Scott D. McDonald and Michael C. Burgoyne, editors, *China's Global Influence: Perspectives and Recommendations* (Honolulu: Daniel K. Inouye Asia-Pacific Center for Security Studies, 2019) 223 https://apcss.org/chinasglobalinfluence/
[14] Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2019* (Washington, DC, 2019), 1.
As China's economic and global influence has grown, so too has its resolve to establish a hegemonic status. However, the economic growth that has sustained its ascension has slowed while its requirement for its industrial complex and prestige projects have remained reliant on external resources. With the US taking a more aggressive stance diplomatically and economically with tariffs, trade embargoes, and Freedom of Navigation operations, China's leaders in the CCP see the US as becoming more and more confrontational.

importantly, these documents define some of the specific threats that China's military will bring to bear in an A2/AD approach to littoral conflict that the Marine Corps will need to respond to, especially regarding LRPF and the Tactics, Techniques, and Procedures (TTPs) needed to employ those assets.

In 2015, the Navy officially recognized the need to adapt its operations in the maritime environments with the publication of "A Cooperative Strategy for 21st Century Seapower."[15] For the first time in decades, sea-control was contested for the United States. The ability to conduct Freedom of Navigation (FON) operations and Force Projection were now jeopardized by a contested littoral environment due to A2/AD. The proliferation of advanced anti-ship and anti-aircraft missiles were no longer limited to great powers. Likewise, China's assertion of territorial claims to its historical nine-dash line, despite international opposition, complicated maritime operations in the East and South China Sea even further.

While not the first time the A2/AD concept had been mentioned in military publications, the Navy's "A Cooperative Strategy for 21st Century Seapower" helped establishes the groundwork for the way forward for the US Naval Forces. The document clearly establishes the requirements to defeat an increasingly complex A2/AD environment by divesting assets across a distributed area on more modular connector systems. Also, it codifies the necessity to develop LRPF that could be used against ships as well as static land-based targets. In the end, this publication provided clear direction for the Marine Corps to shift away from twenty years of

[15] Department of the Navy, "A Cooperative Strategy for 21st Century Seapower," March 2015, 3.
While the A2AD threat was recognized much earlier than 2015 and predates this document, this publication codifies the Navy's recognition of that threat and establishes guidance for the Navy, Marine Corps, and Coast Guard. This document begins to layout the initial concept and requirement for how our naval forces will operate with each other and our allies inside of a plug-and-play network designed to defeat the A2AD system.

COIN operations and the land-based combat that has been conducted in Afghanistan, Iraq, and Syria.

Over the next several years, with a renewed focus on partnership, the Navy and Marine Corps developed concepts intended to defeat or counter the A2/AD threat posed by China in the Western Pacific. Multiple concepts were developed "to describe naval operations in the littoral environment in light of emerging threats in order to provide a unified framework for Navy-Marine Corps innovation," and took shape in the Navy's *Littoral Operations in a Contested Environment.* [16] Likewise, the Marine Corps' Expeditionary Advanced Base Operations (EABO) concept was developed to operate in conjunction with the Navy's newly developed concepts. EABO outlines the process of distributing "low-signature naval and joint forces with operationally relevant sea control and denial capabilities—in particular, the ability to offensively target and strike adversary naval and air platforms, and defensively form the nucleus of an active integrated maritime defense-in-depth."[17]

In concurrence with those developing concepts and doctrine, in 2019 the new Commandant of the Marine Corps initiated sweeping reform for the entire Marine Corps. General David H. Berger laid out five priorities that will guide the Marine Corps over the coming decades, with many of the changes already being executed.[18] With the release of the "Commandant's Planning Guidance" (CPG), General Berger established his priorities as force design, warfighting, education and training, core values, and command and leadership. The first three are critical for Marine artillery and LRPF. Changes associated with these first three

[16] Department of the Navy, *Littoral Operations in a Contested Environment*, 25 September 2017.
[17] Marine Corps Warfighting Lab, *Expeditionary Advanced Base Operations Handbook* version 1.1; Quantico, Virginia, Jun 2018.
[18] Commandant of the Marine Corps. *Commandant's Planning Guidance*. 17 July 2019.
38th Commandant's Planning Guidance CPG > United States Marine Corps Flagship > Electronic Library Display (marines.mil).

priorities have already been implemented, as seen by the release of "Force Design 2030" and will impact subsequent recommendations in this paper.[19]

FUTURE

As early as 2009, the Department of Defense recognized the growing threat posed by an expanding China. This spurred the creation of the AirSea Battle concept that defines how the Army and Air Force would integrate to counter the growing threat in the Pacific arena. The AirSea Battle became part of US Strategy in 2010. Due to the adoption of this strategic concept, weapon systems to better support this concept had to be considered or developed. A Rand report entitled *Employing Land-Based Anti-Ship Missiles in the Western Pacific* was published for the Army in 2013. This report articulated the US military's need for a land-based asset to engage a ship-borne threat. In this manner, the Rand report subsequently helped shape the EABO and the Littoral Operations in a Contested Environment concepts.[20]

Over the last few years, the Marine Corps has undertaken efforts to develop and acquire a land-based anti-ship missile system. There has been no dearth of articles in the last few years detailing the Marine Corps' acquisition concerning a LRPF and anti-ship missile asset.[21] Currently, the Marine Corps is in the process of developing and fielding a new weapons platform

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[19] Headquarters Marine Corps, "Force Design 2030," Washington DC, March 2020.

[20] Terrence K. Kelly, Anthony Atler, Todd Nichols, Lloyd Thrall, *Employing Land-Based Anti-Ship Missiles in the Western Pacific.* Rand Corporation (2013).
https://www.rand.org/pubs/technical_reports/TR1321.html
More than one Rand Report has been published concerning this topic. In addition to this one, the "Land-Based, Multi-Domain Anti-Access/Area Denial Forces" report published in 2017 has direct relevance to the topic of this Literature Review.

[21] Peter Ong, "Land-Based Anti-Ship Missiles and the U.S. Marine Corps: Options Available." *Naval News* (20 September 2020).
https://www.navalnews.com/naval-news/2020/09/land-based-anti-ship-missiles-and-the-u-s-marine-corps-options-available/
This article is but one that defines the way ahead for the integration of Marine Corps LRPF into the Navy's operational concept on how to counter the A2AD environment.

designed to help counter an A2/AD threat in a contested maritime environment. The platform, christened the Remotely Operated Ground Unit Expeditionary Fires (ROGUE-F) Vehicle, is based on the existing Joint Light Tactical Vehicle (JLTV) chassis that can incorporate an advanced anti-ship missile, such as the Ground-Based Anti-Ship Missile (GBASM) or the developing Naval Strike Missile (NSM). This system also can incorporate existing MFOM.[22] To reduce the risk to force, the system is being developed to be an unmanned, semi-autonomous vehicle controlled remotely from a Fire Direction Center or support vehicle nearby. These launchers could then be employed with minimal manning in a distributed manner, as referenced by the Navy's Distributed Maritime Operation (DMO) concept.[23]

Oshkosh defense image showing an unmanned JLTV firing a rocket. The same platform will likely be used by the USMC to launch NSM anti-ship missiles. The launcher capacity appears to be 2x NSM per vehicle. This solution is set to enhance the USMC's anti-ship capability in support of sea control and sea denial missions.

Figure 6 ROGUE Fires Source: Naval News

As the Marine Corps' weapon systems change due to US strategic goals, so too will the need to change the way the Maine Corps trains to achieve these strategic goals. Major Jonathan

[22] Xavier Vavasseur, "USMC Tested a Naval Strike Missile from a JLTV-based mobile launch platform," *Naval News* (08 February 2021). https://www.navalnews.com/naval-news/2021/02/usmc-tested-a-naval-strike-missile-from-a-jltv-based-mobile-launch-platform/

[23] Chief of Naval Operations. *A Design for Maintaining Maritime Superiority.* December 2018.

Bush, in his article "On Target: The Future of Field Artillery Officer Basic Training" lays out the divergent paths the Marine Corps and the Army have taken in recent years at Fort Sill, even before the new direction Marine artillery was directed to take concerning LRPF in the CPG.[24] While this divergence in training and education from the Army at Fort Sill was initiated due to conflicts unrelated to strategic direction for Marine artillery, it is the first unintentional step toward the goal intended by the CPG regarding LRPF. This direction is further accentuated with the release of the 2020 *MCDP-7 Learning* publication, the first new doctrinal publication for the Marine Corps since 2001, that identifies its purpose as creating "a culture of continuous learning and professional competence that yields adaptive leaders capable of successfully conducting maneuver warfare in complex, uncertain, and chaotic environments."[25] The intent of this publication should drive help drive any future Marine Corps endeavors as the service's mission changes to face the threat posed by China in the Pacific.

While A2/AD is not specifically mentioned in *MCDP-7*, it would be difficult to deny that China's A2/AD defense does not meet the criteria of the "complex, uncertain, and chaotic environments" referenced in the publication. Major General William Mullen, the Commanding General of Training and Education Command (TECOM) at the time of *MCDP-7's* publication, pointed to the current operation environment Marines face today and how those challenges are only growing more and more complex, and that the enemy "isn't going to counter us in ways that we're good at. They're going to find ways that we're not good at."[26] This is a direct reference to

[24] Jonathan Bush, "On Target: The Future of Field Artillery Officer Basic Training." Leatherneck Magazine (14 May 2014).
https://www.sandboxx.us/blog/on-target-the-future-of-field-artillery-officer-basic-training/
For the last two and a half years, Major Jonathan Bush has served as an instructor at the Marine Detachment at Fort Sill training new artillerymen and officers.
[25] Headquarters US Marine Corps, *Learning, MCDP 7* (Washington, DC: Headquarters US Marine Corps, February 20, 2020), 1-3.
[26] Diana Stancey Correll, "A Culture of Learning," The Marine Corps Times (20 March 20202).

the threat posed by China's A2/AD through the use of multi-domain assets, such as Electronic Warfare (EW) and Cyber in conjunction with their traditional fire support assets. If the Marine Corps is going to successfully counter China's A2/AD defense in depth, it will truly have to embrace the "culture of continuous learning and professional competence" defined in *MCDP-7* to be adaptive enough to evolve the Marine Corps' fire support and maneuver warfare to fully integrate all of the multi-domain assets now at the US's disposal, such as EW, Operations in the Information Environment (OIE), and Cyber and Space capabilities.

Despite this shift in weapon systems and the TTPs required to integrate with the Naval Forces in a contested littoral environment, there has been minimal guidance on how to update training for the new weapon systems. To be able to meet the strategic intent encapsulated in the CPG, the Marine Corps will have to break with the traditional way it trains artillery at Fort Sill. It will require greater coordination with the Navy, especially as it attempts to master the concepts of DMO and EABO. These concepts require habitual relationships with the Navy that will need to be developed by the Marine Corps to employ this new fire support asset, as the Navy is also developing new platforms to support the larger battlefield framework and incorporate multi-domain assets.

Not only will the technicalities of physically employing the new assets need to be developed within the Navy's framework, but so too will the nuances of command and control, such as fire direction and battle tracking. Just as the Marine artillery community has spent decades building habitual relationships between artillery battalion's and the infantry 'customer' on the ground requesting the support, a habitual relationship will need to be developed between

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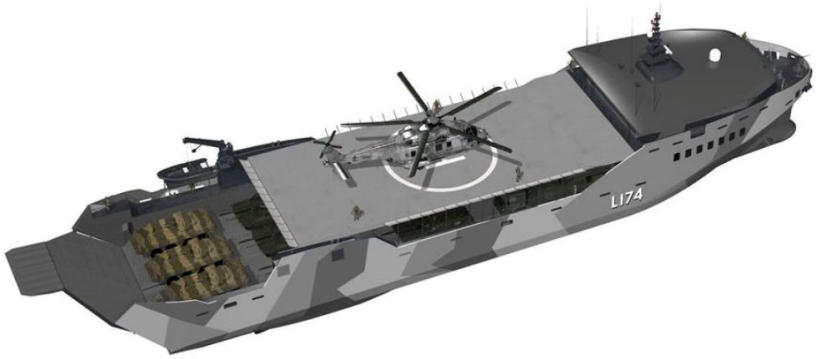
https://www.marinecorpstimes.com/news/your-marine-corps/2020/05/19/a-culture-of-learning-why-the-marine-corps-is-promoting-education-training-in-its-new-doctrine/

the Marine Corps and the Navy as we solidify TTPs for employment, integration, and deconfliction for an asset delivering a missile hundreds of miles across congested airspace and sea space. Some of the most basic questions of the responsibilities of employment and authorities to utilize this asset have yet to be answered. This becomes even more complex when the Marine Corps starts incorporating emerging tactics for EW, OIE, and Cyber and Space capabilities in conjunction with the new LRPF assets.



The Navy's new Light Amphibious Warship (LAW) program envisions procuring a class of 28 to 30 new ships to support the Marine Corps implementing a new concept called EABO. Under the concept, reinforced-platoon-sized units maneuver around the theater, moving from island to island, to fire anti-ship cruise missiles, and perform other missions.

Figure 7 LAW Concept — Source: USNI News

INSTALLATION RECOMMENDATIONS

To fully develop the questions that need to be asked and provide answers that work within the Navy's command framework, a close partnership is required; a partnership that is hampered by geography. While current technology allows for virtual meetings, face-to-face interactions in the development of the TTPs of this new weapon system are critical. By moving the location of artillery training provided by the Marine Corps Artillery Detachment at Fort Sill westward, the Marine Corps can better facilitate the integration of LRPF into a Naval framework, as opposed to the conventional land battle framework that has been focused upon for over a century.

Two locations on the West Coast immediately present themselves for this relocation, both with existing artillery units and facilities available; Marine Corps Air Ground Combat Center (MCAGCC) Twentynine Palms and Marine Corps Base Camp Pendleton, both located in California. MCGCC Twentynine Palms is the premier training facility for the Marine Corps, especially when it comes to integrating aviation and ground combat elements. It currently is home to an artillery battalion and has been able to facilitate the live-fire execution of the developing HIMARS munitions. In addition, 1st Tank Battalion has recently been divested from the Marine Corps, per the CPG, freeing up facilities that could be converted. This is still in relatively close proximity to Navy and Marine Corps Training Command Expeditionary Warfare Training Group Pacific (EWTGPAC) at Coronado, a joint Navy and Marine Corps command which is responsible for the training and integration of Naval Surface Fires. Likewise, this is also closer to Tactical Training Group, Pacific (TACTRAGRUPAC) in San Diego, the Navy command responsible for training the Navy's 3rd , 5th, and 7th Fleets on maritime tactics and the employment of the Tomahawk Land Attack Missile (TLAM) weapons systems.

Camp Pendleton also presents itself. While it does not have the training area and facilities that Twentynine Palms possess, it is in closer proximity to EWTGPAC, TACTRAGRUPAC, and other Naval installations on the West Coast where the asset could be tested and trained with. Similar to MCGCC Twentynine Palms, Camp Pendleton is home to an artillery regiment and possesses facilities that are coming available when 1st Battalion Marine Raiders' moves to collocate with the rest of the Raider community aboard Camp Lejeune, North Carolina.

Either location would provide certain limitations, but they would also provide specific training opportunities unique to each location. Regardless, either location would place the Marine Corps Artillery Detachment in closer proximity to the Navy, which is critical for the

LRPF partnership being developed. Also, either of these locations is close enough to other training facilities, such as Marine Corps Air Station (MCAS) Yuma and San Clemente Island Range Complex, where distributed operations could be trained to with enough distance to simulate a realistic operating environment via air transport, as well as incorporate live-fire opportunities; both of which are missing in Oklahoma and the East Coast. While it could be argued that distributed operations on geographically separated training ranges are not necessary for the level of training that the Marine Corps Artillery Detachment provides, operating in a distributed manner is critical to the employment of these new artillery assets. By providing the artillery training cadre with the opportunity to continually employ the asset in the manner it is intended affords the Marine Corps Artillery Detachment the opportunity to continually evolve and update the TTPs and doctrine for the weapon systems' employment.

Other options for relocation of the Marine Corps Artillery Detachment that provide integration with the Navy could include Naval installations, such as Naval Air Weapons Station (NAWS) China Lake, or Naval Air Station (NAS) Point Mugu. NAWS China Lake, located in the Mojave Desert of California, consists of 4500 square km of training area, and already supports the missile research, testing and evaluation programs of the US Navy. An already established infrastructure and access to a large, relatively isolated range space provides obvious benefits.[27] NAS Point Mugu is home to the Navy's Pacific Missile Test Center. NAS Point Mugu, like NAWS China Lake, already has an established infrastructure and has been hosting live-fire NSM and GBASM test shots for years.[28] This access to viable live-fire range space into

[27] Navy.Mil, "Naval Air Weapons Station China Lake," accessed 28 February 2021. https://www.cnic.navy.mil/regions/cnrsw/installations/naws_china_lake.html
NAWS China Lake is located in the Western Mojave Desert region of California, approximately 150 miles north of Los Angeles. The installation is the Navy's largest single landholding, with its two ranges and main site covering more than 1.1 million acres, an area larger than the state of Rhode Island.
[28] Kongsberg, "Successful final milestone for NSM," accessed 28 February 2021. https://www.kongsberg.com/kda/news-and-media/news-archive/2011/successful-final-milestone-for-nsm/

the Pacific Ocean adds even more realistic training for an anti-ship missile platform that land-bound ranges would not afford. Either NAWS China Lake or NAS Point Mugu would be a viable option, but the Marine Corps would be ceding much control of the training to the Navy, who maintain the installations. While this is an obvious downside, there is a precedence in that Fire Support Marines already conduct a portion of their training aboard Naval Base Coronado, which controls the San Clemente Island Range Complex.

While ceding control of training to the Navy appears to be a downside for Marine artillery, the Marine Corps already does this while operating aboard Fort Sill. Colocation of training with the Army aboard an Army installation requires competition for limited resources, including facilities and training areas. As Major Busch, who is currently assigned to the Marine Corps Training Detachment at Fort Sill, states, "the infrastructure (office buildings, living quarters, etc.) aboard the base are limited due to the high number of operational Army units currently stationed here."[29] While the Marine Corps Training Detachment is already established at Fort Sill, the acquisition of these assets for training will require additional facilities that Fort Sill has yet to be able to provide. As the first project officer and design lead for the ROGUE-F system Major Mathew Browning points out, "the Army is not (at this moment) pursuing this launcher option. Fort Sill also does not have SIPR access; any technical curriculum taught and developed will have to be in a secret environment. Also, the primary subject matter experts for NSM and other Navy missiles serve and work at other Naval locations."[30] This lack of facilities

[29] Major Jonathan Bush, email message to author, March 17, 2021.
Major Busch has served at Fort Sill as the Operations Officer, Officer in Charge of the Officer Instruction Branch, and currently serves as an instructor for the Army's Field Artillery Captain's Career Course. He has training on the Marine Corps' LRPF program, has received briefs on ROGUE-F, as well as being read-in to the Army's LRPF program by nature of being at the Army's Fires Center of Excellence at Fort Sill.
[30] Major Mathew Browning, email message to author, March 11, 2021.
Major Matthew Browning served as the first project officer, design lead, and the anti-ship missile subject matter expert for the Marine Corps to the Navy and Army. He also oversaw the integration process of the NSM onto the first five ROGUE-F vehicles.

and secure internet access will have to be addressed for a new training location or the existing one at Fort Sill, regardless of the path taken concerning the future training of Marine artillerymen with assets like the ROGUE-F system.

Another issue that will need to be addressed along with naval integration, either aboard Fort Sill or at an alternate location, is the ability to conduct live-fire training. Major Busch asserts that at Fort Sill "the training area is limited in space and regulation… If we were to try to execute anti-ship firing, the terrain would not be conducive to those types of missions," and "although there are extensive digital and virtual training facilities, their demand is high and competition is fierce for training opportunities."[31] Major Browning, with intimate knowledge of the ROGUE-F's limitations and capabilities, reiterates Major Busch's claim with the statement, "Ft. Sill doesn't have the training ranges for missiles of this type nor the support system set up."[32]

Fort Sill, however, is not alone in its inability to facilitate live-fire training for rocket and missile artillery. Currently, the capability to execute live-fire training with MFOM is extremely limited by local Range Regulations. In most instances, only Reduced-Range Practice Rockets (RRPR) are authorized for use due to the extreme range that the precision-guided variants, Guided Multiple Launch Rocket System (GMLRS), can attain.[33] As munitions become more and more capable, increasing in range and precision like the GMLRS and NSM, the limitations imposed by Surface Danger Zones (SDZs) required by Range Controls governing safety on the ranges will increase as well. Due to the vast size directed by the SDZ for the longer-range munitions, the ability to conduct a live-fire shot is invariably limited by the size of the rage space

[31] Major Jonathan Bush, email message to author, March 17, 2021.
[32] Major Mathew Browning, email message to author, March 11, 2021.
[33] Department of the Army Headquarters, Army Garrison Fort Sill, "Fort Sill Regulation 385-1," Fort Sill, Oklahoma, 24 June 2016, 25.

available. Only installations with range spaces that exceed the maximum range of the munition, to prevent the SDZ from extending past the range boundary, can facilitate a live-fire exercise without a deviation processed through the installation Commanding Officer or first General Officer in the chain of command.[34] This limits the execution of live-fire missions with MFOM, which are beginning to exceed 70 km with current munitions ranges, to MCAGCC 29 Palms, MCAS Yuma, or a missile test site such as Dugway Proving Ground, White Sands Missile Range, NAWS China Lake, NAS Point Mugu, or San Clemente Island Range Complex, all located in the Western United States.[35] Any relocation of the Marine Corps Artillery Detachment needs to weigh the benefit of not only integration, but the importance of being able to live-fire the weapon system, as well.

BENEFITS AND TRAINING OPPORTUNITIES

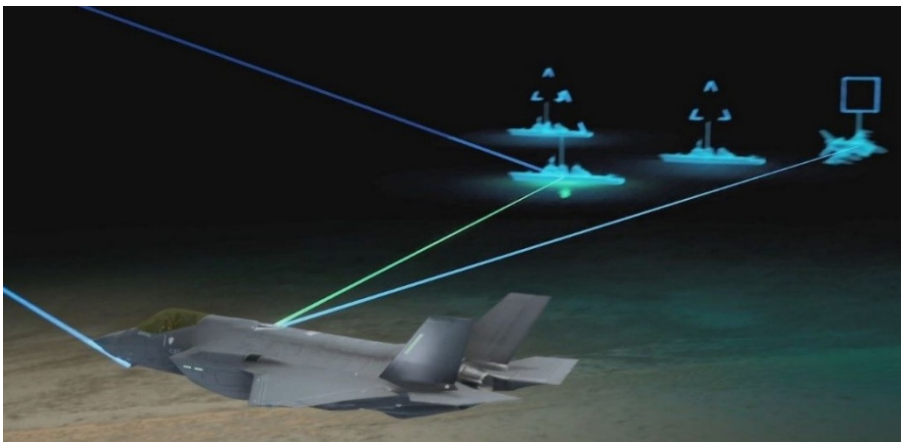
Relocating the Marine Corps Artillery Detachment westward would provide several other benefits and training opportunities that do not currently reside in geographical proximity to Fort Sill. While these specific training events have failed to be incorporated into the past or current training curriculum, the changes in the way Marine artillery will be utilized in the near future due to changing missions and capabilities warrant consideration of their incorporation. There is a vast

[34] Headquarters Marine Corps, "Marine Corps Order 3550.9," Washington DC, 28 June 2005, 4.
While the Marine Corps Order states that installation commanders have deviation authority, unless they are not a General Officer, an SDZ that will exceed the range boundary with a High Explosive round is a high-profile occurrence and may require additional coordination with Training and Education Command, as was the case with the deviation produced aboard MCAS Yuma Range in 2019 and 2020.
[35] Kongsberg Gruppen, "Kongsberg's NSM Naval Strike Missile Completes Final Milestone," *Defense Aerospace.* 23 June 2011.
http://www.defense-aerospace.com/articles-view/release/3/126705/kongsberg-naval-strike-missile-completes-final-milestone.html
HIMARS have been conducting live-fire shots aboard several installations for years, but range regulations and SDZs have limited where GMLRS can be fired due to the maximum range associated with the munitions. GBASM and NSM will similarly have the same issues, unless at a location like Point Mugu or San Clemente, where maximum ranges are not limited.

difference in the way conventional towed artillery is employed and the way a semi-autonomous rocket and missile artillery system is used to counter the asymmetrical challenges of A2/AD.

Any of the locations recommended would provide access to one of the most critical developments for LRPF, which is the integration with 5th Generation aircraft, such as the F-35 Lightning II. This integration allows the 5th Generation aircraft to utilize its advanced sensor arrays to target and communicate precise target location directly to a launcher via a data link, eliminating unnecessary actors in the targeting cycle, effectively reducing the "kill chain". This produces a faster targeting solution referred to as "sensor to shooter", which is continually being developed to reduce unnecessarily long response times.[36] Currently, the Marine Corps has six squadrons with F-35s, three of them at MCAS Yuma and one at MCAS Miramar, just east of San Diego; the other two squadrons with F-35s are in Japan. Relocating the Marine Corps Artillery Detachment to any of the suggested locations in the Western United States would place the Marine Corps Artillery Detachment in closer proximity to these Marine Corps F-35 assets.

[36] Shawn Snow, "Marines connect F-35 jet to HIMARS rocket shot for first time," *Marine Corps Times*. 05 October 2018.
https://www.marinecorpstimes.com/news/your-marine-corps/2018/10/05/marines-connect-f-35-jet-to-himars-rocket-shot-for-first-time/
While this article refers to the connection between a HIMARS and F-35 as a success, it was in a limited capacity, and the article is somewhat misleading. While the F-35 was able to successfully communicate targeting data to the HIMARS launcher for a successful shot, the F-35 required the data be processed through Target Handoff System Version 2 (THSV2) due to the complexity of the F-35's systems and the HIMARS legacy Advanced Field Artillery Tactical Data System (AFATDS) used to process firing solution data. Regardless, this capability is continually being worked on and will become operational soon.



5th Generation capability is defined by the combination of Very Low Observable stealth, advanced sensors, information fusion, and network connectivity. The F-35 serves as an information and communications gateway, sharing its operational picture with the ground, sea, and air assets.

Figure 8 F-35 Source: Lockheed Martin Copyright: Public Domain

Further integration with aviation assets includes what is called HIMARS Rapid Infiltration (HIRAIN). This raid-type mission involves the HIMARS launchers being loaded on C-130s, unloaded to rapidly conduct fire missions, then reloaded and relocated for follow-on objectives. This minimizes the opportunity of detection and counter-fire missions against the high-value systems.[37] The appeal of HIRAIN missions is that C-130s can take advantage of short, expeditionary runways, as opposed to being reliant on longer, established runways. As the distribution of assets across the battlespace to produce a lower signature becomes more relevant in countering an A2/AD environment with the EABO and DMO concepts, this capability will most likely be adopted with the new artillery weapons platforms being developed, Like ROGUE-F. While this capability can be utilized anywhere C-130s are available and where they can land, large-scale recurring training exercises, such as Integrated Training Exercise (ITX) at MCAGCC

[37] Gerard Farao, "U.S. Marines, soldiers, and airmen conduct HIMARS rapid infiltration in Australia," *Marines.mil,* 8 Jul 2019.
https://www.marines.mil/News/News-Display/Article/1897235/us-marines-soldiers-and-airmen-conduct-himars-rapid-infiltration-in-australia/
This article specifically references the inclusion of a HIRAIN mission conducted by multiple launchers and multiple C-130s in the US and Australian bi-lateral annual training Exercise Talisman Sabre 19, highlighting the relevance of this type of mission. Its inclusion in ITX and WTI, which occurs several times a year, only reinforces that relevance. However, live-fire opportunities in conjunction with HIRAIN missions will still be limited to range size.

29 Palms and the Weapons and Tactics Instructors (WTI) Course at MCAS Yuma, are incorporating HIRAIN more and more frequently to utilize LRPF in distributed operations to counter the simulated adversaries' A2/AD capabilities in the training exercise.

While HIRAIN missions were developed to rapidly insert HIMARS into position to execute a fire mission and rapidly egress via the C-130, the JLTV, which the future platform is based on, can likewise be C-130 transportable. This makes it likely that this TTP will be similarly executed with the future platform, possibly taking advantage of further development and future integration of semi-autonomous or fully autonomous systems.

Figure 9
C-130 loading HIMARS

Source: Marine Corps Times
Copyright: Public Domain

While the integration of fire support with aviation assets is critical in countering the A2/AD threat posed by China, the integration of these new weapons systems with other effects-based assets is just as critical. To counter A2/AD adequately, the Joint Force will have to rely on Fires, Aviation, Electronic Warfare, and effects provided by Cyber Command and Space Command. While many of these effects can be coordinated to impact just about anywhere, these effects are often rarely employed within the boundaries of the United States, simply due to safety. If the effects are coordinated into a training evolution, they are incorporated into large training exercises on large range installations, such as with ITX or WTI. Similarly, NAS Point Mugu serves as the Department of the Navy's Electronic Warfare Technical Center, providing further opportunity to collaborate on combining effects that will be necessary to fully counter the A2/AD environment.

With the combined arms approach as one of the key tenets for the Marine Corps' type of Maneuver Warfare, translating easily to the defeat of the A2/AD environment with the multiple

domains available to provide effects, integration of these varied effects needs to be more fully explored and trained to. Locating the Marine Corps Artillery Detachment westward from Fort Sill allows a repository of Fires and Effects subject matter experts to be in closer proximity to the Marine Corps' Navy counterparts in training and education commands, such as NAS Point Mugu, EWTGPAC, and TRAGRUPAC. Proximity, or even better, co-location, will provide greater opportunity for combined training opportunities to develop the habitual relationships that will be needed to fully assimilate the Marine Corps' developing artillery weapons platforms into the command-and-control structure that will be necessary to integrate or deconflict a munition like the GBASM or NSM.

The principal obstacle to relocate Marine artillery training to an alternate installation to better facilitate naval integration is the Marine Corps' current modus operandi of executing the training during major training evolutions, such as ITX or the Rim of the Pacific Exercise (RIMPAC) or simply relying on the individual Fleet Marine Force units to conduct the training. The issue with this method is one of standardization and consistency. Even in the Marine Corps' and Navy's own training and education continuum, disparity exists in courses provided by EWTGPAC and its sister school Expeditionary Warfare Training Group, Atlantic (EWTGLANT) in Norfolk, Virginia. As a recent Marine Corps Training and Education Command (TECOM) Fire Support Instructor Captain Kyle Gannon notes concerning the Fire Support Coordination Center (FSCC) Course conducted by EWTGPAC and EWTGLANT, "each EWTG added or deleted classes from the curriculum. Students from the east and west coast were receiving different training on planning and conducting fires within an FSCC."[38]

[38] Captain Kyle Gannon, email message to author, March 25, 2021.
Captain Gannon served in support of Training and Education Command as a Fire Support Instructor at Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) aboard MCAS Yuma. He has served in various billets in

The movement of the Artillery Detachment would not only place it closer to other units responsible for developing TTPs and training other units, such as EWTGPAC and TRAGRUPAC, but more importantly, it would facilitate standardization. The ability to provide standardization, and the opportunity to proof the concepts through integrated training opportunities, would establish the Artillery Training Detachment as the Marine Corps' resident subject matter experts, standardizing artillery training across the Fleet Marine Force. This is vitally important when considering the emerging TTPs for integration, deconfliction, observation, fire direction, battle tracking, and approval authorities that will be implemented alongside our partners inside the Navy's command and control framework.

Regardless of which location that could be picked, either MCAGCC 29 Palms, Camp Pendleton, or even aboard a Naval installation, moving the training and education location of the Marine Corps Artillery Detachment at Fort Sill westward could help solve the issue of the separation in training between the Marine Corps and its Navy partners that is needed for LRPF in today's complex security environment. Despite decades of historical employment, the continuation of the training of Marine artillery alongside the Army at Fort Sill limits the developing needs of the Marine Corps as an institution. As the needs of the Nation, and the role of the Marine Corps, pivots to the Pacific, the Marine Corps needs to relocate its artillery training to facilitate the integration and partnership necessary with the Navy and to address the challenges and capabilities inherent in the emerging weapons platforms the Marine Corps is adopting.

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the artillery community and attended numerous courses (JFO, FSCC, WTI, JFC, JOFEC, BDA, CDE, Weaponeering, and TACP).

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