# Manned and Unmanned Teaming

## The future of Marine Corps reconnaissance units

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> ***"The general unreliability of all information presents a special problem in war: all action takes place, so to speak, in the twilight, which, like fog or moonlight, often tends to make things seem grotesque and larger than they really are. Whatever is hidden from full view in this feeble light has to be guessed at by talent, or simply left to chance. So once again for the lack of objective knowledge, one has to trust to talent or to luck."***
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> ***—Carl von Clausewitz,* On War**

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*Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms*, defines reconnaissance as

> a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area.[1]

Thus, it is the purpose of the various intelligence, surveillance, and reconnaissance units throughout the Marine Corps to shed light on whatever is hidden from full view, to lift the fog with what Sun Tzu termed foreknowledge, in order to provide the supported commander information on where to maneuver forces. This ensures the uninterrupted advance to objectives despite battlefield conditions, such as impassable routes, blown bridges, unfordable streams, contaminated areas, refugee columns, converging friendly units, and enemy forces.[2] Conversely, an emerging counter-reconnaissance concept defines counter-reconnaissance as

> missions and actions undertaken to deny the enemy's ability to obtain, by visual observation, electronic sensing, or other detection methods, information about activities and resources of friendly forces or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area.[3]

This article seeks to begin the conversation of how the Marine Corps' ground and light armored reconnaissance (LAR) units can use manned and unmanned teaming (MUM-T) to better provide their supported commanders with the combat information needed to strike at the right time and place in the future operating environment.

### MOC Implications

The *Marine Corps Operating Concept* (*MOC*), published in September 2016, proceeded from an assessment published in June 2015 by the Marine Corps Intelligence Activity entitled *Future Operating Environment (FOE) 2015-2025: Implications for Marines.* Looking out to 2025 through the lens of the *FOE*, the *MOC* stated the central problem as,

> The Marine Corps is currently not organized, trained, and equipped to meet the demands of a future operating environment characterized by complex terrain, technology proliferation, information warfare, the need to shield and exploit signatures, and an increasingly non-permissive maritime domain.

This list entails five key drivers of change in how we organize, train, and equip the Marine Corps to execute its

assigned functions, roles, and responsibilities. Four of the five critical tasks and associated issue areas identified in the *MOC* include evolving the MAGTF, operating with resilience in a contested-network environment, enhancing our ability to maneuver, and exploiting the competence of the individual Marine to affect the reconnaissance community and provide a guide for organizing, training, and equipping reconnaissance units to operate, fight, and win in the 21st century.[4] Given the definitions of reconnaissance and counter-reconnaissance, and the change needed to meet the demands of the future operating environment, the following paragraphs describe what GCE reconnaissance units do and how they are beginning to evolve their current capabilities.

***1st LAR vehicles during rafting training at Camp Pendleton. 1st LAR and 7th ESB worked together during this training.*** *(Photo by Cpl Eryn Edelman.)*

## Introduction to Ground Reconnaissance and LAR

Reconnaissance battalions and force reconnaissance companies conduct amphibious and ground reconnaissance, surveillance, battlespace shaping, and specialized raids. These units differ only in who they support. The reconnaissance battalion supports the Marine division and its subordinate elements or a designated MAGTF. Force reconnaissance companies support the MEF, other MAGTFs, or the Marine component of a joint force or joint task force. In the past, training and capabilities were tiered between the two elements with more training, experience, and capability residing in the force reconnaissance companies. This is no longer the case; the training, experience, and capabilities have been distributed across all reconnaissance Marines in both the reconnaissance battalion and the force reconnaissance company.

LAR battalions tactically and operationally maneuver on the battlefield to see the enemy first with the capability to fight for information for the GCE on the flanks, rear, and deep rear of an opponent. Today, LAR units depend upon the family of light armored vehicles (FOLAV) and their assigned scouts to execute their missions. The FOLAV began fielding in 1983 and is the LAR platform that "possesses a potent combination of firepower, high mobility, communications, and protection in an expeditionary platform."[5] The FOLAV has "undergone a series of modifications, product improvements, and other upgrades to maintain threshold performance levels and increase system capability" and was "originally scheduled for replacement in the first decade of the 21st century," extended three times "in deference to higher invest priorities."[6] The exit date is now 2035.[7] Because of its longer-than-anticipated service life,

> LAR units experience capability and capacity gaps and shortfalls in their ability to conduct combined arms reconnaissance and surveillance, counter-reconnaissance, raids and offensive actions, security and defensive operations in support of maneuver, while operating across extended lines of communication with minimal external support.[8]

In June 2016, the Commandant issued a directive to initiate a program for a next-generation capability replacement for the FOLAV in the 2030s and to continue lifecycle management activities for the existing fleet as a bridge to the next-generation armored reconnaissance vehicle (ARV).[9] The next generation platform is expected to deliver a significantly more capable mounted reconnaissance vehicle, with the growth capacity to incrementally integrate the wide range of enabling capabilities that future mounted reconnaissance units will require to be operationally effective and survivable.

The LAR scout is a reconnaissance and security specialist integral to, not separate from, the light armored vehicle crew that seeks to obtain, distribute, and, if required, fight for vital combat and battlefield information on the enemy, terrain, manmade structures, and environmental conditions. Scouts are the commander's eyes and ears on the battlefield that conduct ground reconnaissance,[10] engineering reconnaissance,[11] surveillance,[12] vehicle security,[13] and limited mobility and counter-mobility tasks[14] and control supporting arms[15] in order to shape the battlespace as part of light armored operations in support of the GCE scheme of maneuver. The LAR scout is an infantry Marine who currently receives 100 percent on-the-job training to learn to execute the critical tasks associated with the various reconnaissance tasks highlighted above. Unsatisfied with the current training model and in light of expected future capabilities to conduct their tasks, the LAR Operational Advisory Group has initiated an effort to professionalize the LAR scout training continuum and incorporate training

on new sensor platforms in order to be successful in the future operating environment.

## MCISRE and MCF 2025 Implications

Reconnaissance and LAR battalions in the future operating environment focus on dominating the security area in the conduct of reconnaissance and counter-reconnaissance operations. In alignment with the Marine Corps Intelligence, Surveillance, and Reconnaissance Enterprise (MCISRE) Plan and Marine Corps Force 2025 (MCF 2025), initiatives and innovation drive changes in how reconnaissance units sense, make sense, and act across all domains of the warfighting functions both kinetically and non-kinetically while the function, or nature, of reconnaissance remains constant to enable MAGTF maneuver to dominate the future operating environment. The following paragraphs describe what ground reconnaissance and LAR units will do in the future and discuss their vision for manned and unmanned teaming, important reconnaissance functions in the future operating environment, and how advanced technologies in artificial intelligence and unmanned teaming are focused on the key drivers of change identified in the *MOC* to assist these units in the future operating environment.

## Reconnaissance in the Future Operating Environment

Ground reconnaissance units in the future operating environment will continue to conduct amphibious and ground reconnaissance, surveillance, battlespace shaping, and specialized raids. With a more capable force writ large, Marine reconnaissance will adapt to the future environment with MUM-T, gain capabilities to shape non-kinetically, and serve as a "bridging force" between the MAGTF and special operations forces (SOF). LAR units in the future operating environment will continue to provide the MAGTF commander with the combat information he needs to strike at the right time and place, such as a better understanding of the size and composition of the enemy, his dispositions, and where and when the application of superior combat power could have a decisive effect. In the course of reconnaissance and security operations, LAR units in the future operating environment will continue to conduct offensive and defensive actions by gaining and maintaining contact with the enemy, supplying continuous and useful information, and providing timely and accurate reporting to the main body without becoming decisively engaged. Future armored and ground reconnaissance units remain a significant source of near-realtime combat information for the MAGTF commander.

## Robotic and Autonomous Systems Concept of Employment

In the future operating environment, ground reconnaissance and LAR units should enhance their capabilities through the use of designated unmanned system operators and the use of cognitive artificial intelligence.[16] This article does not propose the wholesale replacement of the human component but rather supposes the human component is aided by technology to sense, make sense, and act more rapidly than the human alone. There are three primary and distinct advantages the human component offers over total automation. First, unmanned systems in the envisioned future operating environment will not have the endurance to be deployed from a distant MAGTF headquarters to seek out, gain access, loiter, and collect or act on target areas likely to be covered by ground reconnaissance and LAR units. Second, near-peer threats likely possess the capability to deny critical communications and navigation nodes necessary for fully robotic autonomous systems. Third, environmental and physical characteristics such as extreme cold weather or dense jungle vegetation can significantly degrade the effectiveness of fully autonomous systems. *MCDP 1, Warfighting*, cautions us that "no degree of technological development or scientific calculation will diminish the human dimension in war," as that would "[neglect] the impact of the human will on the conduct of war and is therefore inherently flawed" because war is a violent "clash between opposing human wills."[17] Ground reconnaissance and LAR forces enabled with unmanned technology and artificial intelligence as a cognitive aid can conduct actions that exploit their personnel and equipment, unit speed, range, mobility, and lethality to fight for combat information and stimulate enemy action in the MAGTF security area. This provides the GCE with sustained all-weather combat power in order to shape the operating environment and provide the main body protection in the form of reaction time and maneuver space.

## Critical Reconnaissance Functions

With an understanding of what ground reconnaissance and LAR units will do in the future operating environment, and the current vision of how autonomous systems should aide Marines in the accomplishment of their missions, it is important to understand critical reconnaissance functions before discussing specific capabilities sought to address the *MOC*'s five key drivers of change. Reconnaissance units in the future operating environment will maneuver, sense, make sense, communicate, and engage enemy forces to shape the operating environment for supported commanders. The following paragraphs begin to explore how ground reconnaissance and LAR units should be enabled by MUM-T.

## Robotic and Autonomous Systems Concept of Operations

Ground reconnaissance units will maneuver to their areas of operations through various means, such as diving, high altitude high opening/high altitude low opening parachuting, helo-casting, submarine lock out, and combat rubber raider craft (CRRC). Once inserted, the Marines will move to gain proximity and leverage MUM-T to assist in the execution of their critical tasks. LAR units will primarily rely on the ARV to maneuver to its area of operations. The ARV will possess the operating range, speed, robust cross-country capability, and on-road performance in nearly any terrain to enable 24/7, all-weather, independent operational maneuver far forward and to the flanks of a supported maneuver task force. In urban

environments, the ARV will be capable of maneuvering through obstacles and restrictive terrain that have historically limited armored platforms. To maintain operational tempo and expand the maneuver space, ARV crews will be capable of rapidly transitioning to water operations under armor to negotiate water obstacles with a shore-to-shore water mobility capability. The ARV will have sufficient water mobility performance to enter and exit littoral surf zones and steep riverbanks to negotiate light surf, bays, inlets, estuaries, and rivers.

Ground reconnaissance and LAR units are critical to answering supported commander combat information requirements. To answer those requirements, they will sense and make sense of the operating environment with traditional capabilities and should be aided by organic unmanned aircraft systems (UAS), unmanned ground vehicles (UGV), unattended ground sensors, and unmanned underwater vehicles (UUV). These systems will extend the surveillance reach of the reconnaissance unit and expand the security area portion of the operating environment along multiple routes, areas, or broader zones beyond what is currently possible. They are used for intelligence collection and targeting, providing a basis for responsive fires, and also serve as a means of force protection by reducing risks to the reconnaissance and LAR Marines. As an example of risk reduction, a CRRC transits from MEU/ARG shipping to a designated point where a UUV is inserted to perform an unmanned hydrographic survey. While recovering the UUV, the reconnaissance team notices an anomaly in the data. Equipped with divers who investigate the anomaly, the team ensures the lane is clear and returns to naval shipping. In a similar scenario, a ground reconnaissance team can insert onto an island and launch smaller UAS with the data fed directly back to the MEU for processing, exploitation, and dissemination. Ground reconnaissance Marines can also infiltrate and link up forces with advanced or other SOF, as a bridging force filling the Marine Corps gap in advanced force operations, to answer MAGTF information requirements, potentially leverage existing networks, and deconflict SOF and MAGTF missions for a deeper understanding of the battlespace by the supported commander. Through training, compatible equipment, and strong working relationships, reconnaissance units create synergistic effects between the MAGTF and SOF.

To sense and make sense of the operating environment is of little use without the ability to communicate combat information to higher, adjacent, and subordinate units. Ground reconnaissance and LAR units will communicate across extended distances within the expanded battlespace. The rapid transfer of information should come from a greater networked C4I (command, control communications, computers, and intelligence) capability to facilitate operations. Beyond traditional voice and data exchange mediums, reconnaissance units should leverage UAS, F-35, UGV, and advanced communications capabilities to provide timely and relevant combat information to supported commanders. When sensors determine a significant threat to detection, cognitive artificial intelligence should alert operators to use lower power settings, data bursts, or directional communications which lessen the detectability. Reconnaissance units should take advantage of unmanned ground and aircraft systems to overcome extended range communications challenges in complex urban and mountainous terrain. In communications denied or disrupted environments, reconnaissance units will rely on commander's intent to shape the operating environment harkening back to the days of the Banana Wars and Evan Carlson's "Long Patrol," where communications from higher were infrequent yet operations were highly effective because of the Marines' aggressive and creative execution of commander's intent.

With regard to engaging enemy forces, ground reconnaissance and LAR units should conduct electronic warfare attacks and deliver, control, or coordinate indirect or aircraft-delivered fires. The ARV-equipped LAR unit should conduct full-spectrum electronic warfare, cyber defense, and counter-UAS. Ground reconnaissance units will coordinate indirect and aircraft-delivered fires. ARV-equipped LAR units should not only provide an enhanced capability to coordinate supporting arms but deliver precision-loitering munitions for engaging targets at operationally rel-

***A Marine gathers information during the Reconnaissance Team Leaders Course.*** *(Photo by Senior Airman Ryan Conroy.)*

***The Reconnaissance Team Leaders Course is designed to develop junior Marines into better team leaders.*** *(Photo by Senior Airman Ryan Conroy.)*

evant distances while remaining outside threat spectrum detection. Additionally, the ARV will provide a medium-caliber cannon to defeat like vehicle threats and extended range anti-armor/anti-material missiles to neutralize enemy armor threats and dominate the battlespace. These capabilities provide the means for reconnaissance units to gain and maintain contact with the enemy while further developing the situation after initial contact to fight for combat information in order to assist the supported commander in determining where and when to engage his forces.

## Focus on Key Drivers of Change

In the complex terrain of the future operating environment, reconnaissance battalion Marines should employ UUVs to more rapidly and more accurately conduct surface and subsurface amphibious tasks necessary in highly contested littoral regions in order to provide supported commands with timely and responsive combat information necessary to execute their missions. Likewise, next-generation ARV-equipped LAR units should use on- or off-board technology to detect underwater obstacles in order to enable their shore-to-shore movements in support of their operational maneuver.

ARV-equipped LAR units should harness on- and off-board sensors across the electro-optical, radio, and acoustic spectrums to enable 360-degree situational awareness, detect IEDs, and enhance local security. Cognitive artificial intelligence should automatically detect, recognize, and identify potential threats and alert the crew by populating relevant combat information through a battle management system that fuses unmanned sensors, communications, C2 applications, and weapons in order to reduce the crew workload, increase vigilance, and mitigate vulnerability induced by under-armor operations.

Technology proliferation ensures "numerous non-state adversaries and individuals gain at least some capability at the tactical level"[18] in addition to sophisticated peer and near-peer capabilities with greater reach and lethality at operational and strategic ranges. As such, ground reconnaissance and LAR units should team with unmanned systems to destroy identified threats before being detected by remaining under threshold detection levels and attacking from beyond the line of sight of the reconnaissance Marines or the ARV crews. Because of the higher detectability of armored reconnaissance units, ARV-equipped LAR units will require an organic capability to avoid or deny UAS attacks; and active and passive protection systems enabled by artificial intelligence should sense, orient, track, and defeat incoming anti-tank and anti-material rockets and missiles. Additionally, artificial intelligence can assist in classifying targets of higher priority to aid in reducing the most pressing threats first.

Additive intelligence and information operations structure will assist ground reconnaissance and LAR units to operate within the informational and human aspects of the operating environment. Conversely, photographic and video documentation captured by these reconnaissance units with manned and unmanned systems will be pushed from the tactical level to supported headquarters in order to enhance their ability to message first or oppose adversary narratives. These units should employ electronic warfare, special technical operations, and military deception through the use of manned and unmanned systems in order to disrupt the adversary's foreknowledge and decision-making processes.

In the future operating environment, to be detected is to be targeted. The *MOC* states that "unmanaged signatures increasingly become a critical vulnerability" as adversaries "net together sensors, spies, UAS, and space imagery to form sophisticated 'ISR strike systems' that are able to locate, track, target, and attack an opposing force."[19] Ground reconnaissance and LAR units should leverage cognitive artificial intelligence to sense the electro-optical environment and reduce susceptibility to targeting by reducing emissions while transmitting. When it is deemed a significant detectability risk to transmit important combat information from the vehicle, LAR units should deploy unmanned systems to move an operationally relevant distance away from the unit and then transmit the combat information to the supported commander or adjacent units. Ground reconnaissance and LAR units should deploy unattended sensors or unmanned platforms to project false electromagnetic signatures in order to "cause an adversary to form inaccurate impressions about our actions and intentions."[20] Ground and vehicle-borne advanced, networked, multi-function electronic warfare capabilities should enable the detection and disruption or

spoofing of enemy communications in order to disrupt their movements. In the "battle of signatures," reconnaissance Marines conduct electronic warfare attacks and defense as non-kinetic means of battlespace shaping. This includes the ability to passively map networks and conduct electronic battle damage assessments. Data gained by reconnaissance units in this way is fed back to the radio battalion, where the data is exploited by signals intelligence Marines. Non-kinetic shaping stimulates the battlespace, finding and fixing the enemy, whereby reconnaissance units then finish the target with lethal kinetic means, such as unmanned loitering munitions.

In an increasingly contest maritime domain, afloat ground reconnaissance units will continue to execute visit, board, search, and seizure missions and subsurface warfare missions. UAS and UUV and their payloads should reduce risks to the Marines and provide timely and accurate target information. In the future operating environment, ground reconnaissance units can enable projecting power ashore by gaining proximity through clandestine insertion and extraction to gain or confirm information regarding the enemy's strength and disposition of not only the overt but that which adversaries may have concealed below other intelligence, surveillance, and reconnaissance system detection levels. With the commander's intent as their guide, ground reconnaissance units can use MUM-T to neutralize or coordinate the destruction of threats, as well as confirm the effects on target. Undetected small teams dispersed about a contested maritime domain, attacking or enabling the attack on critical vulnerabilities and high-value targets, such as mobile A2/AD systems, increases adversary friction and assists in protecting the naval integrated force.

## Conclusion

History is replete with examples of reconnaissance as "vitally important to a commander's mission success" for both friendly and enemy forces.[21] Failing to properly reconnoiter an enemy force and thwart his efforts increases his foreknowledge, increases friendly force friction, and enables the enemy to dictate tempo.[22] Winning the reconnaissance and counter-reconnaissance fight to uncover and exploit the enemy's critical vulnerabilities as well as protecting our own is paramount for mission success in the future operating environment. The advanced technologies in unmanned teaming and cognitive artificial intelligence discussed above should assist these units in successfully protecting our forces and intentions, denying the enemy the ability to collect, corrupting his assessment, and systematically sensing operational and information environments for supported commanders. Furthermore, MUM-T will more accurately and more rapidly provide supported commanders with better foreknowledge and reduce that which we must trust to luck and talent.

**Notes**

1. Department of Defense, *Joint Publication 1-02, Dictionary of Military and Associated Terms*, (Washington, DC: 8 November 2010).

2. United States Marine Corps, *Counter Reconnaissance Concept Draft,* Marine Corps Warfighting Laboratory, (Quantico, VA: 7 February 2018).

3. Ibid.

4. United States Marine Corps, *The Marine Corps Operating Concept (MOC): How an Expeditionary Force Operates in the 21st Century*, (Washington, DC: September 2016).

5. United States Marine Corps, *Concepts and Programs*, (Quantico, VA: 25 April 2017), available at https://marinecorpsconceptsandprograms.com.

6. United States Marine Corps, *USMC Ground Combat and Tactical Vehicle Strategy*, Marine Corps Combat Development Command, (Quantico, VA: 1 December 2017).

7. Ibid.

8. Ibid.

9. Ibid.

10. Ground reconnaissance is the act of collecting information that strictly involves routes, areas, zones, and the enemy.

11. Engineer reconnaissance is the act of collecting information of an area and can provide detailed reporting on lines of communications, i.e., roads, rivers, railroad lines, bridges, and obstacles to maneuver.

12. Surveillance is the systematic observation of aerospace, cyberspace, surface or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means.

13. Vehicle security is providing local security for the vehicle while in static positions and when maneuvering, including counter-IED.

14. Mobility and counter-mobility is the act of clearing lines of communications from both manmade and natural obstacles while being able to make hasty obstacles to slow the enemy.

15. Controlling supporting arms is the ability to control direct (small arms and vehicle-mounted weapons) and indirect fires.

16. Cognitive artificial intelligence: While terminology associated with artificial intelligence is a subject of debate, for the purposes of this article, cognitive artificial intelligence refers to what is currently described as the third wave of artificial intelligence (AI) that

> enables contextual applications, wherein the AI constructs explanatory models for classes of real world phenomena, and reasons like a human. Cognitive AI is initially trained by humans, but once trained, operates with little to no supervision, learning on its own, based on evidence rather than rules.

This definition is pulled from the draft *Ground Combat Element Artificial Intelligence Strategy*. An example of the intended use would be the fusion of sensor input data (detect) that is run through a series of diagnostic and predictive tools (recognize) that then feeds a cue through a user interface to alert the user of a threat target within defined probability (identify).

17. United States Marine Corps, *MCDP 1, Warfighting*, (Quantico, VA: 20 June 1997).

18. *The Marine Corps Operating Concept.*

19. Ibid.

20. Ibid.

21. *Counter Reconnaissance Concept Draft.*

22. *MCDP 1, Warfighting.*