

Passive Radio Frequency Identification

Enhanced expeditionary logistics, answering the call to modernize for tomorrow's fight

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Need for Change

In 2019, Gen David H. Berger, the 38th Commandant, published the *Commandant's Planning Guidance* (CPG) to provide his strategic direction for the Marine Corps in support of the President's 2018 *National Defense Strategy* and the Secretary of Defense's *Defense Planning Guidance*. The CPG serves as an authoritative and strategic roadmap, which details the "Commandant's Intent" for the next four years. Gen Berger concurs with his predecessor's (Gen Robert B. Neller) observation: "The Marine Corps is not organized, trained, equipped, or postured to meet the demands of the rapidly-evolving future operating environment."¹

Gen Berger intends to effect changes to meet the "demands of the Naval Fleet in executing current and emerging operational naval concepts."² One of the changes is developing the Marine Corps' capability to conduct distributed operations (DO). According to the CPG, the Marine Corps must develop DO capabilities to succeed in missions against distant and distributed adversaries, enhance maneuverability to obtain positional advantages during assaults and engagements, protect forces by reducing the effects of enemy fire, inflict battlefield chaos and casualties upon the enemy, and reduce force signature to mitigate or avoid detection.³

To support DO, the Marine Corps will need to develop, test, and refine diversified and distributed logistics capabilities. The Marine Corps must leverage available technologies, processes, and systems to enhance the logistics enterprise, especially in the expeditionary environment. These solutions incorporate technologies, which include passive radio frequency identification (pRFID), among others, to modernize logistics in support of the warfighter.

Headquarters Marine Corps, Logistics Plans, Policy, and Strategic Mobility Division (HQMC/LP), published the final version of *Sustaining the Force in the 21st Century*, which supports the CPG. This functional concept outlines four lines of effort (LOE): Enable Global Logistics Awareness, Diversify Distribution, Improve Sustainment, and Optimize Installations.

The Enable Global Logistics Awareness LOE lays the foundation for leveraging future data-driven operating environments to rapidly gain and maintain situational awareness. We must leverage available joint force resources and those within the area of operations. We need the capability to assess friendly force posture and accurately identify warfighter requirements in all stages of operation. These actions will allow us to develop mature technologies to maximize our responsiveness to force demands.

The Diversify Distribution LOE directs Marine Corps planning and action to capitalize on both legacy and emerging distribution capabilities supporting geographically dispersed forces in multiple warfighting domains. We must support these forces whenever DO are either impractical or inhibited, acknowledging that massed sustainment becomes a vulnerability in DO (e.g., expeditionary advanced base operations: EABO). Improvements within

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this LOE should result in distribution methods that maximize the MAGTF speed, agility, and reliability.

Background

For nearly 30 years, the DOD has successfully employed available 20th century technologies to execute complicated global logistics efforts in support of force deployment, redeployment, sustainment, and retrograde operations, from Operations DESERT SHIELD and DESERT STORM to efforts in Iraq and Afghanistan. The DOD invested in rapidly developed logistics technologies with capabilities to enhance the logistics enterprise. However, not all of the tech-

set visibility (AV) negatively. Inaccuracies in asset technical data, poor data standardization across several logistics databases, and complex data mining requirements exacerbates the problem of obtaining accurate AV. These issues result in a unit's or commander's inability to locate cargo and supplies in order to close the force effectively and efficiently.

Beyond DOD efforts, Marine Corps logistics communities searched for ways to improve AV throughout the supply chain with mixed results. These communities focused their efforts on capturing key asset attributes and information while in-transit, in-processing,

the Pacific," integrating command and control technology with supply and distribution operations during amphibious and prepositioning operations is critical. The Marine Corps needs a common operational picture to support strategic and tactical AV.

The DOD AIT Implementation Plan for Supply and Distribution Operations (March 2008) targeted supply and DO in its attempt to provide an enhanced AV posture and improve materiel chain of custody throughout the logistics supply and distribution chains. This plan directed the implementation of pRFID tags at the wholesale level (Defense Logistics Agency) and the installation of pRFID readers at distribution nodes (installation Distribution Management Offices). The Marine Corps used pRFID readers (installed at various installations) to track Defense Logistics Agency-shipped materiel, enhance the transportation receiving process, and provide automatic supply receipts. While the plan called for a designed approach using incremental and phased implementation, non-existent unit participation combined with contractor renewal complications and a low return on investment caused the Marine Corps to discontinue Service participation. Therefore, the Marine Corps began to explore other pRFID technologies to produce a better return on investment. Unfortunately, those efforts did not align to the scope of the *DOD AIT pRFID Implementation Plan*.

As part of the Marines Corps' expanded look at pRFID technology, two separate pRFID projects were developed. These projects specifically focused on yard management and AV. From these projects, the reported successes prompted an analysis by the Marine Corps' Transportation and Distribution Operational Advisory Group. The ITV Working Group assessed pRFID-related processes and associated costs. The initial analysis necessitated investigation into the gaps between system-to-system interfaces and functional areas where the pRFID technology employed by the two systems provided a bridge for the entire Marine Corps logistics enterprise. The Marine Corps relies on multiple data systems and manual



The vehicle is being tracked using a radio frequency identification tag. (Photo by LCpl Lydia Davey.)

nologies aligned to future operational and infrastructure requirements. The DOD introduced cargo and personnel visibility processes, capabilities, and technologies (e.g., automatic identification technology [AIT] and automated information systems) to improve tracking and tracing of military equipment, cargo, and personnel throughout the distribution and supply chains, from unit home stations and industry, to storage in distribution locations, and through the Defense Transportation System to theater-deployed units. Yet, a lack of data standardization, accuracy, and availability continues to affect as-

in-maintenance, and in-storage, thus enhancing the capability to provide end-to-end visibility of logistics materiel.

The Marine Corps developed capabilities in active radio frequency identification (aRFID), in-transit visibility (ITV), and pRFID infrastructure. These capabilities focused on landbased operations and did not adequately support tactical distribution AV during seabased contingencies: multi-nodal ship-to-shore arrival and assembly, shorebased reception and staging, onward movement, and integration operations. With the Navy and Marine Corps incorporating EABO in its "pivot to

procedures to capture the daily status of assets and on-hand balance records for visibility purposes. These systems and manual procedures are prone to duplicative efforts. Further, there is a risk in degraded AV data quality because of multiple manual processes compared to a single, automated solution.

Many deployment and distribution systems do not interface with GCSS-MC, resulting in a “swivel chair” environment where logisticians attempt to obtain ITV across the supply chain. Ineffective and inefficient data transfers contribute to Service-level AV limitations. Efforts are underway to create data exchanges between deployment and distribution systems that do not automatically share information in order to help the Marine Corps logistics enterprise to keep pace with the speed of operations in EABO environments. Using RFID technologies will bridge this gap, provide enhanced accuracy and integrity into logistics data, and help support force closure during EABO operations.

RFID Technologies and Trade-Offs

How does RFID technology bridge the gap in logistics capabilities? The following provides a quick summary of RFID components and capabilities to enhance logistics processes. RFID transmits encoded tag data via radio waves to readers and associated computer databases. This data provides foundational elements for automated reports and information to assist units with making timely and informed decisions. RFID tags are equipped with antennae for receiving and transmitting signals. These tags also contain microchips for data storage, receipt, and transmission. RFID readers communicate with these tags through sequential and accelerated data transmissions within the range of each reader.

Reading devices contain antennae to send signals to pRFID tags via radio waves. These radio wave pRFID tag antennae provide power to the tag’s microchip. Passive RFID tags are typically small, lightweight, and users can apply them to multiple surfaces. The tags are designed to provide precise location information (within centimeters) as well as asset details like temperature,

humidity, and pressure. The microchip transmits the asset’s unique data identifier to the reader’s antenna. Software or applications on computing devices (laptop, tablet, or other device) connected to the reader stores the data locally in servers or databases. Because the pRFID tags do not supply their own power, they are less expensive than aRFID components. In deployed environments, handheld RFID readers make the inexpensive pRFID tags an attractive option because of reduced fixed infrastructure (aRFID) costs.

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Active RFID tags contain their own power source; they do not require a reader’s radio frequency signal to transmit data. Active RFID tags are typically larger and much more expensive than pRFID tags. Active RFID tags can also be “data rich,” meaning data can be stored directly on the tag versus relying on databases to determine associated tag data. Additionally, aRFID tags have a longer communication range with a reader, which increases efficiency of gathering data.

There are trade-offs with each type of tag: size, range, cost, and capability. Combining passive and active RFID technologies will create greater efficiencies and data accuracy. Each technology provides advantages and disadvantages; however, combining these capabilities will improve the Marine Corps’ ability to deliver the right materiel, at the right place, at the right time, and in the right condition. If used together, AV and ITV capabilities could dramatically improve throughout the Marine Corps logistics chain.

RFID Lessons Learned

Despite the Marine Corps’ efforts, significant AV limitations remain. Service-level AV limitations include the following: ineffective and inefficient data capture, lack of AV throughout the supply chain, and the inability to

create an enterprise dashboard to display pertinent logistics data. AV data is only shared and contributed from selected functional areas and is not available in actionable formats. Furthermore, antiquated, landbased aRFID enterprise solutions do not support EABO, one of the concepts in support of DO. To improve and enhance AV capabilities, the Marine Corps must modify its current protocols and business processes. Data is required from all functional logistics areas to provide tailorable displays for

specific expeditionary requirements.

AV and ITV data significantly contributes to the overall logistics mission. It is critical for the data to reside within an integrated system architecture so that users may access and share it across the logistics spectrum of the MAGTF. The goal of these Marine Corps’ RFID efforts is to produce scalable and improved AV/ITV capabilities based on commercial technologies while conforming to DOD-mandated standards.

Looking Ahead: Testing and Employing RFID Capabilities

The Marine Corps seeks to provide the Fleet Marine Forces with fully networked, interoperable, end-to-end AV across strategic, operational, and tactical operations. This goal effectively supports distributed logistics operations on a large scale: distribution and transportation maritime and ashore reception, staging, and onward movement and integration. Active and passive RFID technologies enhance the operational commander’s ability to make timely decisions by providing accurate, realtime logistics information to make operational and tactical decisions faster than our adversaries observe-orient-decide-act loop.

To mitigate AV/ITV gaps, the Marine Corps is using a phased approach to implement pRFID across the Marine Corps supply chain. The Marine Corps

will enhance and facilitate the application of these technologies using lessons learned from Blount Island Command's utilization of pRFID for the Maritime Prepositioning Force Program.

To accomplish the Marine Corps' AV/ITV goals, and as a means of closing some of the aforementioned gaps, HQMC/LPD is executing a pRFID Proof of Principle (PoP) at Combat Logistics Regiment 15 (CLR-15) onboard Marine Corps Base Camp Pendleton, CA. The pRFID PoP analysis includes the end-to-end visibility of assets—meaning from acquisition to point of employment, including in-transit, in-processing, in-maintenance, and in-storage information—in order to achieve a seamless and effective MAGTF logistics supply chain. The PoP intends to highlight pRFID capabilities in support of enhanced force closure.

The equipment selected for tagging during the CLR-15 pRFID PoP includes organic vehicles in a local motor pool (to demonstrate speed-to-count and accuracy during inventories), vehicles undergoing maintenance (to track exactly where something is during a sometimes-lengthy maintenance cycle), howitzers, and a few selected repair parts (to demonstrate the physical availability of “fast mover” parts on the shelf). Marines will tag, track, and report the items during the PoP, which continues through this year and into 2020. The Marine Corps expects the pRFID PoP to deliver the following benefits:

- Integrate near-realtime and multi-dimensional view of logistics throughout the battlespace and logistics pipeline.
- Inform the integration of systems to eventually eliminate the “stove-piped” information systems from logistics communities (distribution, maintenance, and supply) and provide worldwide, authorized access to shared data.
- Develop interoperable, portable, and scalable AV/ITV capabilities in expeditionary logistics environments through common hardware suites.
- Encourage standardized processes for pRFID tag creation and placement for identified military equipment with pRFID tags, from acquisition to disposal.

- Create one repository for pRFID tag-to-asset relationship, logistics data interfaces, and system-to-system transactions versus multiple system interfaces.
- Facilitate realtime data analysis and process improvement.
- Reduce costs and mitigate gaps associated with AV over the materiel lifecycles.
- Support automated data quality assurance for tagged items, improve asset accountability, and increase inventory accuracy.
- Improves planning with more accurate and easily accessible equipment inventories.
- Minimize expensive and less reliable AIT options.
- Support joint deployment and distribution enterprise logistics framework transition to pRFID capabilities.

... our integration and modernization efforts will reduce man-hours and costs ...

In addition to the pRFID PoP at CLR-15, the pRFID PoP team and I MEF are in the process of tagging military equipment for tracking and tracing as part of the upcoming NATIVE FURY exercise. The purpose of the exercise is to enable military personnel to move large equipment such as tanks, HMMWVs, other vehicles, and supplies from ship to shore. During the exercise, Marines will test current pRFID capabilities to help inform processes, applications, and technologies used in expeditionary environments and across the Marine Corps logistics enterprise. This will help the Marine Corps improve our ability to deploy forces rapidly across the globe. Furthermore, NATIVE FURY will help to develop trained, interoperable forces for combatant commanders.

In coordination with related efforts, Marines are integrating and testing RFID technologies within the logistics enterprise in order to enhance global lo-

gistics awareness and diversify logistics operations to support missions against 21st century adversaries. Previous and current efforts are helping to organize, train, and equip Marine logistics units with upgraded technologies that will keep pace with the speed of EABO and DO. Marine logisticians are acquiring and training with digital and wireless capabilities to help deliver supplies and services to the forward edge of the battlefield.

As the Marine Corps implements strategic guidance outlined in the *National Defense Strategy*, the *Defense Planning Guidance*, the CPG, and the *Sustaining the Force in the 21st Century*, we will leverage pRFID and other technologies to ensure Marines will be trained and equipped to deliver supplies and services across the battlespace. The Marine Corps' logistics communities will reap the benefits by integrating realtime and multi-dimensional logistics data into our planning process. Thus, we will reduce our reliance on more expensive and less reliable AIT/automated information systems options. Ultimately, our integration and modernization efforts will reduce man-hours and costs while enhancing property accountability, informing critical decision making, and improving management of mission essential assets. These enhancements will allow Marines to focus on warfighting tasks rather than waste valuable time on antiquated tracking and tracing processes. With ongoing efforts toward force transformation in support of DO and EABO, we must modernize our current business processes. When successful, our efforts will increase the lethality of our warfighters as they face the formidable logistics challenges posed by any of our 21st century adversaries.

Notes

1. Gen David H. Berger, *38th Commandant's Planning Guidance*, (Washington, DC: July 2019).
2. Ibid.
3. Ibid.

