Marine Corps Groundbased Air Defense

Layered air defense to reduce risk to stand-in forces

by Col David P. Lobik (Ret)

History

Since the Korean War, U.S. ground forces have operated with nearly total air supremacy in every conflict. The collapse of the Soviet Union and ongoing counterterrorism and counterinsurgency operations have led U.S. forces to take air supremacy for granted. U.S. ground units' tactics, techniques, and procedures designed to mitigate enemy air operations through passive defensive measures, such as signature management, have atrophied or have been lost altogether as the greatest air threats facing Marines were limited to rockets and mortars. Marine units, without the layered air defenses employed by the Army, are particularly at risk. After decades of operating without enemy air threats, the Marine Corps has had little incentive to invest in air defense systems or train to operate under contested or hostile airspace—until now. In addition to ballistic and cruise missiles, low-cost, prolific, and highly effective unmanned aerial systems (UAS) are changing the character of air warfare. The Marine Corps recognizes the need to adapt to this new reality by acquiring air defense systems capable of engaging a range of aerial threats and modifying long-standing tactics, techniques, and procedures to increase unit survivability from aerial attacks. No longer can joint and Service air superiority be taken for granted, nor can it be assumed that friendly air protection will be adequate. In future fights, the air domain will be contested at best and hostile at worst. Units must have capable anti-aircraft, anti-missile, and counter-unmanned aircraft system (C-UAS) weaponry and the competence to operate them effectively.

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Light MADIS. *(Photo by LCpl Jessica Foraker.)*

To that end, the Marine Corps must prioritize and sustain investments in modern, rugged, and sophisticated air defense and command and control (C2) capabilities required to operate effectively inside the adversary weapons engagement zone and to protect our forces. If installations, including host nation installations, and forward deployed forces are unable to persist inside the weapons engagement zone, they will be irrelevant, or worse, a liability. The joint force is witnessing the emergence of a new era of UAS, cruise missile, and anti-air warfare and must possess the capabilities required to mitigate those threats. Air and missile defense capabilities are vital for a stand-in force to be successful in any area of responsibility.

Until recently, precision fires were not related to small UAS (sUAS). As drone and sUAS technology proliferated, it has become apparent that C-UAS development is critical to "address the rapidly evolving challenge for U.S. forces at home and abroad."[1]

The Commandant of the Marine Corps recognizes the disparity between the threat and Marine Corps capabilities, providing clear direction in his planning guidance:

> We must accept the realities created by the proliferation of precision long-range fires, mines, and other smart-weapons, and seek innovative ways to overcome those threat capabilities. Our forces currently forward-deployed lack the requisite capabilities to deter our adversaries and persist in a contested space to facilitate sea denial.

The GBAD Program

By the fall of 2018, the growing complexity and increasing number of groundbased air defense (GBAD) requirements proved to be the catalyst for the activation of a separate program office. As a result, the GBAD Program Office stood up under the leadership of a very experienced acquisition professional team and was welcomed by all Marine Corps stakeholders and collaborators from Headquarters Marine Corps and other senior staffs who supported its initiation.

Like the Ground/Air Task-Oriented Radar and Air C2 and Sensor Netting programs, the new GBAD Program Office is subordinate to Program Executive Officer Land Systems. The GBAD Program may be one of the Department's most complex acquisition programs as the majority of GBAD systems were developed and are still under Urgent Needs Statement processes. Moreover, the GBAD Program Office faces broad and complex integration challenges. While other acquisition programs are often described as a family of individual systems, the GBAD Program Office is a Family of Programs, each comprised of multiple efforts. Every GBAD program meets a specific operational requirement, often with unique funding, and requires collaboration, planning, information sharing, and integration of the efforts of joint, Marine Corps, Department of the Navy, DOD, Congressional, and other key stakeholders to meet the requirements of the Marine Corps and the joint force.

The GBAD Program Office is organized into three Product Teams, each led by an individual Product Manager (PdM), with responsibility for multiple systems. The three teams/PdMs are Future Weapons Systems (FWS), Fixed-Site C-UAS, and Advanced Man-Portable Air Defense System (A-MANPADS)/Medium Range Intercept Capability (MRIC).

MRIC Launch. *(Photo provided by author.)*

PdM FWS

The GBAD FWS Product Team will modernize Low Altitude Air Defense Battalions (LAAD Bns) by providing increased capability and lethality to meet evolving and future threats. Supporting a Joint Urgent Operational Need, two mobile systems, Light-Marine Air Defense Integrated System (L-MADIS), and MADIS Increment (Inc) 0/0.1, it evolved in 2017 to address the emergent UAS threat.

L-MADIS is a C-sUAS electronic attack system mounted on a Polaris MRZR all-terrain vehicle. It features a 360-degree radar, radio frequency jammer, and electro-optic infrared sensor. Media reports have credited the L-MADIS with downing an Iranian drone that flew in the close vicinity to the amphibious assault ship USS *Boxer* in July 2019. L-MADIS was recently designated an Acquisition Category IV/T program under PM GBAD and will deliver a significantly upgraded capability leveraged from the Urgent Need system initially deployed in 2017.

MADIS Inc 0 is mounted on a Mine Resistant Ambush Protected All-Terrain Vehicles (M-ATV). It also features a 360-degree radar, radio frequency jammer, electro-optic infrared sensor, and a Common Remotely Operated Weapon Station with an integrated mini-gun direct fire weapon. It demonstrated the first on-the-move detect, track, identify, and defeat capability on a medium tactical vehicle. MADIS Inc 0.1 C-UAS suite is mounted on an M-ATV as well with improved capability of the MADIS Inc 0, such as upgraded sensors and air defense C2 software via the Forward Area Air Defense and Counter Rocket and MortarC2. MADIS 0 and 0.1 are no longer in service and are currently being phased out.

MADIS Inc 1.0 is the Marine Corps' Acquisition Category II program that features a complete C-UAS kill chain capability that is based on the lessons learned from the Inc 0/0.1 systems. With the Joint Light Tactical Vehicle as the platform, the system will provide the Marines with an additional level of force protection and enhanced C-UAS capability. The MADIS Inc 1.0 is comprised of two vehicles, the Mk1 and Mk2, which form a complementary pair and will be the basic building blocks of the LAAD Battalions' GBAD capability.

- MADIS Mk1 includes a turret-launched Stinger missile, multi-functional electronic warfare capability, direct-fire weapons, Electro-Optical Infra-Red (EO/IR) optic, and a shoulder-fired Stinger missile for dismounted operations.

MADIS Mk2 (C-UAS variant) includes a multi-function electronic-warfare capability, 360-degree radar, direct-fire

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weapons, EO/IR optic, and a supporting C2 communications suite.

PdM Fixed-Site C-UAS

Protection of Marines at forward operating bases from UAS incursions has been the focus of the GBAD Program Office during the past three years. PM GBAD has deployed and sustained a fixed-site MADIS capability to various parts of the world with success. These deployed capabilities support not just Marines but also joint forces and include the following systems:

- Expeditionary Marine Air Defense Integrated System for dismounted and fixed-site operations.
- Compact Laser Weapon System provides a directed energy C-sUAS capability in defense of forward deployed, fixed-site operations.

Addressing Continental United States (CONUS) and Overseas CONUS (OCONUS) facilities, traditional base and station planning, as well as the execution processes, make Deputy Commandant, Installations and Logistics and Commanding General, Marine Corps Installations Command's infrastructure, funding, sustainment, training, and employment responsibilities quite challenging. To support these goals, PM GBAD is prototyping various Installation C-sUAS systems that will meet the requirements to protect critical assets. These systems of systems are modular and scalable components that will detect, track, identify, and deliver kinetic and non-kinetic C-UAS capabilities to defeat the full spectrum of low-altitude and low-observable threats to MAGTF commander's vital areas and Marine Corps CONUS and OCONUS Critical Infrastructure.

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PdM A-MANPADS and MRIC

The Marine Corps' currently fielded A-MANPADS is a mobile, Stinger missile-based low altitude surface-to-air weapons system designed to provide close-in, short-range air defense. A-MANPADS consists of a Fire Unit Vehicle, a Section Leader Vehicle, and the Stinger missile as the primary weapon system. The Fire Unit Vehicle is the mobile firing component of the GBAD system, with the capability to transport

MADIS Inc 1. *(Photo provided by author.)*

Stinger missiles and possessing a turret-mounted M-240B or M2 machinegun. The Section Leader Vehicle manages the C2 system that links this capability to the Marine Air Command and Control System. These systems will incrementally "sunset" as their Rotary Wing/Fixed Wing defeat capability integrates into MADIS Inc 1.0 and begins fielding to the LAAD Marines.

The MRIC is in the prototype phase. The MRIC system currently integrates existing Marine Corps capabilities, specifically the Ground/Air Task-Oriented Radar and components of the Common Aviation Command and Control System Air C2 and Sensor Netting with the Israeli Iron Dome's mini-Battle Management and Control and Tamir missile. As stated in a recently released media report:

> The MRIC is a missile system which detects, tracks, identifies and defeats enemy cruise missile threats and other manned and unmanned aerial threats ... It is planned to provide ground based air defense for permanently fixed and operationally fixed sites.

Following its initial demonstration in 2019, senior Marine Corps leadership deemed the event highly successful and the GBAD Program Manager was given the authorization to proceed to the next phase, which was planned to reduce the MRIC footprint, enhance radar capabilities, and provide greater mobility. Recently, MRIC successfully conducted live-fire testing at White Sands Missile Range against multiple relevant cruise missile profiles that stressed the capability of the MRIC system with successful live fire engagements. Additional live fire testing is planned during the remainder of Fiscal Year 2022. Pending results, the Marine Corps will decide whether to potentially certify the prototype for deployment or establish an MRIC program of record with the intent of fielding MRIC batteries in support of force design requirements.

To stay relevant in today's contested environment, a new approach to acquisitions will require a paradigm shift for the Program Office and Industry. Instead of a classical major acquisition program approach using an Industry prime contractor to integrate capabilities, GBAD technology must outpace the threat by aggressively upgrading major component performance over time. Sensor performance, signature management, communications suites, utilities, software, C2, size, weight, power, interoperability, reliability, maintainability, energetics, and more will require continuous, rapid improvement as this capability is fielded to the FMF. Components and subsystems, rather than the major system, will be the primary contributors to advancing capability against threats, evolving to stay ahead of adversary technology and abreast of interoperability requirements of the joint force. Components will be the critical enablers and must have high Technology Readiness Levels, be easily integrated and adapted, and have validated technical performance achieved through agile testing and evaluation processes. These combined, focused efforts will bring the Marine Corps GBAD capabilities well into the 21st century.

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Notes

1. Department of Defense, *DOD Counter-Small Unmanned Aircraft Systems Strategy*, (Washington, DC: January 2021).