Every ACV a Sensor

Influencing future operations

by LtCol Lynn Berendsen

The amphibious combat vehicle (ACV), the Marine Corps' number one ground acquisitions program, will be the primary combat vehicle providing protected mobility to Marine infantry from ship-to-shore in a single lift with all their combat equipment. This mechanized infantry unit will have the ability to gain access to a hostile beach while providing speed, mobility, armor protected fire power, and enhanced communications as they seize inland objectives. Whether landing on hostile beaches, patrolling in the littorals, securing expeditionary airfields, conducting stability operations in urban areas, or defeating enemy mechanized forces, Marines in ACVs will be at points of influence in future operations. The proximity to the decisive point on the battlefield makes the ACV an ideal platform to integrate current and future combat sensors to increase the MAGTF's situational awareness and make the infantry more lethal. The Marine Corps should consider "every ACV a sensor" in the same vein as it embraced "every Marine a collector,"

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and work to outfit the ACV with current and emerging sensor technologies. This article provides a brief explanation of the ACV's current capabilities and examines potential sensor uses now and in the future.

The Marine Corps' primary self-deploying, armored personnel carrier and amphibious surface assault vehicle for the last 40-plus years has been the AAV. The Expeditionary Fighting Vehicle (EFV), an armored amphibious personnel carrier capable of traveling on the water at high speeds, was the planned replacement for the AAV. For many reasons, the EFV program was canceled in 2011 with the Marine Corps deciding to pursue efforts on two alternate fronts.

The first avenue was an effort to upgrade current AAVs to the AAV Survivability Upgrade (AAV SU), protecting the vehicle and Marines in the back against underbody blasts. This added considerable weight and consequently required several additional upgrades which included a new engine, transmission, and armor. The AAV SU was designed to be the primary amphibious surface assault vehicle capable of conducting forcible entry onto hostile beaches from U.S. Naval shipping and would be deployed with MEUs. The second effort was to pursue a wheeled armored personnel carrier optimized for land operations, capable of swimming from shore-to-shore objectives, but requiring little to no technology development. This vehicle was originally envisioned to replace some of the aging AAVs until the Marine Corps could develop an armored personnel carrier capable of providing enhanced land mobility and protection while capable of conducting ship-to-shore, forcible entry operations.

In the spring of 2018, the Marine Corps selected a wheeled vehicle that met land-based requirements for the armored personnel carrier and surpassed the expected swim capabilities, demonstrating the ability to conduct ship-to-shore operations. Since the ACV demonstrated the ability to conduct ship-to-shore forcible entry operations, the need for the AAV SU was called into question. With the success of the ACV, and facing increasing pressure to not invest in legacy systems, the AAV SU was canceled in the fall of 2018. The ACV continues to be a highly capable combat vehicle and is expected to begin fielding to the Operating Forces in FY 2021.

The ACV is an eight wheeled vehicle, operated by a crew of three, and capable of carrying thirteen Marines. It has land mobility equal to, and in some cases better than the M1A1 tank, while the

The ACV is the Marine Corps' primary ground acquisition program. *(USMC photo.)*

wheels allow it to operate effectively in urban areas. It has water mobility similar to that of the current AAV and is capable of conducting ship-to-shore operations of twelve nautical miles and then move to objectives inland without the need to refuel. The ACV comes with a remote weapons system capable of mounting a M2 .50 Cal or a MK-19 and can engage targets at maximum effective ranges while on the move. The ACV was optimized to provide the vehicle and its occupants protection and survivability in an environment where mines and improvised explosive devices are prevalent. This is achieved with several design features including the shape of vehicle's hull as well as individual blast mitigating seats for each occupant.

The ACV personnel carrier (ACV-P) will be augmented with mission role variants providing enhanced maintenance/recovery, communications, and lethality. The maintenance/recovery variant (ACV-R) will replace the AAVR[7] and include an enhanced maintenance capability to amphibious assault companies and battalions. The command and control variant (ACV-C) will provide infantry battalions, regiments, or divisions mobile command posts with modern communications. A 30mm lethality upgrade will be applied to a sub-set of the ACV-P. The ACV-30 will provide a medium caliber cannon capable of delivering longer range fires with air burst munitions in support of the infantry's scheme of maneuver.

The ACV still has some major milestones to complete before fielding and, in its current configurations, is well suited to accomplish its designed mission. Testing and fielding of the current version of the ACV should not be delayed in an attempt to add additional sensor capabilities. Douglas Macgregor and Stephen N. Burke stated in an article about the ACV's predecessor:

> The American taxpayer can neither afford nor does he need gold-plated systems in the form of the Future Combat Systems, Expeditionary Fighting Vehicle or other major programs that suffered from undisciplined requirements and optimistic acquisition strategies. What works now must triumph over 'unobtainium,' the elusive technological silver bullet that never seems to arrive in time or on budget.[1]

It is with this observation in mind that the following future capabilities are discussed:

An immediate advanced capability that should be considered for the ACV is the Marine Air Defense Integrated System (MADIS) that is designed to provide a missile variant for air defense and a direct fire weapon variant for counter-UAS (CUAS). The Marine Corps plans to use the joint light tactical vehicle (JLTV), the HMMWV replacement, as the platform for carrying the MADIS. The MADIS system will be networked with other battlefield platforms to enhance situational awareness and ground based air defense (GBAD) coverage. There are two challenges with using the JLTV as the carrier of the MADIS. First, the JLTV was not designed to carry the weight of the MADIS system and its ammunitions nor to provide the power required to operate the system. This makes MADIS integration on the JLTV challenging and does not account for any future growth of either system. Second, when mounted on a JLTV, it will be challenging to provide the air defense and CUAS protections that MADIS provides during the initial waves of an amphibious landing. The ACV provides possible solutions to both these challenges. The ACV has built with size, weight, and power (SWaP) capabilities that can easily support the requirement for MADIS and mounting this networked sensor system on a self-deploying amphibian ensures MAGTF units have GBAD coverage in the first wave of any operation.

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The Communication Emitter Sensing and Attacking System (CESAS) II is an electronic warfare system mounted on the HMMWV, LAV, and planned for the JLTV. CESAS provides the ability to locate and jam enemy transmissions in the UHF and VHF spectrums while allowing friendly forces to continue to communicate. If an asset like CESAS was added to the ACV, it will allow for increased offensive capability in multi-domain warfare and enhance the first waves' flexibility and responsiveness while combat power is built up ashore. This concept was successfully experimented with the AAV, making it feasible for ACVs to serve as a platform for this sensor suite.

Other sensor capabilities that were already experimented with on the current AAV that could readily transfer to the ACV are small UAS (SUAS). These systems are designed for landbased and maritime operations. Capable of landing in the water or on land, they empower operators with an operational flexibility only recently available in the small UAS class. The addition of an asset like SUAS to the ACV will allow for rapid reconnaissance and increased depth of vision, aerial inspection, and target acquisition in support of embarked infantry forces. When integrated with digital mobile technology like Joint Battle Command-Platform and tactical tablets, a SUAS equipped ACV can significantly enhance the infantry's understanding of the environment, ability to rapidly target threats, and adjust to changes using realtime information.

The ACV should be considered as a host for Low-Cost UAS Swarming Technology (LOCUST) as these technologies develop. This capability was also demonstrated on AAVs. 2d AAV Battalion launched a UAS from an amphibious ship that was controlled by an AAV crewmember trained to operate the sensor. The UAS provided the platoon realtime situational awareness as they swam to the beach. Using the ACV as the LOCUST host will aid the Marines in the first wave of an amphibious landing to build situational awareness and striking targets as they transition ashore in their ACVs. Increasing the sensing capability of the first wave makes the ACV infantry team incredibly lethal and survivable.

Technology exists that could make every ACV a radio frequency (RF) sensor, providing Marines the ability to better manage their own electronic signature and detect enemy electronic emissions to enhance the landing force's survivability on the modern battlefield. A Defense Advanced Research Projects Agency (DARPA) venture

> advanced RF Mapping (RadioMap) program seeks to provide realtime awareness of radio spectrum use across frequency, geography, and time. The goal is to provide a map that gives an accurate picture of spectrum use in complex environments.[2]

RadioMap uses radios that are already part of a unit's equipment set to detect data and voice RF transmissions. According to DARPA, the intent is for RadioMap "to use the capabilities of modern radios to sense the spectrum when they are not communicating."[3]

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The Marine Corps plans to use the RadioMap program to assist small tactical units such as platoons or companies that rarely carry equipment for monitoring radio emissions. With RadioMap, the radios already carried by these units would do double duty to inform the troops about nearby threats and opportunities that are visible in the RF spectrum.[4]

The ACV equipped mechanized rifle company will potentially be dispersed over a large area with multiple radios in each vehicle capable of sensing in the spectrum. This makes the ACV an ideal platform for employment of RadioMap.

Recently, the Marine Corps has shown an increased interest in loitering munitions. These are essentially UAS with the capacity to act as sensors, identify a threat, and then provide a lethal strike. The lethality payloads could come in various sizes and have the potential to destroy personnel, material, and mechanized vehicles. A recent *Marine Corps Times* article described one of these loitering munitions, the Hero 120. It stated that the Hero 120 is

> air launched and features a Javelin multipurpose warhead, meaning a squad of Marines could dispatch the system to take out enemy troops or armored vehicles. The Hero 120 also has a flight time of one hour and a 40-km range, making it an attractive option to replace the cumbersome 120mm mortar system.[5]

Loitering munitions like Hero 120 have been experimented with and show promise for use by the GCE of the Marine Corps. The ACV with its additional SWaP is well-suited to host loitering munitions that provide sensor and strike support the GCE.

The ACV could also become the ideal platform for the future Wireless Electrical Energy Delivery System (WEEDS) designed to lessen the small unit's battery burden and extend the operating time of UAS. WEEDS is essentially a highly directional, long-range application of the wireless charging system for cell phones that has been available in Starbucks coffee shops for years. According to Jeff Muhs, the Army is experimenting with "transferring power between a vehicle seat back to a soldier-worn vest so that as warfighters sit in vehicles, their central battery can be recharging."[6] One near future application of WEEDS is to be able to beam electrical energy for a vehicle mounted power generating system to a UAS allowing for continuous charging of onboard batteries, extending its loitering time. WEEDS application for UAS can also free additional weight and space on board that could then be used for additional strike or surveillance payloads. As the Marine Corps pursues this technology, the ACV should be considered as a platform for this developing technology.

The ACV will provide the Marine Corps with an amphibious vehicle that can maneuver in the water like the current AAV, but will have increased protected mobility, firepower, and communications capabilities. The ACV will be the primary armored personnel carrier delivering Marines and direct fires to support the infantry commander's scheme of maneuver. With proximity to the decisive point on the battlefield, inherent maneuverability, and significant SWaP, the ACV is the ideal host for many current and future sensor systems. Integrating sensors onto the ACV will take time and a deliberate effort, but when completed, every vehicle would be a sensor, thereby making the MAGTF more adaptable and lethal.

Notes

1. Douglas Macgregor and Stephen N. Burke, "Defense Industry Can Profit Despite Downturn," *National Defense Magazine*, (Washington, DC: NDIA, August 2013).

2. Dr. Joseph B. Evans, "Advanced RF Mapping (Radio Map)," Defense Advanced Research Projects Agency, (Washington, DC: DARPA, August 2013).

3. Ibid.

4. Kimberly Underwood, "Mobile Spectrum Tool RadioMap Moves to the Marines," *SIGNAL Magazine*, (Online: August 2018), available at www.afcea.org.

5. Shawn Snow, "The Marine Corps Ditched the 120 mm Mortar, But This Might Replace It," *The Marine Corps Times,* (Arlington, VA: Michael Reinstein, September 2018).

6. Jeff Muhs, "Alleviating the Battlefield Battery Burden with Wireless Power," *Military Embedded Systems*, (Online: December 2013), available at www.mil-embedded.com.