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14. ABSTRACT
The Marine Corps' degraded training proficiency and inability to modernize the equipment required by landing forces has compromised the services ability to conduct the full range of amphibious missions. The Marine Corps currently faces two key, related decisions that will affect the relevance of the self-deploying amphibious capability well into the 21st century. The first is the Amphibious Assault Vehicle (AAV) Upgrade and the second is the decision to acquire its replacement, currently named the Amphibious Combat Vehicle (ACV). Both initiatives face challenges with funding and providing the appropriate capability at the right time. Effective and efficient manning, equipping, and training decisions are needed to ensure the self-deploying amphibian vehicle remains capable of supporting the range of amphibious missions.

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MASTER OF MILITARY STUDIES

THE MARINE CORPS' ABILITY TO CONDUCT SURFACE AMPHIBIOUS TRANSPORT IS AT RISK

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Executive Summary

Title: The Marine Corps' Ability to Conduct Surface Amphibious Transport is at Risk

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Thesis: The Marine Corps' degraded training proficiency and inability to modernize the equipment required by landing forces has compromised the services ability to conduct the full range of amphibious missions.

Discussion: The doctrine of the United States Marine Corps (USMC), strategic documents, and the rhetoric of its senior leaders remain committed to maintaining an amphibious capability. U.S. code Title X, identifies the legal requirement to conduct amphibious operations and maintain the equipment to accomplish the missions these operations encompass. This specialized set of missions requires equipment capable of transporting Marines and their personal fighting equipment through the harsh weather and corrosive conditions of the sea. The Marine Corps' self-deploying, tracked amphibious vehicle capability has degraded to the point that it jeopardizes the services ability to accomplish surface transport missions required to conduct the full range of amphibious operations.

The self-deploying amphibious vehicle is a unique capability unlike any other in the DOD and amphibious missions require unique equipment that must be developed by the Marine Corps. The self-deploying amphibious vehicle not only provides the Marine Corps the ability to accomplish its primary mission of amphibious operations, it also contributes to the larger role of joint forces. The capability provides benefits across the Range of Military Operations.

The Marine Corps currently faces two key, related decisions that will affect the relevance of the self-deploying amphibious capability well into the 21st century. The first is the AAV Upgrade and the second is the decision to acquire its replacement, currently named the Amphibious Combat Vehicle (ACV). Both initiatives face challenges with funding and providing the appropriate capability at the right time. Effective and efficient manning, equipping, and training decisions are needed to ensure the self-deploying amphibian vehicle remains capable of supporting the role of amphibious operations.

Conclusion: Maintaining and modernizing the self-deploying amphibian capability is fundamental to the Marine Corps ability to conduct amphibious operations today and in the future. In spite of fiscal and operational challenges, the Marine Corps must continue to support amphibious vehicle initiatives and increase training proficiency. If the service wavers from its commitment to modernize the AAV it will be unable to conduct the full range of amphibious missions and will not be "the most ready when the nation is the least".

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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INTRODUCTION

The doctrine of the United States Marine Corps (USMC) identifies the requirement to conduct amphibious operations and maintain the equipment to accomplish the missions these operations encompass. This specialized set of missions requires equipment capable of transporting Marines and their personal fighting equipment through the harsh weather and corrosive conditions of the sea. There is no externally levied requirement on the Marine Corps to possess a self-deploying amphibious vehicle. There is however, a legal requirement established in Title X U.S. Code, Section 5063. Title X states: "The Marine Corps shall develop, in coordination with the Army and the Air Force, those phases of amphibious operations that pertain to the tactics, technique, and equipment used by landing forces."[i] The Marine Corps' degraded training proficiency and inability to modernize the equipment required by landing forces has compromised the services ability to conduct the full range of amphibious operations.

The self-deploying, tracked amphibious vehicle has faced criticism since its inception.[ii] The focus of recent criticism is that the likelihood of needing this capability is not worth the cost of maintaining the equipment because large scale amphibious operations are unlikely in future conflict scenarios. In spite of these debates, Marine Corps doctrine, strategic documents, and the rhetoric of its senior leaders remain committed to maintaining an amphibious capability. The Marine Corps Service Campaign Plan 2012 – 2020 states, "Our role in the Department of Defense is clearly defined… Conduct amphibious operations, including engagement, crisis response, and power projection to assure access. The USMC has primary responsibility for development of amphibious doctrine, tactics, techniques, and equipment." [iii] Regardless of whether or not the Marine Corps conducts forcible entry amphibious operations, the need for a self-deploying, tracked amphibious vehicle has been validated numerous times over the past

three decades by military planners and its use in Operation DESERT STORM and Somalia. The capability provides amphibious, armor-protected mobility across a range of missions the cost of needing and not having it far outweighs the alternative.

Marine Corps doctrine, equipment acquisition plans, and the assurance after the cancellation of the Expeditionary Fighting Vehicle (EFV) have consistently reaffirmed the commitment to maintaining a self-deploying, tracked amphibious vehicle capability. The problem with these affirmations is they seem to ignore the current readiness challenges and have not resulted in modernization of the amphibious vehicle. The service-level commitment to maintain the amphibious vehicle capability is often conceptual and theory-based in the form of high-level documents. This is a problem because the very real lower-level readiness challenges have not been effectively addressed. A detailed analysis of the support provided to the only self-deploying, tracked amphibious vehicle in the Department of Defense (DOD), the Marine Corps Amphibious Assault Vehicle (AAV) model P7A1 Reliability Availability Maintainability/Rebuild to Standard (AAVP7A1 RAM/RS) demonstrates the rhetoric of the service is not consistent with its actions. The current AAV is rapidly becoming outdated and is not properly resourced. Manning, training, and equipping across the Marine Corps only three Assault Amphibian (AA) Battalions (2nd, 3rd, and 4th AA Bn) is not sufficient. The Marine Corps must take measurable and significant steps to correct the problems with the current AAV and its planned replacement, the Amphibious Combat Vehicle (ACV). This paper will highlight and reinforce the Marine Corps need for a self-deploying, tracked amphibious vehicle, identify current challenges to maintaining the capability, and address solutions to ensure the Corps maintains the sea-surface transport capability needed to successfully perform the full range of amphibious operations.

WHY DOES THE MARINE CORPS NEED A SELF-DEPLOYING, TRACKED AMPHIBIOUS VEHICLE

For the third time in the last 20 years, the most recent analysis regarding the equipment required by the Marine Corps to conduct amphibious operations, the ACV Analysis Of Alternatives (AOA), has validated the need for a self-deploying tracked amphibious vehicle.[iv] Since the law was established, the Marine Corps has determined through the most recent ACV and its predecessor AOAs that the equipment required to conduct the full range of amphibious operations is a self-deploying amphibious vehicle similar to the current AAVP7A1 RAM/RS and its planned replacement the ACV. Until the law changes or the mission is invalidated, there is a requirement to maintain a self-deploying amphibious vehicle.

It is important to highlight why the ACV AOA once again chose a self-deploying tracked, amphibious vehicle and readdress why it is needed and what capability it provides the Marine Corps and the overall joint force. A self-deploying amphibious vehicle is an essential capability required by Marine Corps operational employment concepts like Marine Corps Strategy 2025 and the recent "Middle-Weight Force" strategy outlined by the Commandant of the Marine Corps (CMC).[v] Additionally, the Marine Corps operational requirement to transport two amphibious Marine Expeditionary Brigade's worth of lift also depends on a self-deploying amphibious vehicle.[vi] Marine Requirements Oversight Council (MROC) chaired by the Assistant Commandant of the Marine Corps created Decision Memorandum (DM) 55-2012 of 2 Aug 2012. DM 55-2012 outlines the current leadership's position on a self-deploying amphibian by stating, "The Commandant and MROC members emphasized that the conduct of amphibious operations is a fundamental, defining capability of the Marine Corps. They unanimously agreed

that the ACV is fundamental to conducting amphibious operations. The Assistant Commandant posits that, "We are swimmers that fight as a MAGTF, not MAGTFs that can swim."[vii]

On 11 July 2012 Deputy Commandant, Combat Development and Integration (CD&I) published the ACV AOA. CD&I is the organization in the Marine Corps responsible for establishing the requirements of every type of equipment and ensures the equipment is capable of accomplishing the missions of the Marine Corps while considering affordability. The ACV AOA reinforces the Marine Corps insistence on maintaining the self-deploying amphibious vehicle by comparing all available options against the most likely employment scenarios. The ACV AOA analyzes alternatives that could supplant the existing capability by comparing the cost and operational effectiveness of the most likely alternatives. A self-deploying amphibian was least costly alternative that was most able to meet the established requirements.

The Marine Corps considers two other means of transporting people and equipment during amphibious operations: connectors and rotary wing aircraft. Conducting amphibious operations with only vertical lift, like the MV-22 Osprey, or a surface connector like the U.S. Navy's Landing Craft Air Cushion (LCAC) constrains the Marine Corps. The number of sorties required from these craft limit how quickly combat power can be built up on shore. In any amphibious scenario, the number of aircraft available and deck space to land them is less than optimal if it is the only option. The same is true for the LCAC. Not only is how quickly combat power is built up ashore an issue, but both the vertical (MV-22) and connector (LCAC) options both have the limitation of being one dimensional. Additionally, the ACV AOA identifies cost and space constraints aboard U.S. Navy ships that make amphibious operations significantly slower without a self-deploying amphibious vehicle. If the Marine Corps does not have the self-deploying amphibian capability, the enemy is free to only defend against the vertical insertion

capability or the less secure connector option, which requires a secure beach to truly be effective. A recent example of this premise was Desert Storm in 1991 when the presence of the 4th and 5th Marine Expeditionary Brigades (MEBs) off the coast of Kuwait forced the Iraqi Army to dedicate four divisions to prevent a landing.[viii] The ACV AOA views connectors and rotary wing aircraft as complementary capabilities to the self-deploying amphibious vehicle.

The combination of a self-deploying amphibian, vertical insertion with rotary wing aircraft, and the use of connectors provide the most optimal combination of lift capabilities for use in amphibious operations across the Range of Military Options (ROMO), or spectrum of conflict ranging from low intensity humanitarian assistance operations to high intensity combat operations. A self-deploying amphibian enhances the capabilities of the other two by not only being more capable in challenging amphibious, landing conditions, but the self-deploying amphibious vehicle is able to continue operations ashore, provide armor-protected mobility on the battlefield, and retrograde under its own power. The CMC has said that the conduct of amphibious operations is a fundamental, defining capability of the Marine Corps.[ix] A self-deploying amphibious vehicle is the most effective way to successfully conduct amphibious operations requiring sea-surface transport and the need is clearly established in doctrine and current operational concepts.

BENEFITS TO THE JOINT FORCE

The Marine Corps' first amphibious craft was the Landing Vehicle Tracked (LVT)-1, which was used in the assault on Guadalcanal in 1942. The current AAV was developed as the LVT-7, which was first fielded by the Marine Corps in early 1972. This means the primary design of the vehicle just passed its 40th year in service.[x] In 1984, following the introduction of the Light Armored Vehicle (LAV), the LVT was redesignated as the AAV to align more closely

with its mission profile and the new vehicle naming convention. The Marine Corps has possessed a self-deploying, amphibious vehicle since the early 1940s, which has allowed the Marine Corps to accomplish its amphibious missions while providing modern-day joint force commanders (JFC) with a flexible crisis-response capability.

Self-deploying, amphibious vehicles force the enemy to defend in multiple domains. They provide the JFC flexibility in determining offensive plans and conducting military operations across the ROMO. The sea-surface transport ability of the vehicle means joint U.S. forces can intervene regardless of the air threat. If there is no credible threat from a surface deployable amphibious vehicle the primary options available to joint force commanders for forcible entry are air assault or the use of airborne forces. If these are the only options available, the access denial strategy of the enemy is made easier because they need only to defend against an airborne threat. The low-cost proliferation of anti-air weapons is a significant threat by even the least sophisticated enemy. This fact is exemplified by the recent overthrow of the Libyan government and their loss of weapons accountability. The current doctrinal concepts of Seabasing and future strategic requirements will continue to require the ability to access the enemy. A self-deploying amphibian capable of providing a credible surface threat provides the JFC with complementary options to accomplish amphibious missions.

A self-deploying, tracked amphibious tracked vehicle requires the least amount of additional lift to support the build up of the ground combat element (GCE) ashore. The GCE must be capable of full-spectrum amphibious operations in support of the Marine Air Ground Task Force (MAGTF). The ACV AOA uses a Marine Expeditionary Brigade (MEB) sized force as an example of this principle, with a launch distance is 12 nautical miles. At this distance with 15 U.S. Navy amphibious ships, the lack of a self-deploying amphibious vehicle requires an

additional day to land a Battalion Landing Team assault echelon and its associated equipment This additional day is added because the remaining landing craft are not able conduct the additional troop and equipment transport lifts necessary to move the troops once ashore. Additionally, it will require nearly two additional days, compared to only two total days, to land an artillery battery. This additional time slows the build up of combat power ashore and also places untenable additional requirements on the connectors, the LCAC and LCU.[xi]

To successfully conduct amphibious operations, the Marine Corps must possess a self-deploying amphibian that provides a credible threat to the enemies Anti-Access Area Denial (A2AD) strategy. A2AD encompasses the range of techniques the enemy can take to prevent joint forces from using any part the domains of air, land, sea, space, or cyberspace and include: anti-aircraft weapons, sea-laid mines, or coastal defenses to name a few. Having a self-deploying amphibious vehicle means the enemy must account for the option of ship-to-shore movement using the sea as maneuver space. This imposes the requirement to defend on additional fronts and not focus solely on air defense. Assured access becomes more likely as the enemy is required to defend on multiple geographical points.[xii] Without the capability, the Marine Corps does not possess a vital component of assuring access. Access to a defended location would only be available through the one-dimensional capability of helicopter and aviation use. LCACs and LCUs require permissive environments. The self-deploying amphibious vehicle capability enables the joint force commander to use it as part of a broader joint campaign capable of seizing defended terrain outside the primary A2AD threat as the joint force builds.[xiii]

A self-deploying amphibious vehicle such as the AAV P7A1 RAM/RS provides many tactical benefits during ship-to-shore movement and subsequent operations ashore. Vehicles are

capable of transitioning from sea to land movement without stopping as they make the transition from water to land. They offer armor-protected mobility to move around the battlefield and the speed to adjust to changing enemy circumstances because of their overland capability to negotiate challenging terrain and obstacles.

Not only does the current AAV offer protection from up to caliber 12.7 mm rounds from the enemy, it provides a direct fire support capability with the M2 Heavy Barrel .50 caliber Machine Gun and the destruction ability of a high explosive grenade with the Mk 19 40 mm Grenade Launcher. Each individual AAV possesses this pairing of weapons. AAV units provide high volume, direct fire support capability to supported infantry units.

By its nature, the AAV and its predecessors are multi-purpose vehicles capable of doing the unique amphibious missions of the Marine Corps in the harshest ocean environments. This tremendous versatility, armor protection, and fire support is dedicated to the Marine Corps' most important asset, the individual Marine. The AAV diversity ranges from being able to conduct open-ocean, water operations for seven hours without refuel to recently providing armor-protected mobility to the 1st Marine Division during the almost 300 mile overland drive to Baghdad in 2003. The Marine Corps more than 600 AAVs supporting both Operation DESERT STORM in 1991 and Operation IRAQI FREEDOM in 2003. The AAV is a versatile asset that, if properly sustained and modernized, will continue to provide a wide range of capabilities across the ROMO in support of the missions of the Marine Corps and the joint force.

Having identified the reasons a self-deploying amphibian is needed, the issues and challenges faced by the current AAV will be identified and the path toward regaining lost amphibious capabilities for the Marine Corps will be established. The presentation of these challenges are not intended to frame a picture of hopelessness for the Marine Corps, but instead

highlight the significance of the problem and identify short and long-term solutions to maintaining a viable amphibious capability.

ISSUES AND CHALLENGES

Several issues highlight the Marine Corps' challenges to maintaining a relevant, self-deploying, tracked amphibious vehicle capability. The vehicle possesses limited armor protection against improvised explosive devices (IED), the competition from wheeled vehicles has increased doubt about the need for tracks, the slow water speed of the AAV leads some consider it obsolete on the modern battlefield, operating distances in the water in excess of 3000 meters are thought to degrade troop performance once they exit the vehicle ashore, recent AAV mishaps cause some to consider it ineffective, and the A2AD threat of today and the future make amphibious operation obsolete. The degree to which these challenges are true and the facts surrounding their validity must be considered.

On the modern battlefield the IED threat is significant and it poses a challenge to a tracked amphibious vehicle. Generally, the design of an amphibious, armored vehicle can have a high degree of armor, carry more than 10 troops, or float well. Engineering and physics challenges prevent it from doing all three simultaneously to the extent each could do alone. The Marine Corps' self-deploying vehicles have always focused on floating and troop transporting in this triad of capabilities. This choice comes from the simple fact that a highly armored vehicle will not float well or carry as many troops and the risk and cost associated with trying to do all three is too significant. The thought is that a more mobile amphibious vehicle can be employed in ways that avoid the IED threat rather than preventing the damage when they are hit with one.

Wheeled vehicles are very capable and versatile, offering on and off-road capability similar to a tracked vehicle.[xiv] Wheeled vehicles have limitations when expected to achieve the

same amphibious capability as the current AAV. One advantage of a wheeled vehicle often cited as a benefit is that it can be made Department of Transportation (DOT) legal to travel on U.S. highways. In order to carry the same number of troops as the AAV and reduce the width of the vehicle to be DOT legal, the length must be increased. The increased profile of the vehicle makes it less able to be loaded on amphibious shipping, which is a more important consideration in this type of vehicle. Because a wheeled vehicle maintains the constraint of having to transport the same number of troops, it becomes less capable of doing this when the width is decreased. Additionally, a significant benefit of tracks on an amphibious vehicle is that they lower the center of gravity and make the vehicle "self-right," meaning if it flips in the open water it can correct itself due to being bottom heavy.

Armored combat vehicles are not traditionally designed to provide a high degree of comfort to the inhabitants. They are machines of necessity. As a result, many argue that extended times in the back of a tracked, self-deploying amphibious vehicle significantly degrades the performance of the embarked troops, who upon reaching land are required to execute missions involving detailed organization and precision weapon firing. A habitability study recently conducted by Program Manager Advanced Assault Amphibian office focused on cognitive and physical skill degradation caused by riding in an AAV and determined that "[i]n favorable seas conditions, test results indicate that individual Marine performance is not significantly impacted by waterborne motion exposure up to 3 hours."[xv] This is much better than the one-hour troop transport time that is commonly used as a planning factor. This information supports increased distance with which the AAV can be launched from the shore because it does not come close to exceeding the fuel restrictions of the vehicle, which is the next greatest concern at nearly seven hours in the water.

Previously addressed, but worth mentioning again, is the speed with which the MAGTF can build combat power ashore during amphibious operations. Without a self-deploying amphibious vehicle the landing of one battalion landing team of the MEB goes from less than 24 hours to almost two days and its associated artillery battery is not completely ashore until almost 96 hours compared to 48 with self-deploying amphibious vehicles. The reason for this is the additional lift requirements demanded of the connectors (LCAC, LCU).

MCWP 3-13 states that the AAV "is the most seaworthy personnel landing craft in military service."[xvi] It is capable of operating with embarked personnel in sea state 4, which is characterized by up to 21-knot winds and open ocean wave heights up to 7.5 feet.[xvii] Current concerns over the sea worthiness of the AAV can be attributed to six AAVs sinking in the past six years. In the ten years prior to this period there were only two vehicles sank. Of all of these incidents, none had embarked troops, three were attributed to mechanical failure, and two were the result of errors induced by improper operating procedures. These issues are symptoms of larger problems, training and vehicle readiness, which will be discussed in detail later. In spite of this recent spike in the number of AAVs sinking, a well-maintained vehicle with a crew trained to operate it to the existing standard have a superbly seaworthy craft that has served the Marine Corps for over 40 years.

The modern A2AD environment challenges the use of the current AAV. The anti-ship missile threat, which exceeds 100 nautical miles can threaten every capability the U.S. has available to conduct amphibious operations, including aviation. A2AD is an issue for every aspect of amphibious operations. This problem increases as distance to shore decreases and this reinforces the need for an advanced, self-deploying amphibious vehicle capable of operating at greater distances from the source of A2AD threats than the current vehicle. Although the range

of enemy weapons were less at the time, the U.S. was able to overcome the submarine, shore-based fires, and mine A2AD threats during the Solomon Island Campaign in 1942 and more recently the British during the Falklands Campaign in 1982.

From 2008-13 AAV use has decreased by ground commanders for a multitude of reasons, some perceived and some legitimate. The following list of challenges highlight important distinctions because this decreased use appears to have pervaded the mentality of Marines and joint commanders. The AAV currently has some significant problems, which translate to a degraded Marine ability to its ability to successfully conduct amphibious operations.

The AAV has limited applicability in the current war in Afghanistan where it would have been constrained to travelling on predictable roads. This lack of use in the current war means there is no incentive for units to conduct operations with AAVs during their limited training time prior to deploying to Afghanistan. After an excellent performance transporting the bulk of the 1st Marine Division to Baghdad during OIF I, the AAV had a limited role in the high Improvised Explosive Device (IED) threat areas in Iraq from 2004 to 2008 when the AAV use was stopped in favor of the more IED-protected, Mine Resistant Ambush Protected (MRAP) vehicles. This idea of limited usefulness is compounded by reduced AAV training opportunities, decreased reliability of the AAV, the Marine Corps' focus on counterinsurgency operations, and decisions made regarding the planned decrease in the end-strength of the Marine Corps.

Last, but not least, after numerous attempts in the last 35 years, the Marine Corps has failed to field a suitable replacement for the current AAV. The AAV is now over 40 years old and this fact alone is the greatest contributor to the degraded capability of the current self-deploying amphibious vehicle capability. Each attempt to develop a replacement has distracted from the current capability and it stands to reason that the ACV will have the same impact. As

ACV development progresses it will compete against the AAV for resources and the older capability will be further degraded.

REPLACEMENT HISTORY

The cancellation of the EFV program in January 2010 is indicative of the greater problem of the Marine Corps not adhering to a consistent strategy that supports its amphibious capability. Every attempt in the last 40 years to replace the current AAV has failed, principally due the cost required to develop and deliver the required capability. The current AAV P7A1 RAM/RS is principally the LVTP7, which replaced the LVTP5 in 1972. Also in 1972, planning for the replacement for the LVTP7, the LVT(X), began. The LVT(X) was cancelled in 1985, but the need to improve the capability was still recognized, which resulted in the LVTP7 undergoing a Service Life Extension Program (SLEP) update to become the LVTP7A1. In the same year, the name was changed to the AAVP7A1, which was then upgraded to the Reliability Availability Maintainability/Rebuild to Standard (RAM/RS) capability in 1999 and with minor upgrades is the vehicle the Corps uses today. Still recognizing the need for a modern capability the Corps started the Advanced Assault Amphibian Vehicle (AAAV) program in 1992, which was then cancelled in 2011. The number of attempts to upgrade the amphibious vehicle capability is indicative of the need, but the inability to field a modern and improved self-deploying tracked amphibious vehicle has led to many of the problems experienced today.[xviii]

Two ongoing initiatives add to the list of AAV upgrades and replacement attempts. The first is the AAV Upgrade program focused on survivability enhancements to the current AAVP7A1 RAM/RS and the second is the previously discussed ACV. The requirements and capabilities the ACV must possess have been completed and it is scheduled to fully replace the AAVP7A1 RAM/RS in 2029. This future replacement date makes the AAV upgrade even more

critical because it will be require to serve for at least another 16 years. It is not possible to build and buy enough ACVs to replace all AAVs at the same time so the plan incrementally replaces the existing AAV.

It is still recognized that something must be done to improve the capability of the current self-deploying amphibious vehicle and like its many iterations of successors and planned replacements, the upgraded AAVP7A1 RAM/RS was intended to "bridge" to its currently unrealized replacement. This decision to improve the capability of the current vehicle is required, but it puts the Marine Corps in a position where it may have to go to war with a vehicle that is almost 60 years old by the time it is replaced. This creates a significant technological capability gap and forces the Marine Corps' customers, JFCs and infantry Marines to assume tremendous risk in the use of the AAVP7A1 RAM/RS or its planned upgrade.

MANNING

The Marine Corps Ground Combat Tactical Vehicle Strategy (GCTVS) and capabilities determined necessary to conduct major conventional operations (MCO) were significant considerations in the Force Structure Review (FSR) decision to decrease the size of the current Assault Amphibian (AA) units. Active Component AA structure was reduced from 11 AA companies to eight in the 2010 FSR. The current Marine Corps Plan under the GCTVS is that the targeted lift requirement for an MCO forcible entry scenario is 12 infantry battalions. The effect that will be realized by the FSR reduction of AA units decreases support to the GCTVS 12 battalion lift strategy.[xix] Eight of these battalions are required to be lifted by a self-deploying amphibious vehicle, the future ACV.[xx]

The Marine Expeditionary Unit (MEU) deployments make the ability to provide eight AA companies for the GCTVS even less supportable. The FSR cuts do not take in to account

that of the remaining 11 AA companies, three platoons will be deployed with a MEU and three will be training to replace them. This is the equivalent to two AA companies that are accounted for in the GCTVS, which will not be available.

AA units from the U.S. Marine Forces Reserve (MARFORRES) account for the lift of two of the eight infantry battalions required to be lifted via self-deploying amphibious vehicles according to the GCTVS. These eight battalions needed to support the GCTVS represent the minimum the Marine Corps has said is required to conduct major, conventional, amphibious operations up to and including forcible entry. This is not consistent with putting the capability to conduct operations with two of these eight battalions in the MARFORRES. The ACV AOA states "…reserve AA companies do not have the same complement of equipment as the eight active AA companies."[xxi] The MARFORRES also does not possess the ability to mobilize two companies of Marines quickly enough to be relevant in a first-wave crisis response situation requiring the surface transport of eight infantry battalions. This plan does not provide responsive capability in the quantity needed to conduct its most challenging mission. The remainder of the FSR directed AA unit decreases do not happen until fiscal year 2014, so there is time to change this plan and eliminate the risk it imposes.

BUDGET AND EQUIPMENT

The U.S. President stated in the 2013 State of The Union address that the U.S. is recovering from the greatest recession since The Great Depression, but the DOD anticipates significant budget cuts in the next five years.[xxii] These cuts will impact the Marine Corps' budget and their ability to procure new equipment and maintain existing equipment while accomplishing responsibilities around the globe in support of the national security strategy. In the case of the current AAV, the development of a new amphibious vehicle, the ACV, has been

approved in an attempt to ensure the relevance of amphibious capabilities. While the plan to develop these initiatives has been approved, the funding has not been allocated for the entire purchase of the AAV upgrade or the ACV. These initiatives are made more complicated by the fact that funding will still be competed for in future Program of Memorandum (POM) submissions, which allocate funds to the services for such projects. Maintaining the current AAV will continue to be a challenge because of its age.

There are two significant financial challenges faced by the ACV. First, because of the nature of the DOD budget cycle and time duration it takes to procure such a piece of equipment, the money has not been allocated for the entire purchase. Although this is true for any major equipment purchase in the DOD, the Marine Corps shrinking budget compounds the problem. Second, and related to this is the decision regarding whether or not the ACV should have the capability to go high or low water speed has not been made. High speed is defined as in excess of 18 knots and low water speed would be slightly higher than that of the current AAV at around 11 knots. The difference between high and low speed is a hydrodynamic issue. For a vehicle to go as fast as possible and still possess its tracked on-land abilities, a flat bottom is a constraint. Related to this constraint is the power needed to make the vehicle come out of the water and plane. Vehicle speeds up to 12 knots require significantly less power and consequently cost less than speeds ranging from 12-18 knots. The 12-18 knot speed range is considered the transition speed where the vehicle comes out of the water and go up on plane, which is achieved around 18 knots.[xxiii] What this means is that for a vehicle to come on plane it must go in excess of 18 knots and this is significantly more expensive and complicated than going 12 knots, so cost becomes a significant issue. While cost of anything is an issue, it must be tempered with achieving the capability that is required. If the Marine Corps intends operate according to planned doctrine, it

needs a high-speed self-deploying amphibious vehicle with the speed to take advantage of the sea as maneuver space and the ability to operate at increased distances that helps neutralize the projected A2AD threats. If the EFV was too costly for the Marine Corps, it stands to reason that the ACV, if determined to need high-speed water capability will have comparable costs.

AAV maintenance readiness rating was approximately 65% across the Marine Corps in the year 2012.[xxiv] Prior to OIF in 2003 it was routinely above 90%.[xxv] This can be attributed solely to age, but there is a more significant cause. AAV sustainment activities, those activities conducted to keep a piece of equipment at the capability level desired, have been neglected. There are several reasons for this. The most significant is the impact of the fielding plan of the now-cancelled EFV. In 2004, when it was determined that the EFV reached appropriate development milestones the AAV "end of life" was designated as 2017. This decision established when parts were no longer needed, which led to optimize parts supplies (decreased due to expected demand) and low-density parts going out of production. The problem this causes is that the Marine Corps is now past the time it was required to support the current number of AAVs. Critical parts shortages are continuously realized and they cannot be replaced because they are no longer being made.[xxvi] Economies of scale make it significantly more costly to restart production of parts that were previously thought to be obsolete.

Closely linked to the development of the EFV is the funding allocated to the AAV. Since 2004 the AAV program has only been allocated enough funding to take care of the minimum requirements of the vehicle: roughly classified as safety and urgent external requirements that address specific issues. Supply-chain obsolescence, reliability, and cost-avoidance initiatives were not funded because they were not anticipated to have long-term impacts since the vehicle was going to be replaced. This problem was caused by economically sound business decisions,

but the variables changed when the EFV was cancelled and now those business decisions combined with the need to maintain the AAV until 2029 (ACV Full Operational Capability (FOC)) have resulted in degraded amphibious capability.[xxvii]

TRAINING

AAV readiness and its contribution to maintaining the amphibious capability of the Marine Corps is affected by training readiness in addition to the financial and material readiness issues that have been presented. In the past ten years there have been a limited number of division level and above exercises focused on amphibious operations and AA unit training has been focused on other assigned tasks in support of the ongoing U.S. wars in Iraq and Afghanistan.

Recent major amphibious exercises have mainly focused on the headquarters staff functions and U.S. Navy coordination required to conduct amphibious operations and focused less on the ship-to-shore movement of the assault element with AAVs. Not considering the Marine Expeditionary Unit (MEU) deployments, which involve only a platoon of AAVs (14 vehicles), the number of large-scale exercises involving AAVs in the past ten years has been limited. While the MEU deployment has significant strategic implications, it only deploys with a platoon of AAVs and the number of training operations does not significantly impact the overall readiness of the larger battalions within each Marine Division. The command chronology, documents that detail the significant training and administrative actions of the command, for the last ten years of operations in the 1st and 2d Marine Division indicate less than ten major amphibious operations, with varying degrees of AAV involvement. The 1st Marine Division took a step in the right direction toward maintaining the amphibious skills required by conducting Exercise Steel Knight in December 2012, which had significant AAV

involvement.[xxviii] The focus of future large-scale exercises needs to include providing increased opportunities for infantry-AAV operations and not just staff training.

Since the completion of Operation Iraqi Freedom I in 2003, training cohesion of AA and more importantly infantry units have suffered from constant rotations required to support the non-amphibious roles required for war-time operations. Rightfully so with two wars going on, AAV units have been focused on supporting the Marine Corps in other ways, conducting non-traditional missions not involving AAVs. Infantry units have been focused on the mission they will have in their future deployments, which did not involve AAVs. Conducting the full range of amphibious missions requires infantry and AAV units that are able to seamlessly combine two separate and distinct skill sets to accomplish the difficult task of coming from the back of an U.S. Navy amphibious ship, at night, in sea state 3, and be able to accomplish the mission. AAV operations are not simple, it takes time to build a cohesive unit and make experienced AAV operators. When amphibious missions are required in a high threat environment, it will not matter how many MV-22 sorties can be flown if AA units are not capable of a credible surface threat because the Marines have not been given training opportunities to achieve the readiness required by JFCs.

WHAT IS GOING WELL AND WHAT CAN BE DONE BETTER

In spite the issues that have been presented there are things going right for the Marine Corps in the area of maintaining amphibious transport capability. The AAV Upgrade is planned, but not yet funded and the same is true of the ACV. Despite the cancellation of the EFV, Marine Corps leadership has confirmed the need to maintain the self-deploying amphibian capability. These two programs are instrumental to modernizing the Marine Corps self-deploying tracked amphibious vehicle, but their high cost makes them fragile. They will continually have to be

defended against other priorities. Although equipment modernization is necessary, there are also training issues that must also be addressed. Training solutions will provide the greatest low-cost benefit as the Marine Corps looks for ways to manage a decreasing budget. If the ACV procurement maintains its current schedule, the AAV will still be in use until 2029 when the ACV becomes FOC. This fact alone highlights the imperative that action must be taken to address the current challenges and to posture (fiscally and operationally) to ensure the capability remains relevant in the future.

During a brief on 30 Nov 2012 to Marine Corps Command and Staff College, General George J. Flynn, Director for Joint Force Development, The Joint Staff J-7 made the following comment, "We will have to make choices in a fiscally constrained environment that leads us to the best solution."[xxix] Maintaining the AAV may be a smart choice both in terms of cost savings and capability in the current economic environment. The Marine Corps needs to focus on maintaining the amphibious vehicle it has today as it once again tries to procure a more modern replacement. With this in mind, the following topics are presented as solutions the Marine Corps should consider.

The U.S. Navy-Marine Corps partnership must continue to focus on the equipment and ships needed to conduct surface amphibious operations. The Navy has tremendous global force requirements and limited resources to support amphibious ship requirements needed by the Marine Corps. This relationship must take in to account the requirements of both services because the Marine Corps relies on the Navy to provide this capability. The Marine Corps continues to conduct operations with the AAV and plans to employ the ACV in a similar manner. Both require U.S. Navy ships capable of delivery. The planned America class amphibious assault does not have the ability to employ self-deploying, tracked amphibious

vehicles. This will impact how the Marine Corps conducts future missions and highlights the need for continued partnership between the services.

Sustainment funding for the current AAV must be increased to support readiness. The aging AAV has languished for many years. The capability must be maintained for another 17 years and in order for this to happen, the funding must be made available to support supply chain obsolescence issues and maintainability improvements. Related to this, the AAV upgrade should be fully funded in the POM and consideration should be given to ensure that this upgrade provides the necessary capability to "bridge" to the ACV and is not solely constrained by cost. On many occasions, the CMC has stated that the Marine Corps needs to be ready to go to war today with the force that it has today. AAV funding in the short term ensures that the Corps can go to war today and maintain the capability to succeed.

The following recommendation will require significant policy exceptions, but this is a solution if the Marine Corps has no better way to improve reliability of the current AAV units. The total number of AAVs currently exceeds 1000. The planned number of ACVs needed to meet the future requirements of the GCTVS is only 520 vehicles. This discrepancy in numbers indicates the current number of AAVs in the Marine Corps exceeds the requirements. What can be done to alleviate readiness and no supply of critical parts is taking parts from unneeded vehicles to improve readiness of the smaller number of required vehicles. The benefits of this are: parts costs are reduced because the Marine Corps already possesses them and maintenance cost also goes down because as unnecessary vehicles are taken out of service, there will be less equipment to maintain. This proposal has underlying costs like reduced ability to profit from the AAV through the Foreign Military Sales program, but it is a viable option to improve readiness and alleviate some of the sustainment issues.

Over the past decade, decreased training opportunities between AAV and infantry units, has resulted in an entire generation of inexperienced company-level leaders. The first step to overcoming the lack of training is education. There are many Marines who have never been on an AAV and many more who do not know anything about the capability they provide the Marine Corps. A simple, focused training plan to educate and demonstrate the capabilities of the AAV to Marines across the Corps, led by the Marine Divisions, could eliminate misperceptions and present an old and effective capability to a new audience.

Recent training exercises have focused on amphibious capabilities and to a lesser extent, AAV proficiency. Large exercises are beneficial, but a decreasing budget will continue to limit their frequency. Marines must reinforce basic, creative, and less costly ways to maintain proficiency. A training consideration that is often overlooked because it is not required for Afghanistan pre-deployment training, is that AAV-infantry integration training. The nature of these operations requires a combined arms mentality and multi-faceted problem solving skills that transfer to other tasks. At the company and battalion level, AAV and infantry units need to synchronize training schedules in a way that emphasizes AAV-infantry coordination. Leaders need to force subordinates to adhere to established training standards, which are proven effective. Another training related solution is, for the next several years, to increase the frequency of the Training and Readiness manual amphibious related tasks. This will require Marines to dedicate more effort to maintaining and improving amphibious-related skills.

CONCLUSION

The Marine Corps identifies a self-deploying, tracked amphibious vehicle as fundamental to its ability to accomplish amphibious missions. In every attempt since the LVT-7 (fundamentally the current vehicle in use today) was introduced in 1972, the Marine Corps has

failed to develop a modern vehicle capable of supporting amphibious missions on today's battlefield. The current AAV is not properly utilized in service-level training nor resourced sufficiently to maintain readiness. Maintaining the status quo could soon lead to a point when the degraded capability of the Marine Corps' self-deploying, tracked amphibious vehicle precludes success. The solutions are difficult, but they are clear and will not be as costly as failure.

There are threats to every major capability in the DOD: cyber, missile vulnerabilities of aircraft carriers, diesel subs that can match the best U.S. submarines, and missiles that can destroy American tanks. In much the same way, there are threats to the self-deploying, tracked amphibious vehicle. The Marine Corps currently faces the challenge of maintaining its amphibious capability while simultaneously trying to replace its current self-deploying amphibious vehicle. The service needs to make sound decisions about maintaining this amphibious capability, even when these decisions are not popular or do not fall in line with the post-war budget pressures that will challenge the service.

The Marine Corps must improve its self-deploying, tracked amphibious vehicle capability or adjust requirements for the right reasons, not just for the sake of change. The self-deploying amphibious vehicle capability developed almost 70 years ago has fundamentally remained the same. The reason is relatively simple; the tracked amphibious vehicle is a stable and consistent piece of equipment on which the Marine Corps relies. The missions of the Corps require will always require Marines put their "boots on the ground". To do this they must possess the flexibility to get to the most challenging environments under the most trying circumstances. They will require well-trained units with capable equipment. The Marine Corps

requires a modern, self-deploying, amphibious vehicle and must effectively resource current training and equipment to ensure it maintains the ability to conduct missions required by law.

End Notes

[i] *Composition of the Department of the Navy*. U.S. Code. Title X, Chapter 507 (1947).

[ii] A self-deploying amphibious vehicle is one that uses its own power for transport from ship to shore and then on to land and the AAVP7A1 RAM/RS is the current self-deploying amphibious vehicle in use by the United States Marine Corps. This paper will use the term to distinguish the capability from a specific piece of equipment. Another alternative to a self-deploying vehicle is one that requires a connector, which is the equipment used to transport another piece of gear from ship to shore so it can then use its own power on land. The Landing Craft Air Cushion (LCAC) transporting an M1A1 Abrams Tank from ship to shore is an example of using a connector to transport a vehicle that is not self-deploying from amphibious shipping.

[iii] Headquarters U.S. Marine Corps. Marine Corps Campaign Plan 2012-2020. Washington, DC: Headquarters U.S. Marine Corps, April 24, 2012.

[iv] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[v] Amos, James. 2012 Report to the House Armed Services Committee on the Posture of the United States Marine Corps. Congressional testimony, Washington D.C.: United States Marine Corps, 2012.

[vi] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[vii] Dunford Jr., Joseph F. Assistant Commandant of the Marine Corps. Marine Requirements Oversight Council Decision Memorandum 55-12, 2 August 2012.

[viii] Center of Military History. “War in the Persian Gulf Operations Desert Shield and Desert Storm August 1990–March 1991” United States Army. Washington, D.C., 2010.

[ix] Dunford Jr., Joseph F. Assistant Commandant of the Marine Corps. Marine Requirements Oversight Council Decision Memorandum 55-12, 2 August 2012.

[x] Zaloga, Steven J. *Amtracs Us Amphibious Assault Vehicles*. Vol. 30. Osprey Publishing, 1999.

[xi] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[xii] Work, Robert O. and Hoffman, Frank G. Defense Technical Information Center." Hitting the Beach in the 21st Century. November, 2010. http://www.dtic.millndial2010expeditionIWORK.pdf.

[xiii] Cancian, Mark. "Preserving Amphibious Capabilities in a Time of Austerity ." *Marine Corps Gazette* 96, no. 12 (2012): 16.

[xiv] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[xv] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[xvi] Headquarters U.S. Marine Corps. Employment of the Amphibious Assault Vehicles (AAV). MCWP 3-13 w/chg 1. Washington, DC: Headquarters U.S. Marine Corps, February 17, 2005.

[xvii] Sea State Conditions
Sea State 1
Wind speeds between 5 to 9 miles per hour (5 to 8 knots).
Wave heights considered small wavelets between 0.5 and 1 feet (0.6093 to 0.304 meters.
Small wavelets with glassy-appearing crests and no breaking.

Sea State 2
Wind speeds between 10 to 11 miles per hours (9 to 10 knots).
Wave heights considered large wavelets, between 1.5 and 2 feet (0.456 to 0.609 meters).
Large wavelets, crests begin to break and whitecaps are scattered.

Sea State 3
Wind speeds between 16 to 17 miles per hour (14 to 15 knots).
Wave heights considered small, between 3.5 and 4 feet (1.06 to 1.21 meters).
Small waves becoming longer and whitecaps are numerous.

Sea State 4
Wind speeds between 19 to24 miles per hour (17 to 21 knots).
Wave heights considered moderate, between 4 and 7.5 feet (1.24-2.5 meters).
Moderate waves forming numerous white caps and some spray.

Sea State 5
Wind speeds between 24 to 28 miles per hour (21 to 25 knots).
Wave heights considered large, between 8 and 12 feet (2.43 to 3.65 meters).
Large waves form and whitecaps are common, along with more spray.

[xviii] Zaloga, Steven J. *Amtracs Us Amphibious Assault Vehicles*. Vol. 30. Osprey Publishing, 1999.

[xix] Mills, Richard P., Lieutenant General, Deputy Commandant for Combat Development and Integration. Memorandum, 8 November 2011.

[xx] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[xxi] Marine Corps Combat Development Command, Amphibious Combat Vehicle Analysis of Alternatives. Quantico, Virginia July 9, 2012.

[xxii] The author listened to The State of the Union on 12 February 2013 via www.whitehouse.gov.

[xxiii] Lin, Ray Q and Hoyt III, John G. "Fast Ship Motions in Coastal Regions," (PowerPoint Presentation, Naval Surface Warfare Division, Carderock, MD, 18 March 2011).

[xxiv] Doheney, Shaun M. "AA Readiness OPT Update," (PowerPoint Presentation, Headquarters Marine Corps, Quantico, VA, 21 November 2012).

[xxv] Author's personal experience from being in an AA Battalion from 2000-2003.

[xxvi] Author's e-mail interview with Chief Warrant Officer 2 Mike Bressler, Battalion Maintenance Officer for Assault Amphibian School Battalion on 19 November 2012.

[xxvii] Doheney, Shaun M. "AA Readiness OPT Update," (PowerPoint Presentation, Headquarters Marine Corps, Quantico, VA, 21 November 2012).

[xxviii] 1st and 2d Marine Division Command Chronology from 2002-2011. Archives Collection, Library of the Marine Corps. Accessed on 18 December 2012.

[xxix] Paraphrase from Lieutenant General George J. Flynn's address to Command and Staff College, Marine Corps University, which the author attended.

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