

An Analysis of The Employment of the LVT-5 in Riverine Operations in Vietnam
and a Recommendation For the Employment of the AAV Future Riverine
Operations

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Subject Area Strategic Issues

EXECUTIVE SUMMARY

Title:

An Analysis of the Employment of the LVT in Riverine Operations in Vietnam
and a Recommendation for the Employment of the AAV in Future Riverine Operations

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Thesis:

The employment of the AAV in future riverine operations, like the LVT in riverine operations in Vietnam, will be based on the capabilities and limitations of the platform, doctrine and creativity of the maneuver commander

Discussions:

The LVT used in Vietnam was the fifth variant developed for the Marine Corps and they were many intended for classical amphibious assault operations to the shore and not much further. In Vietnam there were no classic amphibious assaults across the beach, but there were inland waterways, liquid highways, that carried the enemy and his supplies. Tactics, techniques, and procedures were designed to allow for the maximum employment of LVTs in riverine operations in Vietnam, but there were simply some things the LVT *could* and *could not* do in riverine operations.

The AAV is a quantum leap from the LVT employed in Vietnam. With multi-spectrum signature reduction, increased land and water speed, digital communications, and increased firepower the AAV will provide the MAGTF with an ideal platform to support riverine operations. There will be things the AAV *can* and *can not* do in riverine operations.

Recommendations:

Employment of the AAV in future riverine operations, like the LVT in Vietnam, will be based on the capabilities and limitations of the platform. The AAV will not replace PBRs, rubber boats, LCACs, and LCUs, but the AAV will provide the commander with operational reach and leverage at the tactical and operational level never before seen with assault amphibians. The AAV may enable rivers, which previously were regarded as obstacles, to serve as maneuver space. Future MAGTF maneuver forces employing AAVs will be able to seamlessly transition from the ship to the objective through blue, green, and brown water instead of having to pause to conduct specialized riverine operations.

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Table of Contents

	Pages
Chapter 1 Introduction	3
Chapter 2 Background on Riverine Warfare	3-5
Chapter 3 Riverine Warfare in Vietnam	5-17
Chapter 4 The LVT5	17-20
Chapter 5 LVT5 Employment in Riverine Operations in Vietnam	20-27
Chapter 6 Analysis of Lessons Learned from LVT5 Riverine Operations in Vietnam	27-28
Chapter 7 The Transition from LVT5 to AAV	28-31
Chapter 8 Stagnant Riverine Warfare Doctrine since Vietnam	31-32
Chapter 9 Emerging Doctrine and Over-the Horizon Requirements	32-36
Chapter 10 The AAV	36-41
Chapter 11 The AAV and Future Riverine Operations	41-43
Chapter 12 Possible Scenarios for Future AAV Riverine Operations	43-45
Chapter 13 Recommendations for Employment of AAVs in Future Riverine Operations	45-46
Chapter 14 Conclusion	46-47
Bibliography	48-50

the Employment of the AAV in Future Riverine Operations Introduction

The United States Marine Corps will introduce the Advanced Assault Amphibian Vehicle (AAAV) in 2005, which according to the approved fielding plan will, completely replace the current Assault Amphibian Vehicle (AAV7A1) fleet of 1,013 vehicles by 2015. The AAAV will be the seventh version of the Landing Vehicle Tracked (LVT) referred to as “Alligators, Amphibious Tractors or Amtracs”, and will continue a legacy of unique and innovative assault amphibians begun by Donald Roebling in 1942 with the original “Alligator” (LVT1) used in World War II.¹ While the development and history of the Amtrac is a fascinating story, the focus of this paper is to specifically analyze the employment of the LVTP5 in riverine operations in Vietnam and make recommendations for the employment of the AAAV for future riverine operations. The LVT5 Family of Vehicles (FOV) from the Vietnam era were employed in combat riverine operations more so than the current AAV7A1 FOV and with a greater scope of employment and source of materials available was therefore chosen for the analysis. The analysis will begin with a history of riverine warfare and specifically riverine operations in Vietnam and the employment of the LVTs. Secondly, the analysis will reveal the key lessons learned from riverine operation in Vietnam and in particular employment of the LVTs. Thirdly, we will transition from the LVT5 FOV to the AAAV by analyzing the current AAV and reviewing a recent operation in the riverine environment. Fourthly, we will analyze the requirements for AAAV and explain the capabilities it will provide the MAGTF and Joint Force Commander. Lastly, we will make recommendations for the employment of the AAAV in future MAGTF and Joint riverine operations.

Background on Riverine Warfare

Man has long made use of rivers, bays and inlets of the lands he occupied to better his agriculture and facilitate his commerce in peace and to move and support his military forces in war. He has flourished in the pleasure that he has learned to use them.²

Crossing rivers has always been important, but it's the control and use of the waterways that are a key in warfare. Inland waterways flow to the sea and to other lands of opportunity and opposition. The Egyptian trireme became the standard war vessel for several centuries. As combat tactics afloat and ashore developed crews were established. Sailors and Marines were identified separately on Athenian triremes. The Greek

¹ Col. Victor Croizat USMC (Ret.), Across the Reef: A History of the LVT (Quantico: Marine Corps Association, 1989), 1.

² Col. Victor Croizat USMC (Ret.), Riverine Warfare in Vietnam 1945-1975 (New York: Bland Press, 1986), 11.

victory at Salamis versus the Persians employed Phoenician mercenary seamen to lure the Persian fleet into narrow waters to destroy them was perhaps the first recorded sea battle, but it was in the littorals—brown water.³

In 326 BC Alexander began a campaign in the Kingdom of Taxila, present day Pakistan, where he built a fleet on the banks of the Hdaspes River, now the Jhelum, to conduct a sweep afloat and ashore down river to the Indus River and its delta in India. He split his forces and sent the main body overland with the river force transiting through the Indian Ocean to the Arabian Sea, and Persian Gulf to join near the Amanis River near Minab Dzdan, present day Iran. Maritime power became a vital part or the key to national power for nation states.

Rome began as a land power and saw waterways as obstacles. Vegetius noted that each legion had an engineer detachment with pontoons for bridging. Their protection and imperialism necessitated and justified sea power. Viking ships, often shallow in draft, were used primarily for navigating rivers and taking a land army to meet a land enemy—riverine warfare.⁴

The grandeur and endurance of ancient civilizations is related to the effectiveness with which they controlled and used their water resources. Inland and inshore waters were the first great avenues of movement and commerce: warfare on and from the waterways has been the inevitable concomitant.⁵

Most of the world's cities, then as now, are located in the littorals and along the inland waterways making brown water operations vital to overall campaign success. Since the War of American Independence brown water warfare has been a regular feature in early American military history reflected in battles for the control of Lake Champlain, Lake George, and the Hudson River. Brown water forces again were employed in The War of 1812 on the Potomac approaching Washington and the Mississippi for control of New Orleans. The Seminole Wars in Florida introduced the Army, Navy and Marines to brown water combat in an environment similar to what would be experienced in Southeast Asia over one hundred years later. The War with Mexico featured blockades and the attacking of the town of San Juan Bautista from seventy miles upriver from the port of Frontera in 1846 achieving a tactical and operational level surprise to the Mexican defenders.⁶

³ Croizat, Riverine Warfare, 10.

⁴ Croizat, Riverine Warfare, 11.

⁵ Croizat, Riverine Warfare, 10.

⁶ Croizat, Riverine Warfare, 14.

All great nations with coasts have developed navies or they were overtaken by other powers with navies. Therefore, waterways and eventually the seas and oceans were seen as vital to economic power. The conquering or extension of civilization of the rivers led to the expansion and control of the interior of America. In the American Civil War it was Grant's war in the west and control of the rivers by the Union Army and Navy through combined operations that was the key to a Union victory more so than defeating Lee in Virginia. Lincoln recognized this and sent General Grant to solve the problem. With Grant's victory at Shiloh, eventual control of the waterways and later successful blockades of major southern ports and rivers, the Confederacy was choked of a means to resist the Union invasion that cut to its very heart. The role of the Union Navy and riverine operations are usually overshadowed by the land campaigns of the Confederacy under General Lee, but the insightful student of warfare would be wise to note that riverine warfare was a key component to a larger operational campaign plan that actually led to a Union strategic victory.

Riverine Warfare in Vietnam

Rivers are the lifelines of continents. Their importance is economic, political and social. The relationship between man and brown water is nowhere as evident as it is in Asia—especially Vietnam. The course of the Mekong River itself is only 250 kilometers long in South Vietnam, but the navigable waterways in the delta area extend over 3900 kilometers.⁷

In under developed countries such as Vietnam, the waterways are the highways. Control of these lines of communication would be key to any campaign in Vietnam. The critical capability for insurgency in Vietnam was the supply of war materials as the uprising transitioned from the “Dau tranh chinh tri”(political struggle) to the “Dau tranh vu trang” (armed struggle). Supplies were forced south and surged for “cach danh doc lap” (gnat swarming), the technique of dozens of daily small unit actions, none being important, but together the effects raise tension among the enemy.⁸ The Ho Chi Minh Trail that stretched from China through Laos, Thailand, and Cambodia percolated into the Mekong Delta and the Republic of Vietnam (RVN).

The French in Vietnam and Riverine Warfare

In Cochinchina, meanwhile, the French strategy of holding the Mekong to isolate the Communist stronghold in Camau from the piedmont and the central highlands had proven effective and the high losses suffered by the Viet Minh were facilitating the French task of pacification.⁹

⁷ Croizat, Riverine Warfare, 18.

⁸ Douglas Pike, PAVN: Peoples Army of Vietnam (San Francisco: Presidio Press, 1986), 265.

The French found many parts of Indochina criss crossed with rivers, making land movement difficult and river boats became attractive alternatives. They used ex-US landing craft (LCM, LCI, LCU, LCVP, LVTs) and locally produced small-craft transformed into combat and transportation units mixed with naval and army personnel. Initial efforts involved ad-hoc units, which evolved into “Divisions navales d’assaut” or “Dinassaults”. Dinassaults proved to be successful river forces that developed workable battle-tactics and equipment for the war in the deltas.¹⁰

The Army Engineering Corps operated STCAN/FOM boats swapped for their armored cars and LVTs with 40mm Bofors guns and LVT(A)4s with 75mm howitzers left over by the American lend lease program. Riverine Flotillas of combinations of naval and army forces called “Flottilles Fluviales de Fusiliers-Marins” (FFFM-Naval Infantry River Flotillas) established a Northern Group in Haiphong and a Southern Group in Phu My in 1946. The French Army in Vietnam further transformed by switching their armor units into Independent and Amphibious Groups and Squadrons by employing M29C “Crabs”, former U. S. Marine Corps M36 “Weasels” and additional LVT(4)s. The Crab had exceptional maneuverability in marshy areas, but had to be transported to assembly areas by boat or truck. Crabs with their low track pressure provided reconnaissance and rapid maneuver elements while the LVT provided lift for a shock element. The LVT (4) s, used by Marines on Siapan, could swim and travel to the fight, but were not always able to traverse the mush without getting stuck and the soft river banks at low tide were a challenge. Also, LVT(A)4s provided organic fire support with 75mm howitzers on a gyrostabilized two-man turret. The French were learning to improvise to counter the threat in the riverine environment.

Firepower was vitally important to deter and destroy enemy attacks. Even the Crabs were armed with .30 caliber machine guns and 57mm recoilless rifles. Dinassaults, task organized using LSMs, DUKWs and LVTs as part of river transport companies of four platoons each and each platoon had 8 LCMs, one officer and 80 men. The LCMs were very reliable boats and served well throughout the war. They replaced many of their tracked vehicles with boats, but they found the Crabs and LVTs when employed together with boats provided

⁹ Croizat, Riverine Warfare, 42.

¹⁰ “Dinassault, French Riverine Forces” Vietnam/Riverine Warfare, <http://members.tripod.co.uk/Indochine/cefeo/dinassault.html> (16 August 2001).

the good combination of firepower and mobility for riverine warfare. Innovativeness was key and the Dinassaults experimented continuously.

Boats for riverine patrols were absolutely vital in controlling the river, but the boat is a single faceted platform. Amphibious vehicles provided a multifaceted platform, but lacked significant water speed while adding armor, firepower, land maneuverability and provided operational flexibility. The Crabs which later were affixed with machine guns, mortars, and recoilless rifles, proved to be too slow and were increasingly vulnerable to Viet Minh attacks. Additional firepower helped, but what was needed was more maneuverability.

Vietnam, (that is, Tonkin, Annam, and Cochinchina) was a largely road less area with multiple rivers presenting difficulties to the movement of conventional forces. In Tonkin the Red River and its delta provide a natural highway, and the Mekong gives a similar effect in Cochinchina, but Annam has very shallow, narrow waterways restricting the size of river vessels.¹¹

A French Joint Riverine Force assembled Naval Transports of LCM's and LSTs to attempt to out maneuver Viet Minh forces in the Delta to counter the insurgency in a nation with an aqueous transportation network and liquid roadways. They tried to overcome the challenges to mobility and maneuver with airborne forces, but they did not have enough lift. In the final analysis, the French Expeditionary Forces chose a more conventional approach with the Dinassaults. There was no perfect solution to riverine warfare in Vietnam and the French and later Vietnamese learned out of necessity to balance strength and weaknesses when planning riverine operations—a lesson the Americans would have to learn twenty years later.

American Interests in Riverine Warfare in Vietnam

Col. Victor Croizat was the first American Advisor to the Vietnamese Marine Corps in 1954. He was influential with Vietnamese senior officers who he had established a relationship with in Quantico, the French War College, and in Haiphong at the Vietnamese Staff College. President Diem was convinced to establish a Vietnamese Marine Corps (VMC) with 1,150 men dispersed from Hue to the Mekong Delta and was dependent on the French Expeditionary Force for logistical support. Because many Vietnamese officers had begun attending the Marine Basic Officers Course, Amphibious Warfare School, and Command and Staff College in 1954 there was common understanding for littoral warfare concepts. Gaining boats and vehicles

¹¹ "Dinassault" 1.

from the French when they left, the Vietnamese Navy (VN) and VMC combined for riverine operations.¹²

Seeing the growing need for an updated riverine warfare doctrine and the likelihood of advisors becoming assistants and later fellow combatants, the Commandant of the Marine Corps (CMC) tasked Croizat to develop the Marine Corps Riverine Doctrine. Croizat, one of the original “Alligator Marines” from WWII, Korea and moreover an expert on Vietnam and riverine warfare, was also tasked by CG FMFPAC, LtGen. Victor Krulak, to prepare an interim document on riverine warfare for Vietnam as the Marines were gearing up for war in Indo China. Meanwhile, General Westmoreland was planning on deploying a riverine force in the Mekong River delta. The Marine Corps had been approached to provide the ground component for the force, but the Commandant had replied that all his resources were committed in the Northern I Corps Tactical Zone. The mission had been assigned to the Army. Westmoreland called a conference at his Saigon Headquarters to review the experience of the French and Vietnamese and develop the organization and operational concepts needed by the American riverine force.¹³ Krulak ordered Croizat, who had turned over command of the 5th Marines at Camp Pendleton in 1965 and was serving as the Chief of Staff of the 1st Marine Division, to support Westmoreland with an interim doctrine for riverine ops and attend the conference. Since Croizat had formed the VMC in 1954 he was ideally suited for the mission.

Late in 1965 the Vietnamese wanted a river patrol force, but they no base in the Mekong Delta. The U. S. Army Corps of Engineers prepared to dredge and use the fill for an “island” base, but in the interim a floating base would be employed. After the planning conference with Gen. Westmoreland in 1966, Croizat summarized the political and economic importance of the delta areas.

It makes no difference whether the security forces there are army or navy as long as they are organized, trained, and equipped to operate in that unique environment.¹⁴

Col. Croizat mentioned to General Khang, the CMC of the VMC, on the subject of VC threat in the Rung Sat,

It’s four hundred square miles, a perfect example of a land that time forgot, a steamy home for prehistoric monsters.¹⁵

To which a General Khang replied,

¹² Col. G. H. Turley, The Easter Offensive: Vietnam, 1972. (New York: Warner Books, 1985), 7.

¹³ Col. Victor Croizat, USMC (Ret.). Journey Among Warriors: Memoirs of a Marine. (Shippensburg: White Mane Publishing Company, 1997), 201.

¹⁴ Croizat, Journey, 203.

¹⁵ Croizat, Journey, 203.

The VC, who threaten shipping in the channel to Saigon, use it's maze of lesser waterways to move their troops and supplies in and out of their bases on the isolates islands. They are more dangerous than any monsters.¹⁶

The first American to die in Vietnam at the hands of the VC in the Rung Sat was Lt. H. Dale Meyercord USN who was an advisor to a combined VN and VMC river assault group.¹⁷ “Rung Sat”, Vietnamese for dense jungle, is a vast mangrove swamp between Saigon and the Sea. The Communists used the area as a transit zone between US III and IV Corps TAORs and set up supply depots and other facilities.¹⁸ Various vehicles and animal conveyances made convoys susceptible to ambushes. The VC denied the use of the road and offshore waterways turned to the upland and inland waterways to establish the Ho Chi Minh Trail as their major LOC from the north to the south. Croizat told the Amphibious Force Pacific staff in San Diego just before a planned operations were to begin in the Rung Sat, that if the Marines were to land in a conventional fashion, then enemy would simply slip through the mesh and disappear.¹⁹ He saw a need to coordinate landings with a blocking force by river patrols forces. This called for a combined and joint riverine operation, but the concept was never validated, ran afoul of command problems, especially with coordination of local forces, and little was accomplished.

The Vietnamese Navy and Marine Corps using the French Dinassalts model and leftover equipment adapted their military organization, equipment, and tactics to the unconventional nature of the conflict and imperatives of the terrain, as best they could. After the French left, the Vietnamese Navy and Marine Corps even with the equipment, tentative doctrine, advisors and a strong will to fight, were simply over matched by the scale and ferocity of the Viet Cong insurgents. The United States Navy took over coastal surveillance and inland waterways missions with coordination with the Vietnamese forces during Operations MARKET TIME and GAME WARDEN.²⁰ The Americans with their Army Air Assault Battalions could lift 600 men at one time in order to maneuver land forces behind the enemy. Similarly the Marines could conduct a vertical assault behind enemy lines from the sea and would make conventional opposed landings across the beaches of Vietnam almost unnecessary. The rivers were not the coast and the triple canopy jungle, which combined with

¹⁶ Croizat, *Journey*, 203.

¹⁷ Croizat, *Journey*, 206.

¹⁸ Croizat, *Riverine Warfare*, 20.

¹⁹ Croizat, *Journey*, 211.

²⁰ Croizat, *Journey*, 155.

the mangrove mushiness provided an impossible landing zone for conventional air assault operations, provided a dilemma for American planners.

Initial Lessons Learned in Vietnam Riverine Warfare are Studied in Quantico

Nor must Uncle Sam's web-feet be forgotten, at all the watery margins they have been present. Not only on the deep sea, the broad bay and the rapid river, but also up the narrow muddy bayou and wherever the found was a little damp, they have been and make their tracks. Abraham Lincoln on the contribution of the Union Navy during the Civil War.²¹

In May 1966 the CMC directed the Coordinator of the Marine Corps Landing Force Development Activities at Marine Corps Schools in Quantico to incorporate the recent lessons learned in Vietnam riverine operations into the FMFM 8-4 as the basis for doctrine and techniques. He advocated the use of rotary wing and fixed wing support into the governing principles for the Marine-Air-Ground-Task-Force (MAGTF) in the riverine environment.²² Croizat, as Commander of the United States Military Advisors Command in Vietnam (COMUSMACV), an armament suite which consisting of armored turrets, aircraft 20mm machine guns with flash suppressors, 40mm machine guns, M60 machine guns, M60 mortars and LAWs for the river assault craft and an M14, M49, 357 Magnum Smith and Wesson M19 pistols and Missger (M185) 20 gauge shot guns for the crews. Charts of prototypes were under evaluation including everything from rubber boats to air cushioned vehicles (PACV) which were the predecessor of the modern Landing Vehicle Air Cushioned (LCAC). The existing systems LCMs, LCVPs, and LCUs were adequate for partial fulfillment of requirements identified, but the lessons learned so far identified requirements for other specialty craft for riverine operations.

The South Vietnamese Navy had sampans which only drafted one foot, but were limited in speed and responsiveness. The Dong Nai Class motor boat was 17 feet and 2 feet high with a draft of 2 feet. It had a speed of 17 knots and carried 17 passengers. Patrol Boat River (PBRs) were 32 feet long, drafted 2-5 feet and could carry 6 passengers at speeds of 25 knots for a range of 150 miles. Various armament packages could be configured onto each of these craft, some ingeniously so.

Under the requirements for riverine operations identified in the FMFM 8-4 (Draft), it was decided that river boats must be operationally superior in speed, endurance, firepower, and protection to river boats

²¹ Thomas J. Cutler, Brown Water, Black Berets (Annapolis: Naval Institute Press, 1988), 210.

²² USMC, "HQMC Comments on Vol. 2 FMFPac River Warfare Study" 13 May 1966 (Quantico: MCRC Archives, 2), 12 December 2001.

currently operating against North Vietnamese riverine craft. Newly constructed or purchased craft would be required to maintain a sustained speed of 15 knots and a range of 200 miles. The maximum draft requirement would be 3 foot six inches, including being able to scrape bottom without damage to propulsion systems. Common and interoperatable radios were also identified as primary requirements. Trade offs went in favor of firepower.

The VN grew by leaps and bound between 1961 and 1965. They created three task oriented forces: sea force, river force and junk force with three associated River Assault Groups (RAGs) for Sat Cong (killing Communists) operations patterned after the French Dinassauts.²³ Lessons learned from the French and the Americans initial experiences were quickly published in a series of Fleet Manual/Reference Publications from 1966-1968 with key information for planners of future riverine operations.

Viet Minh and North Vietnamese Army Riverine Forces

Against the French, the Viet Minh (VM) developed great skill at placing and carrying out ambushes on road and river convoys, because on their reliance on the road and river systems especially in rough terrain and marshy areas where switchbacks meant that a convoy could only defend piecemeal. Also the VM artillery could not hit moving targets, so the disabled craft by means of an ambush, would become a static target on pre-registered coordinates via a combination of command detonated mine and ambush of a convoy.²⁴ North Vietnamese Army (NVA) forces improved their capabilities to counter the VN, but the threat of vertical assaults in combination with river sweeps with boats presented a confounding dilemma. The Rung Sat Special Zone (RSSZ), a large mangrove swamp area astride the main shipping channel between Saigon and the South China Sea. In the (RSSZ) rivers served as the principle lines of communication for civilians, enemy, and friendly units. Defoliation was employed to some effect, but many neap palm groves only changed colors leaving concealment for riverbanks and small boat traffic. A diurnal tide with a range of 12 feet presented unfordable streams with steep banks. The VC T-10 HQ in the (RSSZ) directed the activities of eight main force companies equipped with maritime mines and small arms. Their mission was to interdict traffic on the main shipping channel (LONGTAN) as sappers in small decentralized groups. Their operational goals were

²³ Cutler, 21.

²⁴ "The Tiger and the Elephant: Viet Minh Strategy and Tactics 1945-54" Vietnam/Vietminh/Tactics, 23 August 2001, <<http://members.tripod.co.uk/Indochine/vm/tiger/html>> (23 August 2001). 8.

twofold: interdict traffic on the river, and deny use of the river to the South Vietnamese. They used a small force to “doi ti” (tie-down) a larger force from being employed in another zone. The VC technique was to trigger the ambush with a command detonated mine and then follow with small arms for less than a minute of intense firing and then “didi mau” (run quickly) to their awaiting sampan and escape before sufficient reaction forces could be introduced.²⁵

Marine Corps Riverine Warfare Doctrine

Although much has been written in the historical vein, little treatment has been given the subject from a doctrinal view point. Defensive riverine operations are those operations necessary to achieve and maintain control of waterway systems and its contiguous areas for the purpose of denying their use to the enemy.²⁶

USMC riverine concepts of operations were focused at the rifle company or smaller level include offense, patrols, ambushes, counter ambushes, raids, river traffic control and base defense. Such river support requires shallow draft boats. Marine Corps concepts included the LCU 1610 Class Mother Ships, fire support boats, command boats, basic river boats and fire team boats.²⁷ Headquarters Marine Corps published a draft doctrine for riverine operations in 1966, which addressed only equipment organic to the USMC and hence had only limited applicability to the ‘joint operations’ conducted by the US Army and Navy in the III and IV Corps TAOR’s. The doctrine did provide guidance for the conduct of small-scale riverine operations in I Corps TAOR for Marines.²⁸ A Joint committee developed by the Commander Amphibious Force, Pacific Fleet proposed that for riverine operation the Navy would provide assault lift in support of the Marine Corps (or Army) landing forces for a full range of interrelated and sometimes uniquely naval waterborne operations.²⁹ The Chief of Naval Operations (CNO) directed the Chief of Naval Material in August 1966 to establish river warfare boats for Vietnam to improve Navy’s capability to conduct counter-guerrilla operations on rivers and deltas of South Vietnam in support of Vietnamese and US combat operations. Interest in other areas of the world, specifically counter-insurgency missions, was at play here, as well as, the immediate need for boats in the Mekong Delta. In a section entitled, ‘harmonization’ the CNO directed that information of his

²⁵ USMC, FMFMRP 12-41 Vietnam 1967 (Washington D. C.: Headquarters Marine Corps, 1968), 161.

²⁶ USMC, FMFM 8-4 1968 Doctrine for Riverine Warfare Operations (Washington D.C.: Headquarters Marine Corps, 1968), 2.

²⁷ Commandant of the Marine Corps, Letter to the Coordinator of the Marine Corps’ Landing Force Development Activity, Marine Corps Schools: 13 May 1966 (Washington D. C.: MCRC Archives, CD-ROM #43, 21 December 2001), 2.

²⁸ USMC, FMFM 8-2 Riverine Operations (Washington D. C.: Headquarters Marine Corps, 1966), .

decision to be transmitted to the United Kingdom, Canada, Australia, Norway and Germany. A Marine Infantry Support Boat was designed for a troop lift of infantry –type forces in riverine operations with the capability to lift (14) combat equipped troops and four navy crew. The boat would be 30 feet, by 10 feet with a draft of 2 ½ feet and armed with a 50 caliber machine gun with high maneuverability and minimum draft for waters with heavy vegetation.³⁰

The Director of the Marine Corps Landing Force Activities Development Center sent a letter back to the CMC in August 1966 requesting an increase from 202 boats to 300 with troop carriers, command boats and assault boats. He argued that any boats over 50 feet places severe handicap on maneuverability. He argued that the boats must be highly maneuverable and capable of a turning radius of 50 feet at 6 knots. A total length of 40 feet would be acceptable. The dangers of certain arms was discussed such the 40mm grenade launcher, 60mm mortar and the LAW when employed from the boats in triple canopy jungle. Also, the firing of the LAW from a small boat produces a significant back blast that could injure exposed passengers or ignite the gasoline used in the outboard boat motors. Embarked troops would also require protection from the elements and a soft canopy was suggested that would not interfere with the employment of the boats weapons or individual weapons. The letter closed with a recommendation for the CMC to make arrangements with CNO for active Marine Corps participation in development and testing of boats for riverine warfare. ‘Draft, speed, armor, firepower and troop interests should be represented.’³¹

Joint Riverine Operations in Vietnam

The enemy moved at night often in human powered craft using the river current. Marines in 1965 were wholly engaged in northernmost part of the country and their riverine operations experience was limited to using Amtracs to move and support troops opening the restricted waterways of Annam (I Corps TAOR). Even with the limitations of the Amtracs, had the Marines been made available for redeployment to the Mekong Delta area, after specialized training, they would have had a more traditional relationship with the

²⁹ Chief of Naval Operations, Letter to the Commandant of the Marine Corps about Doctrine for River Operations, 9 December 1966. (Washington D. C.: Headquarters Navy, 1966 (Washington D. C.: MCRC Archives CD-ROM #43, 21 December 2001). 1.

³⁰ Chief of Naval Operations, Letter to the Chief of Naval Material August 1966.. (Washington D. C.: Headquarters Navy, 1966 (Quantico: MCRC Archives CD-ROM #43, 21 December 2001). 2.

Navy than the Army did. During Operation GAME WARDEN in February 1966 the US Navy embarked VMC, paramilitary units, and police as infantry to check boats and enforce curfews on the river. Later the Army and Navy conducted Joint Riverine Operations in the Mekong Delta. The Army did not have the longstanding amphibious relationship the “blue-green team” and their brown water experience started from zero. Marines would have been better suited to the environment in the delta operating with the Navy, but they were assigned to the north where they were more immediately needed as a buffer just below the DMZ. From 1965-1969 the peak of US involvement in Vietnam, Marines conducted 62 landings, mostly by the Special Landing Force/Amphibious Readiness Group (SLF/ARG) of the 7th Fleet. The capabilities of the SLF left no doubt in the enemy’s mind that no coastal area of Vietnam was immune from attack from the sea.³²

River operations are normally timed in order to take advantage of optimum tidal conditions. Prediction of a 2.5 foot tides have been found to usually provide sufficient floatation for the LVT to permit successful movement. Experience has shown that the LVTP-5 family of vehicles can negotiate rivers and waterways when considerably less than optimum conditions prevail.³³

The Navy Operation GAME WARDEN code named (TF- 116) for its river patrol force utilized LCPL’s and various craft. PBR’s were developed for Vietnam through the CNO’s initiative for a balanced force to control the rivers. The PBR was equipped with the Raytheon 1900/N radar, two AN/VRC-46 Fm radios for army hops, Vietnamese Air Force and other boats. A crew of four armed with various machine guns and small arms were employed in sections of two PBRs for river patrols. The Navy had a preoccupation with speed and supped up the Mk1 PBR to do 30 knots. After they installed the communications suite and ceramic tiled armor protection the MK1s could only manage 20 knots. The Navy used speed as a combat measuring stick. The Mk2 emerged in 1967 with more speed, more armor and more firepower at the request of the GAME WARDEN sailors.³⁴ Minesweepers were employed on the Long Au River with MSB in the lead to clear a path for the MRF PBRs.

Operation MONSTER (Quai Vat) focused on the VC forces in November of 1966 hiding in the Plain of Reeds north of Saigon. River depths near the guerrilla hideout varied between 1 and 6 feet and the Navy employed Patrol Air Cushioned Vehicles (PACVs) and used Army Green Berets to ferret out the VC. The air

³¹ Chief of Naval Operations, Letter to the Chief of Naval Material, 3.

³² Col. Victor Croizat USMC (Ret.), Across the Reef, 216.

³³ USMC, FMFMRP 12-40, 159.

³⁴ Cutler, 157.

cushioned vehicles were so fast and maneuverable that they were a key to the success for CTF 116.9.1 at Moc Hoa. Using the right type of vehicle for the terrain and hydrograph with combined arms and a joint force seemed to be a recipe for more PACVs, but at a price tag of one million dollars apiece compared to ninety thousand dollars for a PBR the Navy sold most of their PACVs to the Iranian Navy and went with the MKII PBR instead.³⁵ The PBRs were quick and could go quiet with an add on small outboard motor for creeping through the narrow channels to debark SEALs or conventional forces. Admiral Zumwalt advocated the MRF put Swift Boats in the Mekong Delta to put pressure on the enemy and did so with success in Operation SEA LORDS. The Army and Navy formed a Joint Task Force 117 dubbed the Mekong Delta Mobile Afloat Force or MRF with squadrons of PBRs and a HQ on LST “Mother ships.” It was more potent and less venerable than the VNN and French Dinassauts had been. The impact of the newly conceived force would ideally have been elements of the US MC because of their capability in amphibious warfare and their familiarity with working alongside the Navy, but the Marines had been committed in force to the northernmost military region early in the war and they did not have the resources to commit the delta as well. The Commandant advised the CNO that the Marines were needed up north near the DMZ and along the coast as well as a SLF and could not support the Mekong Delta Force as well with out reserve call ups.³⁶ General Westmoreland convinced the Army to reactivate the 9th ID and used the 2nd Brigade (General Westmoreland’s old WWII unit.) to operate with the MRF.

The VMC, USN and USMC conducted Operation DECKHOUSE V, Song Tang in Vietnamese, on January of 1967 in the IV Corps TAOR for a combined and joint riverine operation. Boats were used to attack the enemy in the Communist Sanctuary of Thanh Phong, on Thanh Phy Island off Kien Hoa Province. The terrain was laced with rivers and canals and would require a variety of craft for a surface assault combined with a heliborne insert. As the tides changed the current and water level in the rivers and canals began to rise and progress was slow. Due to the lack of progress of the small boats against the current and foot patrols, the Marine Brigade organized for helicopters to transport troops over the more dangerous rivers. LVTs would have enable the maneuver force to better sweep the area . It was touted as the first amphibious operation for the joint VMC, USN and USMC, but it did not accomplish its objective due to poor planning, coordination,

³⁵ Cutler, 190.

and the lack of a LVTs. LVTs were not available for the mission due to their commitment and support of units to the north and the distance from I Corps to IV Corps. Perhaps a combination of vertical envelopment may have been possible if the waterborne force identified the enemy force and could call in fire and block their escape, but that would take training that they did not have.³⁷

The mission of the Vietnamese Marine Corps at about 1100 strong, was to prevent the interdiction of enemy forces in the RSSZ by continuous patrolling and ambush activity in area adjacent to the river. Search and destroy missions were oriented on the guerrilla elements in the TAOR using River Assault Group –22 (RAG) with helicopters attached in a joint VN and MC operation. A company was inserted by RAG with platoons spreading out on SSB while others patrolled the river banks. The RAG boats could provide suppressive fires and trip ambushes as well as coordinate aircraft and artillery if available. During a 70 day period 18 sampans were destroyed with numerous VC killed and the equivalent of a battalions worth of arms and supplies. An analysis of the joint Vietnamese riverine operation in the RSSZ was characterized by close cooperation, combined arms, excellent intelligence, and rapid reaction to accomplish the mission with minimum forces. The results proved the validity of sweep operations in the delta and provided a basis for future operations in similar terrain, especially the III and IV Corps TAOR, of which the Army and Navy would team up—not the Marines and Navy. The Marines were spread out in the I Corps TAOR as an immediate buffer against the VC along the DMZ. The common doctrine, language and ethos that the Marine and Navy shared would have provided a starting point for riverine operations in the south perhaps better than what the army and navy later put together.³⁸

The LVT5

The LVT5 used in Vietnam was the fifth in a series of assault amphibians developed for the Marine Corps. There were five variants that comprised the LVT5 FOV—all with bow ramps and designed for eighty percent waterborne operations and twenty percent land operations. The ramp was moved from the rear, as on previous Amtracs, to the front, based on the recommendations of infantry leaders, who fought in World War II

³⁶ Cutler, 237.

³⁷ Col. That Ton Soan RVNMC, “Amphibious Operation Deckhouse I, Song Than 1/67,” *Vietnam/Riverine Warfare RVN Navy/MC* 3 Dec 2001, <http://members.tripod.co.uk/Indochine/riverwarfare.html> (19 December 2001), 13.

³⁸ USMC, *FMFMRP 12-41*, 168.

and Korea and thought a bow ramp would allow for quicker debarkation and more rapid orientation on the enemy. At a monstrous 29 feet 8 inches in length, 11 feet 8 ½ inches in width, and 8 feet 7 ½ inches high the LVT5 weighed 87,780 pounds when fully loaded. On land the range of the LVT5 was 250 miles and in the water the range was 65 miles. The inverted “V” bow and bottom hull produced more stability in the water than previous Amtracs. An LVT5 had a land speed of 30 miles per hour and a water speed of 6.8 knots in calm water. What most people remember about the Amtracs in Vietnam was that they carried 486 gallons of volatile gasoline for their thirsty LV1790-1 Continental engines in a fuel tank in the hull, under the deck plates in the troop compartment, which in many cases proved to be a mine magnet. The LVT, a truly amphibious platform, provided the key operational maneuver capability to the ground combat commander to conduct riverine operations as part of a MAGTF. The LVTs were employed in amphibious assaults, riverine operations, and on land in the I Corps Tactical Zone. When employed in support of the infantry, the LVTs provided the lift and close-in suppressive fires in order for the infantry to close with and destroy the enemy through fire and maneuver. The LVT5 FOV are the only Amtracs in the 60-year history to employ the bow ramp, which was discovered in Vietnam to open into deadly fire instead to the rear with the front of the vehicle for cover.³⁹

The LVTP5A1, designed to transport a maximum of 34 combat-loaded troops with 25 as the optimum, was employed to transport troops across rivers to the line of departure for dismounted sweeps or blocking operations, and to provide limited fire support with the M6 .30 caliber machine gun housed in the unstabilized M1 cupola. The weapons system was designed to deliver suppressive fires from the water level during amphibious assaults, where it performed well; however, on land it was difficult to spot targets through the angled vision blocks while in motion. It was even harder to train the gun on fleeting enemy by frantically turning the hand crank of the heavy cupola, which frequently jammed during violent cross-country movement. The LVTP5A1 also lacked night vision/night firing capabilities.⁴⁰

No one wanted to ride inside an LVT for fear of hitting a mine due to the gasoline fuel tanks in the deck and fear of explosions, but riding on top voided the protection of the steel hull, which offered protection against small arms and fragmentation.

³⁹ Croizat USMC (Ret.), conversation with author, Camp Pendleton, April 2001.

By this time, Amtracs carried sand bag emplacements for a machine gun forward of the M1 turret. The turret design allowed only limited depression of the M6 .30 caliber machine gun and its position resulted in a wide area of ‘dead ground’ to the front of the vehicle.⁴¹

Consequently, sand bagged machine gun positions for the embarked infantry were developed atop the Amtrac and forward of the onboard .30 caliber machine gun. Ingeniously, 106 recoilless rifles and 81mm mortars, and other improvisations were rigged atop Amtracs to provide more firepower. Jury rigging additional weapons systems atop the Amtracs was productive at times, but often the back blasts or higher silhouette of the Amtrac singled them from “vanilla” LVTP5s for NVA RPG gunners.

The LVT(C)5, the communications variant, provided communications capabilities to various elements of the MAGTF and was employed by Amtrac units for internal command and control or for supported units. Fitted out with a special communications suite, the LVT(C)5 provided a command post, that was mobile either on land or in the water. The communications variant began by improvising an LVT(P) on Okinawa during 1945 and has been a requirement on each subsequent Amtrac FOV series.

The LVT(R)5, recovery vehicle, was organic to Amtrac units and provided support to platoons and companies with the maintenance and repair of the LVTs. The boom of the LVTR5 could lift the massive LVT engine and the wench could be used to recover mired LVTs or other vehicles. LVT(R)5s were vital to the Amtrac units.

The LVT(E)1, engineer variant, was capable of firing two line charges for clearance of waterborne or land mines. It was assigned a wide variety of duties ranging from simple transportation of men and equipment to firing line charges, removing obstacles, and excavation of mines. With a cowcatcher on the front, the LVT(E)1 could plow a path 12 feet wide and at a depth of 16 inches. The plow could be lifted hydraulically and made negatively buoyant by filling it with sea water for conventional amphibious assaults or riverine operations. The massive LVT(E)1 weighed 94,470 fully loaded.

The LVT(H)6 was an LVT(P)5 hull with a T96E1 105mm howitzer turret and a 50 caliber machine gun gyrostabilized which fired a combination of rounds including, HE, HEDP, WP, Cor Fam, and Flachettes. Called the “How-6”, the LVT(H)6’s 105mm howitzer had a range of 12,000 yards with HE rounds. LVT(H)s

⁴⁰ Croizat, *Riverine Warfare*, 118.

⁴¹ Simon Dunstan, *Vietnam Tracks: Armor in Battle*, (London: Osprey Publishing Ltd., 1982), 147.

were employed as mobile and floating artillery pieces in various supporting roles and could lead an amphibious assault or river crossing with deadly accuracy and overwhelming firepower. Since World War II, Amtracs had always had an LVT(A) or armored vehicle. Beginning with a 37mm and progressing to a 75mm at Iwo Jima, Okinawa, and Korea, the “big gun” variant was a key player in the LVT FOVs.

Land and water operations utilizing the LVT are possible without modifications due to the low silhouette in the water, protection from small arms and employment as floating bridges. Command and control is afforded by the command variant LVT(C) 5, and the firepower and versatility of the missions of the LVT(H)6 and the LVTE1 round out a very useful Amtrac FOV even with certain limitations. The LVTs were slow in the water, offer limited maneuverability while afloat, produce high noise, and extensive maintenance problems. Intelligence preparation of the battlefield was important when planning for the employment of LVTs, but amphibious planning factors applied to riverine operations nicely and the Marines adapted nicely.

Factors for successful employment of LVTs in the riverine environment include: river width, condition of river banks, river velocity, mine, barriers, obstacles, river depth, tides, approaches to crossing sites, composition the river bottom.⁴²

The LVT5 Employment in Riverine Operations in Vietnam

The proposed mission of the LVT in Vietnam was to support amphibious assaults for the (SLF) 7th FLEET for ship-to-shore movement similar to WWII and Korea by leading the surface assault element ashore. In 1964 the Marine Corps published a Fleet Manual directing a mission for the Amphibious Tractor (LVT) Battalions.

The mission of the Amphibian Vehicle unit is to support the landing force both tactically and logistically. Amphibian vehicles are employed during the amphibious assault, during river crossings as part of mechanized task forces and during other special operations ashore. When properly employed, they are effective in operations after dark.⁴³

Even though the Marine Corps had a remarkable history of amphibious assaults against traditional anti-landing defenses, the nature of the conflict and the littoral environment in Vietnam meant Amtracs would operate in ways not yet planned for in Fleet Manuals or taught in Marine Corps Schools.

⁴² USMC, FMFM 9-2 (Proposed Revision) (Washington D. C.: Headquarters Marine Corps, 1969), 37.

⁴³ USMC, FMFM 9-2, 3.

Early Unconventional Missions for the LVTs in the Riverine Environment

Mike Company 3/3 was tasked with crossing the Vu Gia River in 1966. On this very unconventional mission, eight LVTP5s crossed the Vu Gia River to bag some elephants, two of the LVTP5s were armed with 81mm mortars and two were topped with 106s to provide cover. Intelligence reports revealed the VC were using elephants to bring heavy artillery from Thailand along the Ho Chi Minh Trail to a village adjacent to the Vu Gia River, which if established, could range the 3rd Marine Division supply area. While there was a slim chance of spotting VC in the bush, the next best thing was the elephants. Upon contact with the VC a firefight erupted leaving no Marine casualties, 5 dead VC, 1 wounded, and 5 dead elephants.⁴⁴

In Search of Riverine Warfare Doctrine

By 1968 the Marine Corps published a Doctrine for Riverine Warfare (FMFM 8-4) that refers to successful US Navy riverine operations along the Yangtze River in China from 1927 to 1932. It also mentioned that the LVT(H)6s can be towed if it has to go a long way or if the currents are strong and that it can be fired from a landing craft from the water or shore. Other capabilities and limitations are mentioned in FMFM 8-4.

Missions for the LVT include: river blockade, fire support, floating medical aid station, waterborne supply point, crash/rescue, support of night fighting with the Xenon Searchlight kit, and for medevac with litter kits. For the LVT, river operations in water six foot deep are a 'go', but a marsh would be too shallow or river currents over 6 mph would preclude LVT participation.⁴⁵

LVTs in Operation DOUBLE EAGLE on Riverine Patrols

Amtracers from Bravo Company 3rd Tracs supported BLT 2/1 from August 1965 to April 1966 in Operation DOUBLE EAGLE. Operating for weeks at a time from the Chu Lai Junk Fleet cantonment from the "Splash Point", they spent hours daily in the rivers north and west of Chu Lai, Danang, and later in support of 5th Marines in An Hoa. They patrolled the Song Vu Gia, Song Cu De and Song Tra Bong Rivers for days serving as floating river control points at night, and they also conducted sweeps of the rivers during the day. They were effective in controlling the river lines of communication in their sector.⁴⁶

⁴⁴ "Amtracs Crossing the Vu Gia River," Amtracs/Vietnam, ><http://geocities.com/2689/mpic9.html>> (18 December 2001).

⁴⁵ USMC, FMFM 8-4 (Washington D.C.: Headquarters Marine Corps, 1987), 2.

⁴⁶ David Stefansson. [stefanssd001Ahaawaii.rr.com] "Amtracs in Riverine Operations in Vietnam," personal e-mail (2 November 2001).

LVTs at the Battle of Dai Do

Tom Williams recounts the Battle of Dai Do from the viewpoint of an 18 year old PFC (Amtrac Crewman), who rode an LVT(P)5A1 with a 106mm recoilless rifle rigged on the top deck as a floating tank. As he creped up the Cua Viet River from Mai Xe Tai to Dai Do in support of BLT 2/4, he noticed an unoccupied bunker with a captured 106 mm recoilless rifle pointing at the near shore ingress route of the LVTs. After a night sapper attack and fire fight his LVT attempted to re-enter the river to evacuate KIAs, but hit a mine. As he struggled under fire to repair his vehicle, he realized he was in an NVA anti-landing minefield 100 yards away from the now re-occupied 106 position--an NVA crew was loading the gun.

The Amtracs were already a huge and tempting target and having the 106's on top made them even more tempting to shoot at. Amtracs performed many functions during Dai Do. We carried troops and assaulted with them into some of the actions. We used 106s and acted like tanks...until the vehicles disabled were by RPG fire. We were instrumental in doing evacuations because it was too risky to bring in the choppers.⁴⁷

LtCol. William Wise, Commanding Officer of BLT 2/4 was medevaced after the Battle of Dai Do in Tom Williams Amtrac along with several WIAs and KIAs—nothing else could have done the job. Amtrac's removed all the dead and wounded Marines—2/4 left no one behind...except dead VC. At Dai Do, the VC had encountered "The Magnificent Bastards" of 2/4 and the capabilities of the versatile but gangly LVT, but were overcome with combined arms and retrograded to fight another day. Amtrac's were key to the extraction of 2/4. Wiese received the Navy Cross and two company commanders, Captains Livingston and Vargas, were awarded Medals of Honor at action at Dai Do. Intelligence reports would later reveal that the action of 2/4 preempted a division sized attack down the Cua Viet river to Dai Do aimed at the 3rd Marine Division Headquarters.⁴⁸

The Limitations of the LVT paid hell for the Marines during Operation NAPOLEON/SALINE at Dai Do. BLT 2/4 hit Lam Xuan East in Operation NAPOLEON/SALINE after assaulting along the riverbanks of the Cua Viet River on both sides of Jones Creek to keep the supply lines open to Saigon and to the sea. Due to the rough terrain and mud flats one LVT got stuck, hit a mine and led to a piecemealed dismounted attack.

⁴⁷ Tom Williams, "An Amtracers View of Dai Do" Amtracs/Vietnam, 1997, <http://www.mvcc.com/user/amgrunt/my-memoris.html> (18 December 2001), 2.

BLT 2/4 wanted Onto's and 106s, but the Onto's and jeeps couldn't swim. They realized later what they needed was a truly amphibious fire support asset--not Onto's or 106's lashed to the top deck of LVTP5's. They needed LVT(H)6s and their 50 cal and 105 howitzers. The LVTs did not have smoke grenades or an on-board smoke generation system for screening movement and would have been key to covering the dismounted infantry and other Amtracs during river crossings and dismounted attacks. The limitations of the LVT played havoc during many operations especially riverine operations since often the enemy could hear and see the Amtracs coming for miles. The 30.cal machine gun on the Amtrac lacked any real punch and could not depress enough for close in firing or covering fire in the water.

The LVT Platoon (10 LVTP5's) at Dai Do from 1st Amphibious Tractor Battalion in support of 2/4 against the 320th NVA, had one vehicle destroyed by a mine and 3 damaged from RPG hits in a three day period. By the end of the 1968 3rd Platoon, Bravo Company, 1st Amtrac Battalion had replaced every vehicle due to combat damage.⁴⁹ This was true for most Amtrac platoons in country.

LVTs in Operations BOONE and DESOTO

The 3rd Amphibian Tractor Battalion FMF, 1st Marine Division (Rein.) FMF during April 1967, participated in Operations BOONE and DESOTO by conducting river patrols to enforce nighttime curfews on the river and by day to check out watercraft for VC and VC supplies. Typically two LVTP5s were used to establish a traffic control point afloat. One would block the traffic while the other LVT would provide covering fire as necessary with small arms and from the bobbing M1 turret. They supported 1st Tank Battalion with a variety of capabilities: mobile reaction force, resupply, troop transport, mine clearing with the LVTE1s, control of water routes, night listening and observation posts, and medevacs. The versatility of the LVT, even with its drawbacks, provided a truly amphibious platform that could seamlessly transition from a land based patrol to a riverine patrol and conduct sweeps from inland to seaward for defense of beach support areas.

⁴⁸ Keith Nolan, Magnificent Bastards: 2/4 in Vietnam: The Joint Army-Marine Defense of Dong Ha, 1968. (New York: Dell Publishing, 1994), 234.

⁴⁹ TomWilliams, "The Platoon, Vietnam-1967 & Mineapolis-1995, 1997," Amtracs/Vietnam, 24 August 2001, <http://www.geocities.com/Pentagon/5791/PLTHistory.htm> (24 August 2001).

The LVT(E)1s were especially useful in destroying mines, booby traps, caving in tunnels through their weight and explosive charges, and for reducing bamboo thickets and fortifications.⁵⁰ A LVT section was employed to destroy an entire village comprised of thatched huts atop a complex tunnel system when a stubborn and deadly skillful VC sniper could not be roused. The explosion sent the ‘vil’ two hundred feet into the air. When the smoke cleared—the ‘vil’, tunnels, and the sniper were gone.⁵¹

LVTs in Operation WOLF GARDEN

During Operation WOLF GARDEN, 1st Amphibious Tractor Battalion, 3rd Marine Division (Rein.) FMF, was directed to protect the mouth of the Cua Viet River. Employed as an independent battalion and maneuver element, the battalion task organized for riverine warfare with what they had on hand and could scrounge.

An effective combination on river patrols and sweep operations along the banks was a combination of two LVTP-5s afloat with 106s mounted on the top decks. With the low profile of the Amtracs in the water the 106's didn't give us away like they did on land.⁵²

3rd Amtrac Battalion was assigned the tactical mission with no supporting units--a role reversal from traditionally supporting the infantry and tanks. Amtracers became “Amgrunts” (Amphibious Ground Unit-AMGRUNT) patrolling riverbanks on foot and along the rivers by LVTs, which illustrated the flexibility of Amtrac units in the riverine environment as part of a MAGTF.

LVTs Employed in Sweep Operations in the Riverine Environment

Sweep operations typically assigned to Marine units in I CTZ in 1967-1968, were conducted in areas partially bounded by rivers and provided natural obstacles. Rivers and riverbanks were controlled in order to use waterways as line of communication and resupply. Rifle teams in 15 foot boats with 15 horsepower motors were used to sweep the riverbanks while ground forces conducted sweep operations parallel to the river.⁵³ The Viet Cong (VC) employed maritime and land mines to thwart the Amtracs and to ambush patrols.

⁵⁰ Headquarters 3D Amphibian Tractor Battalion FMF, 1st Marine Division (Rein.) FMF, “Command Chronology for the Period 1 March to 31 March, 1967, Combat Report Sit. Rep. #234 for period 010001H to 012400H 1967,” MCRC Archives, 10 December 2001, 2.

⁵¹ Col. Donald Head USMC (Ret.), personal conversation with author, 1991 Camp Lejeune.

⁵² Thomas Williams, [williamstbigfoot@aol.com] “Amtracs in Vietnam,” 4 November 2001, personal e-mail (4 November 2001).

⁵³ USMC, FMFMRP 12-42, 41.

During an operation, an LVT supporting a combat patrol struck a mine. Marines from the LVT and the patrol immediately began examining the damaged vehicle and prepared to make repairs. While the troops clustered around the vehicle, an explosive device was command detonated by the enemy causing severe personnel casualties.⁵⁴

LVTs with The Special Landing Force

The SEVENTH Fleet Special Landing Force (SLF) executed 13 amphibious operations during 1968, a total substantially smaller than the 25 conducted during 1967. In the northern part of the I Corps Tactical Zone (CTZ) two Marine BLTs from the SLF conducted Operations KENTUCKY, LANCASTER, and NAPOLEON/SALINE. These extended periods ashore were initially begun as amphibious assaults to clear the Cua Viet area accounted for nearly 3,500 NVA/VC killed in 1968.⁵⁵ The BLTs came from the sea—Amtracs were the prime movers of personnel and equipment in the littorals of the I CTZ. The flexibility and responsiveness of the SLF BLT's reduced enemy action in the northern I CTZ so much so that both BLTs were back loaded to provide a mobile strike force from the sea instead of remaining in a static position ashore. The synergy of the SLF for the commander of the SEVENTH Fleet was tremendous. Employed either as an integral part of the SLF as in Operation MEADE RIVER south of Da Nang or as a separate tactical entity, as in Operation DARING ENDEAVOR and VALIANT HUNT, both south of Hoi An, the SLF proved the value of rapidly deployable mobile amphibious forces.

LVT(H)6's in Action

Col. John Harms USMC (Ret.) was the Commanding Officer of the 1st Armored Amphibian Company, 11th Marines, 1st Marine Division (Rein.) in Vietnam from September 1968 to May 1969 and employed the LVT(H)6s in numerous riverine operations.

On at least three occasions, we took four guns out of battery and sent them seaward about 2,000 yards and down the coast line to a predetermined area we were to land (shore to shore maneuver). We shot cor fam bomblets as we approached from the sea. We did riverine operations up Cau Viet at the mouth of the river when we were OPCON to a 105 battalion of the 12th Marines. We had (6) LVT(H)6s in direct support for the infantry and 1st Amtrac Battalion, who we lived with.⁵⁶

The How-6s provided direct fire with HE to seal off the avenues of escape. Infantry then went through the objective mounted or dismounted from LVT(P)5A1s. How-6 fires were controlled by the supported infantry unit for indirect fire on the cor fam missions and by the Amtrac Platoon Commander when they could observe

⁵⁴ USMC, FMFMRP 12-42, 44.

⁵⁵ USMC, FMFMRP 12-42, 8.

the impact themselves, and the supporting artillery fire direction center other times, which provided deadly responsiveness and great flexibility.

LVTs: Operation GEORGIA Near An Hoa

Operation GEORGIA in the Quang Nam Province near An Hoa further illustrates the utility of the LVT(H)6s. Bco 1st Amtracs in support of 9th Marines near An Hoa were on a mission to eradicate the VC and determine suitable river- crossing sites and assemble and re-supply points for the forthcoming operations. The LVT(H)6s were in position to support Lima Company 3/9 with its LVT convoy after it crossed the Thu Bon River. As the situation began to calm down, Mike Company (9th Marines) prepared to cross the river in LVTs bound for their objective, the hamlet of O Phy Long on the northern bank of the river, but during the river crossing the VC V-2S (5th VC) “R-20” Battalion with two companies forward along the river bank opened fire on them. After a four hour firefight, where the LVT(H)6s that accompanied "Mike" Company in the river poured direct fire upon the enemy and were instrumental in neutralizing enemy fire and preventing more casualties. The body counts that were used at the time to justify operations revealed a favorable “kill ratio.”⁵⁷

TASK FORCE KILO--The Right Combination for MAGTF Riverine Operations in Vietnam

Amtracs used in BLT 2/4 Operation TASK FORCE KILO, 29 March- 2 April 1968, a multi-battalion punch to the DMZ employed LVTs in a river crossing under preparatory fire like a classic amphibious wave across the beach, but with troops riding on top. When the Amtracs got to the far side bank and the enemy opened up, but the direct fire weapons of a supporting Naval River Assault Group (RAG) gave excellent support for the Marines who fought their way ashore. Employment of the RAG in the Marine TAOR was infrequent.⁵⁸ The RAG that employed with Marines was the combination of PBRs and assault support craft, which the early proponents of riverine warfare espoused as the recipe for success, but unfortunately Operation TASK FORCE KILO was an exception—it should have been the model for riverine operations instead of the Army and Navy MRFs in the south and II, III and IV CTZs.

⁵⁶ Col. John Harms USMC (Ret.), JandBHarms@cs.com “Amtracs n Riverine Operations in Vietnam,” 5 November 2001, personal e-mail (5 November 2001).

⁵⁷ “Operation GEORGIA”, [Amtracs/Vietnam](http://64.69.71.234/operatins-history-folder/georgia.html), 23 August 2001, <http://64.69.71.234/operatins-history-folder/georgia.html> (23 August 2001, 2.

⁵⁸ Nolan, 40.

The 3rd Amphibian Tractor Battalion in May of 1968 was especially busy when focused in the riverine environment and a variety of mission for requiring their LVTs.

We were supporting 7th Marines, 2nd ROK Marine Brigade, Task Force X-ray, and the 1st Engineer Battalion with 90 Amtracs committed daily, 74 on re-supply missions, 3 on patrols and mine sweeping operations, 9 evolved as a blocking force, 2 as medevacs, 2 as a madcap force, 20 as a reaction force, 19 on search and destroy and 1 on ambush mission, 62 on security patrols, 28 on administrative details, 3 on recovery missions, 53 on troop movements. The LVTs averaged 7 engine hours a day, carrying 8.7 persons, and 388 pounds of cargo. The LVTE1s fired 32 line charges that month. There were 3 KIA's, 45 WIAs, 45 Purple Hearts awarded to in country members of the Battalion in May 1968 and 15 LVTs were damaged or destroyed mostly by satchel charges, mines and RPGs.⁵⁹

Analysis of Lessons Learned from LVT5 Riverine Operations in Vietnam

To begin with, the lack of the LVT(P)5A1s firepower has been discussed, but the real drawback of the weapons station is the one-man cupola and dilemma presented by the one man system. The Platoon Commander, crew chief and machine gunner all need to be in the turret—one man must do it all from the M1 cupola in the LVT(P)5A1. Near Dai Do, the "Gulf" Company Commanding Officer began receiving friendly fire on his right flank from one of his Amtracs. He tried to raise the LVT Platoon Commander on the radio, but to no avail. He then ran through the mud and brush over to the firing LVT with its' smoking .30 cal still pumping rounds out at the cyclic rate and pulled the gunner from the cupola. He was shocked to find that it was none other than the Amtrac Platoon Commander. The fighting was in close proximity and the Amtrac was attempting to fire at a target that had moved, but had lost his battlefield awareness due to the deafening experience and the smoke clouded up inside his turret and vision blocks. An ineffective one-man turret was a severe limitation for the LVTP5 and the Marines it was designed to support.

I need you to be a commander, not a gunner. You have somebody else do that! I need you on the radios so you can control your troops.⁶⁰

Secondly, the troops embarked in the LVT faced a dilemma, either stay in the vehicle and die if it hit a mine, due to the gasoline in the fuel cells under the deck, or ride atop and risk sniper fire. Most preferred to ride atop, even the crews, except for the driver—usually the new kid who had no choice and became “mine bait”.

⁵⁹ Col. Frank Chace USMC (Ret.), “Commanding Officer of 3rd Amtrac Battalion Remembers May 5th ...”, *Amtracs/Vietnam*, 1998, <http://members.tripod.com/amtrac/area.html> (23 August 2001), 2.

⁶⁰ Nolan, 104.

When using the LVTP-5 for riverine operations, little or no protection from sniper fire is afforded personnel riding on top of the vehicle. By piling sand bags three high on each side of the vehicle top, some protection is gained without compromising the tactical response of the infantry aboard.⁶¹

Thirdly, the LVTs did provide amphibious lift as designed, but were limited in mobility, armor, firepower, and communications in the riverine environment. The LVTs made possible operational maneuver for infantry units and for combat service support, but they were effective only as much as their limited capabilities allowed. Tactics, techniques, and procedures were developed to allow for the maximum use of the LVT in riverine operations, but it was the synergy of the effective combination of employing forces by means of various platforms and the use of combined arms that proved successful.

In summary, small unit leaders improvised and MAGTF Commanders, BLT Commanders and Company Commanders operated with the Amtracs enough to know how to make the best out of a bad situation. They knew the Amtrac was not the ideal river assault vehicle, personnel carrier or even amphibious assault vehicle, but they improvised and employed them within their capabilities using the advice of the Amtrac leaders and lessons learned from previous operations. There were simply some things the LVT5 could do—and there were things the LVT5 could not do. During the wind down of the American involvement in Vietnam as the Amtracs redeployed to Okinawa and CONUS they discovered that their aged LVT5s were being replaced by a series of LVTs--the LVT7 FOVs.

The Transition from LVT5 to AAV

Wars never come at a good time—especially for acquisition types and when it interrupts the scheduled fielding of new equipment. During the late 1960s the Marine Corps was scheduled to replace the LVT5 Family of Vehicles with the LVT7. A LVT6 hull design was developed, but never approved. Not until 1975 did the Marine Corps finally field the LVT7 FOVs to replace the LVT5 FOVs. The LVT7 and the current AAVP7A1 have an improved hull design and are faster in the water due to a water-jet induction system. The overall capabilities of the AAV are vast improvements from the LVT5.

The LVT7 had improved armor, firepower, smoke grenades, as well as, an on-board smoke generation system. A diesel engine was selected instead of a gasoline engine. The fuel tank was relocated to the port hull utilizing multiple cells. With the ramp relocated to the rear, similar to World War II and Korea Amtrac

⁶¹ USMC, FMFMRP 12-41, 130.

variants, the LVT7 was intended to be used 80 percent on land and 20 percent on water. The LVT7 was later modified with a more powerful engine and improved weapons station and re-designated as the Amphibious Assault Vehicle (AAVP7A1) using the LVT7 hulls cut in 1972. The AAVP7A1s are projected to remain in service until replaced one-for-one beginning in 2006 for initial operating capability and concluded in 2016 with full operating capability with 1,013 AAVs. The current AAV7A1 hulls were introduced in 1972 and continue to serve the Marine Corps well. The AAV7A1 FOV includes the AAVP7A1, AAVC7A1, and AAVR7A1, but the LVT(H)6, which was vital to the success of many operations in Vietnam was scuttled and the monstrous LVTE1 was mothballed, never to emerge again.

During Operation DESERT SHIELD in August of 1990, the Marine Corps did purchase several Mk-154 Line Charge Kits which were mounted in the cargo compartments of two platoons worth of AAVP7A1's sourced from Maritime Propositioned Ships stocks for I MEF. The reintroduction of the Engineering variants met with some puzzled looks. Several "old timers" remembered the LVTE1s from Vietnam and immediately went to work organizing the assets for combat to include a proposed landing in "Zero Wave" with 4th MEB at Al Amadi, Kuwait in support of NAVCENT for Operation DESERT STORM in February of 1991. The landing turned into a demonstration, but the linecharge Amtracs later went ashore and provided a key mobility/counter mobility capability for I MEF who breached the defenses outside Kuwait and assaulted into the heart of the city along the Persian Gulf.

The present AAVP7A1 has had several add-ons, including an Up gunned Weapons Station with a coaxially mounted 40 mm Mk-19 grenade launcher and a 50 caliber M2HB Machine Gun, Enhanced Appliqué Armor Kits (EAAK), Halon Fire Suppression System (FSS) and improved radios that add an additional 4,000 pounds of load on an engine already overstressed. After several improvement programs such as the Service Life Enhancement Program (SLEP), Inspect Repair or Replace Only as Necessary (IROAN) and the Reliable Available and Maintainable-Rebuild to Standard (RAM/RS), the Amtrac in service today has been pushed far beyond its original expected service life. The AAVs are receiving another Product Improvement Program by means of the Reliable-Available-Maintainable/Rebuild-to-Standard (RAM/RS) program. The RAM/RS Program replaces the current engine, transmission, and suspension of the AAV with the more powerful M3A1 Bradley Infantry Fighting Vehicle (IFV) parts made available from excess stocks at the Defense Logistics

Agency depots. The “Rammer” is not a step forward--it merely returns the AAV back to its original 1972 capabilities by beefing it up to compensate for 30 years of wear and tear. The AAV7A1 is destined for the scrap heap in terms of its capabilities and failures to provide the critical capabilities associated with future Marine Corps and Joint doctrine.

AAV Employment in Riverine Operations Since Vietnam

While LVT5 family of vehicles saw extensive service in Vietnam and especially riverine combat operations, the AAV has yet to be employed extensively in riverine operations in combat, except in 1992 in Somalia during Operation RESTORE HOPE. A Special Purpose MAGTF (SPMAGTF) was created for the operation and TASK FORCE BARDERA was organized around the 3rd Assault Amphibian Battalion (Rein.), 1st Marine Division (Rein.) equipped with AAV7A1s in the area adjacent to the Juba River upstream from Mogadishu. The Battalion employed their AAVs and used Amtracers without their vehicles as "Amgrunts" (infantry), similar to what 1st and 3rd Amphibious Tractor Battalions did in Vietnam, to conduct operations which established a "safe zone" for food distribution.

The Juba River, west of Bardera, was not an obstacle to these security missions as the AAVs conducted numerous river crossings in order to reach outlying villages...AAVs proved to be versatile components of the task force.⁶²

AAVs were employed in zone, including the Jubba River with missions which included: mine sweeping, patrolling, traffic control points, as well as for airfield security, and as reaction forces. These missions were almost identical those that the LVT Battalions were tasked with 30 years earlier in Vietnam, but OPERATION RESTORE HOPE was a military operation other than war (MOOTW)--the "enemy" was hunger, disease, and the political environment. There were local bandits with small arms, RPGs, heavy machine guns, and 106mm recoilless rifles mounted on the back of compact late model pick up trucks called "technical vehicles", but the scenario did not replicate the numbers or scope of combat in Vietnam. Interestingly, some threats such as land mines, close-in small arms fire and hand grenades caused many infantrymen to begin riding atop the AAVs resembling scenes from Vietnam. The aging AAVs performed

⁶² Jackson, John J. LtCol. USMC “Hippos in the Jubba”, Marine Corps Gazette, March 1994, 24-27.

well, but were only kept running through the practice of selective interchange and creativity of their operators until they were back loaded aboard MPS ships in February 1993.

Stagnant Riverine Warfare Doctrine Since Vietnam

Doctrine for riverine warfare written in 1978 incorporated the lessons learned from Vietnam. The current MCWP 3-35A/NWP 13 (Rev. A) "Doctrine for Navy/Marine Corps Joint Riverine Operations" rewritten in 1987 basically put a new cover on the 1978 version, but updated the nomenclature of new vehicles and craft. Current doctrine and techniques, tactics, and procedures are based on equipment, which in many cases are designated by a parenthetical note as (no longer available), but a good definition is offered for riverine operation, albeit quite generic. .

River operations in full concept integrate and employ various types of ships, craft, aircraft, weapons, and Marine Corps and naval special warfare forces in a concentrated effort to achieve and/or maintain control of a river, coastal, or delta areas...Riverine operations are separate and distinct from amphibious operations even though common techniques may be employed.⁶³

Riverine operations include assaults, surveillance, interdiction, security, and support operations. Usually the smallest unit the MRF employed is the Marine BLT as part of the MEU, which is the Marine Corps smallest MAGTF and can employed from a base of operations either ashore or afloat. The organization and command and control of the MRF rely on the outdated CATF/CLF relationship. Under the Vietnam model, the Army and Navy serve as the CLF and the CATF respectively. The MCWP 3-35 still prescribes the Landing Force to wet net to small boats for missions in a throw back to World War II procedures. Because of the Marines being assigned to the I Corps Area in Vietnam, outside of the Mekong Delta, the doctrine, tactics, techniques and procedures offered in the MCWP 3-35 largely are a replay of the Army and Navy lash up circa 1968. AAVs are mentioned as a means for landing troops or patrolling the rivers with mounted infantry while Riverine Assault Craft (RACs) would provide a blocking force and fire support stations depending on the mission.

The Marine Corps and Navy really missed the mark with the 1987 MCWP 3-35 clearly showing the lack of commitment and interest in future riverine operations. Perhaps riverine warfare does not sell in peacetime. Small plastic boats and PBRs which were vital for successful riverine operations, according to the

⁶³ USMC, MCWP 3-35 Riverine Warfare (Washington D.C.: Headquarters Marine Corps, 1987), 1-1.

after action reports from the French Dinassalts and Americans in Vietnam, are not present in today's forces. During the Cold War the United States focused on major theater war while current riverine warfare doctrine remained stagnant.

Emerging Doctrine and Over-The-Horizon Requirements

During the early 1980s the Marine went ashore in the AAVP7s at Grenada and Beirut while the Argentines seized the Falkland Islands, but it was the sinking of surface combatants and support ships at the Falklands that illustrated a new threat and challenge for amphibious assault forces. The combination of Argentine submarines and aircraft armed with anti-ship missiles drove the British over the horizon to provide support for the Falklands Campaign. Effective anti-ship missiles, both air and surface delivered, illustrated the vulnerability of amphibious forces in the ship-to-shore movement phase. Traditional amphibious assaults took place inshore, usually within 4000 yards from the beach and stopped at the beach where a lodgment was achieved before movement was attempted to inland objectives. With the development and proliferation of anti-ship missiles, surface assaults were forced over-the-horizon (OTH) and out of the range of the threat. Doctrine had to be rewritten--requirements for OTH would drive development and purchase of supporting systems.

For American planners studying the Falklands Campaign the message was clear—future U. S. amphibious operations would have to come from over the horizon. The Navy and Marine Corps, as part of a strategic review, determined that the majority of future military operations would involve operations that would take place in the littorals since 80 percent of the world's population are located within 200 miles of the sea. The requirements for over the horizon landings drove the Marine Corps and Navy to develop a littoral warfare doctrine and drive the requirements for effective platforms.

The visual horizon from the beach is 17 miles and the military defined the horizon for military operations from the beach as 25 nautical miles. The Navy developed the Landing Craft Air Cushioned (LCAC) to provide lift for the elements of the surface assault at speeds of up to 50 knots. The Marine Corps CH 46 Chinook helicopter does not have the life expectancy, strength, or range to support OTH and a requirement for the tilt-rotor MV-22 "Osprey" was identified. The AAV is limited to an hour in the water or about 12, 000 yards from the beach, due to troop comfort at a sluggish and undulating 8 knots water speed.

The replacement for the AAV would need to achieve a water speed of 25 knots per hour to accomplish the OTH requirement. While the OTH requirement was driving amphibious assaults over the horizon, doctrinal changes in the Marine Corps were also changing traditional paradigms.

A Doctrinal Shift to Maneuver Warfare

In the late 1980's, General Al Gray the CMC, with the assistance of Mr. William Lind, author of Maneuver Warfare, began exploring a new approach to warfighting based on Clausewitzian principles and the writing of Sun Tzu. Largely dismissed by many American students of warfare as philosophical misfits and losers, Clausewitz and Sun Tsu did inspire new thoughts amongst Marine Corps doctrine writers and Requirements Officers who worked in the bowels of the MCCDC headquarters at Quantico and were prodded by the CMC. Second Lieutenants were introduced to maneuver warfare doctrine at The Basic School in 1988. The principles of maneuver warfare focus on fighting smart vice methodical or attritionist styled warfare. When the Soviet Union suddenly collapsed, maneuver warfare doctrine was already on the table and the Marine Corps had already made a paradigm shift to operations other than war and a doctrinal shift to identify requirements for funding by Congress. Doctrine drives requirements and requirements drive funding.

The Marine Corps went on a public relations press to sell the Congress on a new doctrine--one that would require new and expensive equipment. Leading the way was General Gray with the hip-pocket sized MCWP-1 Warfighting, full of Sun Tzu's and Clauswitz' mantras.

Speed is the essence of war. Take advantage of the enemy's unpreparedness; travel by unexpected routes and strike him where he has taken no precautions.⁶⁴

Maneuver warfare is a warfighting philosophy that seeks to shatter the enemy's cohesion through a variety of rapid, focused, and unexpected actions which create a turbulent and rapidly deteriorating situation with which the enemy cannot cope.⁶⁵

Subsequent Commandants continued and refined maneuver warfare doctrine and applied it to the Marine Corps bread and butter of amphibious operations. A Marine Corps Warfighting Lab was established to define and refine the concepts of maneuver warfare and justify the purchase of the “triad” of the LCAC, AAV, and MV-22 to meet OTH requirements.

⁶⁴ USMC, MCDP 1 Warfighting (Washington D. C.: Headquarters Marine Corps, 1997), 70.

⁶⁵ USMC, MCDP 1, 73.

Maneuver warfare is the doctrine of the Marine Corps and the basis for its concept for amphibious operations, as published in "Operational Maneuver From the Sea" and the future concept for amphibious assaults, published as Ship-to-Objective-Maneuver. Both are revolutionary concepts for littoral operations in which the sea is used as maneuver space to project power...from distances that can extend from over the horizon...The combination of the AAV, MV-22, and the recently upgraded Landing Craft, Air Cushioned (LCAC) will provide the triad of delivery systems necessary to project an amphibious force ashore from over the horizon.⁶⁶

The AAV was wearing out while the emerging maneuver warfare doctrine was identifying new capabilities.

Given all that is occurring within the Marine Corps today, it is fair to say that the current AAV7A1, in its present form, is at its optimal technological limit and is the last vehicle of its kind.⁶⁷

With the capability of AAV, sea-based fires, sea-based logistics, mine countermeasures, improved reconnaissance, surveillance and target acquisition and deception systems MAGTF and joint operations in the brown water give U. S. forces overwhelming advantages over a potential enemy. Production of the AAV would be driven by the requirement to replace the AAV due to its reaching its service life, but more so by the emerging maneuver warfare doctrine and the anti-ship missile threat. An AAV would have to swim at least 25 knots to come from over the horizon.

Naval and Marine Corps Emerging Doctrine and Requirements Specify AAV/LCAC/MV-22

In the White Papers, "...From the Sea" and "Forward...From the Sea," the Secretary of the Navy, with the Chief of Naval Operations and the Commandant of the Marine Corps, began development of a new approach to naval expeditionary warfare. This approach, which places a new focus on the littorals, provides the foundation for Operational Maneuver From the Sea (OMFTS). OMFTS focuses on an operational objective and uses the sea as maneuver space to create overwhelming tempo to pit strength against enemy weakness.

It (OMFTS) will permit Marines to use the sea or any other significant body of water as high speed avenues of approach/maneuver that are, conversely, obstacles to the enemy.⁶⁸

⁶⁶ Col. James Lasswell USMC (Ret.), "Waterborne Warriors: Putting The Amphibious Pieces Together." Armed Forces Journal International. January 2001, 23-28.

⁶⁷ Major James Feigley USMC, "Dynamic New Concepts To Change Amphibious Tactics." Amphibious Warfare Review, Winter 1989, 34-35.

⁶⁸ CWO2 Robert Jenks USMC, 'AAAV : The Future in Amphibious Warfare.' Marines. January, 1995, 23.

⁶⁹ United States Marine Corps Warfighting Concepts for the 21st Century. (Quantico : Concepts Division MCCDC, 2000),

The concept of employing amphibious forces from the ship to the objective vice establish force beach head line and beach support area before attacking inland objectives emerged into the concept of Ship-to-Objective-Maneuver (STOM). STOM employs the concepts of maneuver warfare to project combined arms from the sea against inland enemy objectives without having to establish a lodgment ashore as in traditional ship-to-shore movement. Operations will begin over the horizon, beyond visual range, and rely on speed to achieve surprise.

By requiring the enemy to defend a vast area against our sea borne mobility and deep power -projection, naval forces will render most of his force irrelevant.⁶⁹

The over the horizon requirement demanded by the anti-ship missile threat to the amphibious task force and the maneuver warfare doctrine applied to the littorals levied a requirement on the Marine Corps of providing an alternative to the AAV. An analysis of alternatives revealed that an AAAV capable of 25 knots would be required to support OMFTS. The AAAV would provide the MAGTF with the means to deliver the surface assault element in a single lift from the ship to the objective in a truly amphibious vehicle. The Marine Corps requirement for the AAAV is based on the Department of the Navy's overarching strategic concept of "Forward...From the Sea" and the Marine Corps' "Operational Maneuver From the Sea." The examples used to sell OMFTS are Okinawa and Incheon. OMFTS is a slick sales job by the Navy and Marine Corps to get expensive modern equipment from Congress--it worked and Congress had fully funded both programs, the AAAV and the MV-22 while committing to do a Service Life Extension Program on the LCACs as well.

The AAAV

The AAAV is the next generation of amphibious assault craft representing one third of the OMFTS triad and its , capabilities represent a major break through in the ability of naval forces to avoid enemy's strength and exploit their weakness. The AAAV is designed to operate 80 percent on land and 20 percent on the water, in jungle, arctic, desert, riverine or mountainous terrain and propositioned aboard Maritime Propositioned Ships for link up with the Fly-In-Forces. In the land mode the AAAV will have a cross-country mobility equal to the M1A1 main battle tank, 45 mph and a range of 400 miles. AAAV will be able to climb a

3 foot wall, cross an 8 foot span, negotiate a 60 percent forward slope and 40 percent side slope as well as perform a 360 degree pivot steer. In the transition mode in the water, AAV will be able to achieve 12 knots with two 23-inch water jets and drive over reefs, sand bars, launch and recover, perform a 360-degree pivot and negotiate eight-foot plunging surf. In the water mode on plane, the AAV will achieve speeds of over 20 knots in Sea State II for a range of 65 nautical miles and continue for a range of 250 miles to an inland objective on a single tank of fuel (365 gallons). In a silent watch mode using an on-board auxiliary power unit the AAV "cloaks" by greatly reducing its thermal and acoustic signature while still maintaining weapons stations, sights and command and control assets while static.

The two-man Mk 46 turret, full solution digital fire control system, is fully stabilized. Utilizing a second generation forward looking infrared and eye-safe laser range finder allows all-day and all weather engagements. The turret allows for 360-degree continuous traverse in azimuth, as well as, a +45 to -10 degree vertical elevation and depression capability. The Mk 46 30mm cannon armored fighting vehicle and surface craft out to a range of 1,500 meters with a coaxially mounted 7.62 machine gun for targets out to 800 meters.

The AAV is designed to maximize its survivability on the 21 Century battlefields. Through specialized paint, flash suppression, low smoke powder and ceramic tiles to reduce infrared signature the AAV can fire and disappear. In addition to the rapid obscuration system with smoke grenades for visual, infrared and MMW protection, a NBC DW system provides interior and exterior point detection of NBC contamination while a NBC collective system provided protection for the crew and embarked passengers. For navigation the AAV a Global Positioning System and digital compass to conduct precision navigation over extended distances integrating moving maps with operational overlays in support of infantry embarked or when assigned an autonomous mission.⁷⁰

AAV Command and Control AAV Variants AAV Capabilities

The AAV is designed specifically to satisfy to Corps' operational requirements, the AAV will be capable of fighting, surviving, and winning on the modern battlefield well into the 21st Century... with three times the water speed of the current AAVP7A1 and cross country mobility, agility, and speed equal to or greater than the M1A1 main battle tank.⁷¹

⁷⁰ United States Marine Corps, "AAV Concept of Employment", Quantico: Marine Corps Combat Development Command, 2001, 27.

⁷¹ Fiegley, 23.

The AAHV will have twice the armor protection of the AAV, will carry a reinforced squad of Marines (17) and have no cargo carrying capacity. It will have collective protection for crew of (3) and (17) embarked troops. The weapons system, a Mk 45, 30 mm stabilized turret with the M1A1 Abrams main battle tank firing controls will be able to destroy, neutralize, or suppress anti-tank weapons, light armored vehicles, emplacements and bunkers. The system is being designed to tackle future weapons systems variants similar to the BRDM, BMP, and BTR. A stabilized system will allow the gunner to engage targets day or night, all weather, on the move on land or water with the additional position in the turret for the vehicle commander.

The AAHV will be employed to attain surprise, rapidly build up combat power deep in the objective area to disorient, divert, and disrupt the enemy.⁷²

AAHV Interface with Joint Expeditionary Warfare Operations, Training and Simulations

The AAHV will provide the MAGTF with the capability to carry 17 combat equipped Marines on the sea at 20-25 knots [23-29 mph] or on land 45 mph. The AAHV will operate from the LPD-17 San Antonio Class Amphibious ships and support a broad spectrum of training requirements for its embarked Marines. The LPD-17 is being designed to support the Total Ship Training System which will support deployable Marine Corps training systems: Marine Corps Deployable Resource Center and indoor marksmanship trainer. The ship will support full mission profile rehearsals which integrate on board AAHV systems into the LFOC, CIC and integrated C4I2.⁷³

Every application will be completely embedded, and every operator and maintainer function will be supported by training technology. The AAHV will have over 1.3 million lines of code and a drive-by-wire capability, whereas the AAVP7A1 has about three circuit cards and no lines of code.⁷⁴

The AAHV 30mm cannon is married to the sophisticated M1A2 [tank] technology, but the system is designed with the 18 or 19-year-old Marine in mind--the human part of the system. LPD-17s will employ Mk 46 turrets, Naval versions of the AAHV turret, for close in defense. Both Navy Gunners Mates and Marine Corps Amtracers will be trained on the Mk 46 at the Amphibious Assault School at Camp Pendleton, California.

⁷² Jenks, 34.

⁷³ Mark Delmonico, "Training Tomorrow's Amphibious Force." Armed Forces Journal Global Publication. Summer, 2001, 25.

Simulators with four degrees of motion similar to entertainment industry for driver and gunner training as well as CD-ROM based applications and wireless systems will allow realistic, inexpensive and safe full mission rehearsals, while live-fire and “wet-runs” would be more successful on the first attempt through the use of simulation. The latest intelligence updates, hydrography and operational overlays on a moving map display will prepare AAV operators for riverine missions.

AAAV Logistics

Interactive Electronic Technical Manuals (IETMs) will provide instructions and education for AAV operators to replace and service on board systems as required. Imbedded self-diagnostics will provide operators with vital information on vehicle performance and data for analysis for predicting future performance. A two level maintenance concept will feature operators and contractors—maintenance men will be eliminated. Operators will have tool boxes with less than fourteen tools compared to current tool boxes with over 100 tools. Plug and play technology will empower AAV operators and parts will be systematically replaced based on hours of use to prevent break downs. Parts will be under warranty and contractors either on site or remotely will service systems--Federal Express delivers. Under a streamlined process, the operator would order a part through his onboard computer and send a message through the logistics net to the contractor via a secure digital burst transmission. The contractor would provide the necessary replacement part for the operator to "plug in" while AAV battalions would monitor the process and provide the coordination or delivery for the last tactical mile. Current AAV maintenance men will not be required due to contractor support and operator autonomy. Contractor support would make more Marines available for reinvestment in trigger puller billets or allow a reduction of the overall Marine Corps manning levels. DLA's would have nothing to do with AAV. The operator to contractor concept has already been proven to accomplish the mission and save money with selective parts on the AAV RAM/RS. The motivation for contractors is profit--profit is only guaranteed if service is provided.

AAVPs and AAVCs—No AAVRs, AAVEs or AAHVHs

Only AAVPs and AAVCs will be produced--there will be no recovery, engineer, or big gun variant for the AAV FOV. There will be an option to produce other variants in the future, but the engineer, recovery

⁷⁴ Marty Kauchak, “Training Tomorrow's Amphibious Force.” Armed Forces journal Global Publication, Summer, 2001, 23.

and big gun capabilities will have to come from outside the AAV FOV. Will the lack of these capabilities hamper future Marine Corps riverine operations? What is required are capabilities not a variety of platforms. Hopefully the AAV will be so reliable that it will not breakdown. The systems should provide ample warning to operators to make plans to replace parts and catastrophic damage can not be helped by a recovery vehicle. Recovery will be by other AAVPs or by Naval craft as part of a recovery plan.

The LVTE1 and AAV Mk-154 Line Charge kit basically provided for clearing a lane. Mine detection and removal should be provided by unmanned vehicles in the future—not manned AAVPs with add-ons. There is no need for a manned system to clear and proof for mines at sea or on land when robots and drones could accomplish mine detection and clearing. In maneuver warfare one should use speed and tempo to out maneuver an opponent and avoid his strengths (minefields) and maneuver against his weaknesses. Having to conduct deliberate mine detection and removal would be against maneuver warfare doctrine. Host nations with assistance could clean up the mines after maneuver forces had secured victory.

Aside from the revolutionary water speed, the next most impressive capability of the AAV is firepower. An AAV could not float with a tank turret or “big gun” on it and if one could be designed to do so—it could not make 25 knots with all that weight. The AAV Mk 46 turret in preliminary testing has shown that the 30mm is capable of delivering a knock out punch without having to use a big gun. The Mk 46 is a two man stabilized turret with the M1A1 firing system that can provide killing blows to light skinned vehicles and lightly armored vehicles. Interestingly, the AAV Mk 46 weapon system in testing has destroyed a BMP-1 frontally and penetrated a M60A3 main battle tank turret with a flanking shot. A Mk 46 turret mounted on a Navy Swift Boat destroyed a PBR type target on the water moving at 20 knots. The MK 46s 30mm rounds are similar to the current 25mm rounds fired from the Light Armored Vehicle (LAV-25) turret, but the similarity ends with outward appearances. The 30mm round resemble a long neck beer bottle in size and the Mk 46 feeding system was modeled after an automated beer bottle processing line. The 30mm round provides the space for improved munitions to include "smart munitions", as well as, improved projectile tips and shaped charge technology. The Mk- 46 can be modified to fire the 40mm super shot long round by changing the barrel. The 30mm should provide a big enough punch to knock out infantry fighting vehicles and possibly light tanks as well as a variety of other softer skinned vehicles, certain bunkers and then kill

troops with the coax 7.62.

AAAV Limitations

The AAAV will not carry supplies like the cavernous LVTP5 or the "Winnebago-like" AAV; however, according to maneuver warfare doctrine, Marines will strike like lightening from the ship to the objective and return without having to set up a lodgment ashore. Real time and precision logistics will support maneuver warfare vice the tradition of establishing supply dumps. Meanwhile, the AAV will remain in service until 2016 and on land can carry extra gear as necessary and at a pace much slower than the AAAV and M1A1 on land.

The LVT could carry up to 34 combat equipped troops and the AAV can carry 25. Extra gear and ammunition was stowed almost anywhere in the LVT and likewise in and outside the AAV. During Desert Storm PVC fascines were attached to the sides of AAVs to be dropped into trenches as fillers. More weight onboard the AAV makes it lower in the water and thus faster. In contrast, any extra weight on the AAAV will negate planning which is vital in achieving high water speed. The AAAV will carry up to 17 combat equipped Marines seated in ergonomically designed seats with no wiggle room or space for extra gear. The AAAV on plane will be similar to a ski boat and the proper placement of passengers and total weight of the vehicle must be maintained down to the inch and pound to achieve the proper thrust to weight ratio and attitude for planing and high water speed. The AAAV's "skin" is part of the complete integrated defensive system and cannot be fouled by gear stowed externally. Signature reduction and "visual and acoustic cloaking" are part of the total survivability system of AAAV. Education on AAAV systems will be vital for Marines at all levels of the MAGTF and will represent a paradigm shift that should cause war planners, war fighters and commanders to think of the AAAV more like an aircraft in terms of lift and command and control than the AAV or a fast swimming armored personnel carrier.

The AAAV and Future Riverine Operations

In 1989, Col. William Brahnmeier, a former MEU Commander, was placed as the first AAAV program Manager. He predicted AAAV employment in future MEU maritime interdiction operations, raids, and patrols in the littoral regions where conflicts would likely arise as independent maneuver elements within

the GCE, but also employed as in their traditional role as troop carriers.

The AAV will turn rivers into avenues of approach for the MAGTF GCE vice obstacles...when you consider that inland waterways and rivers are the primary means of transportation and communication in many areas of the world, the value of a high-speed amphibian becomes apparent.⁷⁵

The application for the AAV to deliver riverine assault forces is obvious in keeping with the STOM tenants, but there are several key factors that must be identified pursuant to successful employment of AAV borne forces in the riverine environment: current, water depth, composition of the river bottom and exit points, and the terrain in the areas adjacent to the river. AAV missions could include: river control points, patrols (show of force), listening and observations posts, base of fire and support force, deliver assault forces in combination with MAGTF, naval, joint and combined forces. The AAV is the ideal vehicle for a surface assault--it will be a marvel to see.

Lessons learned from riverine operations Vietnam, with regard to the limitations of the LVT, revealed a lack in mobility, firepower, and survivability. The AAV was a giant leap forward in capabilities from the LVT, but the AAV is a quantum leap from the AAV. One of the keys for the success of AAV is the high water speed. To achieve the high water speed the AAV employs a high efficiency diesel engine producing 2500 horsepower to push the vehicle on top of the water similar to a ski boat getting up on plane. Chine flaps are deployed to provide the planning surface for high water speed. A minimum water depth of 15 is required to deploy the chine flaps. Failure to fully deploy the chine flaps would limit the AAV to a transitional water speed of 12 knots. For amphibious operations from the sea, the minimum depth for deployment of the chine flaps is achieved by launching from a ship, which requires 15 feet plus for its own draft and safety factors. The AAVs launch and proceed at 12 knots to pre-designated point to deploy chine flaps and achieve planning. Once on plane the AAV would maneuver at 25 knots until transitioning back to 12 knots for a littoral penetration point or recovery aboard ship--recovery of the chine flaps occurs before the surf zone.

For riverine operations, as long as the AAV can deploy chine flaps it can achieve high water speed. At high water speed the AAV drafts from 6 inches to two feet--it skims over the water. The challenge for the AAV in riverine operations would be the deployment and recovery of the chine flaps. In the case that a river depth of 15 feet was not present--the AAV could not deploy chine flaps and achieve planning for high water

speed unless it got a "flying start" from the sea already on plane. Conversely, if the AAV did achieve high water speed and arrived at a point which it could not recover the chine flaps it not only could not transition to land mode, but would be stuck on the bottom with chine flaps in the down position and vulnerable to enemy location, targeting and fires. In lack of proper planning or in an emergency to counter this scenario, the AAV will have an override system and could blow the chine flaps to achieve the transitional speed of 12 knots water speed and move ashore in the land mode. An AAV with no chine flaps could not achieve high water speed without a replacement set of chine flaps--a major maintenance procedure requiring another set of chine flaps and possibly a 40 ton crane or hoist to lift the AAV 15 feet in the air to install and perform operational checks on the system. Deploying platoons will have available an extra set of chine flaps for every other vehicle that would be carried on the support ship. For a raid, an AAV that had to blow chine flaps would severely limit the maneuver force in the withdrawal to either 12 knots or doubling the time to withdraw the degraded vehicle and singling it out for observation and attack or destroying it in place and recovering the passengers and crew through other means. Recovery of broken down AAVs in the water will require creative thinking and a thoroughly rehearsed plan, because an AAV could only tow another AAV at a maximum speed of 8 knots in the water--makes for a long and vomit us 25 nm swim. Safety boats or some not yet discovered method of recovery for inoperable AAVs in the water must be explored.

Control of the sea and battle space in the littorals from the high water mark to the horizon is well within the power of the U.S. against most adversaries, but brown water deltas and mangrove swamps with triple canopy jungle and "low tech" villages and real alligators could be a problem. Intelligence preparation of the battlefield would be vital for success of riverine operations involving AAVs. River depth, composition and tides would determine the feasibility of riverine operations. Real time hydrographic reports would be necessary to provide commanders with essential elements of information for operational plans and decisions. In maneuver warfare intelligence plays a vital role. Multifunction displays, moving maps, target data, operational graphics and voice communications would enable maneuver commanders multiple options for courses of actions.

Riverine operations with AAV units as maneuver elements or as platforms for embarked infantry

⁷⁵ Col. William Brahnmeier USMC, Amphibious Warfare Review, Summer 1989, 24.

will have capabilities never before seen in the Marine Corps or joint forces, but the fundamental principles for employment of Assault Amphibian Vehicles, AAV or AAVV, must be considered--mud is still mud and tides and weather will always impact operations to some degree. The drafter of the AAVV Concept of Employment for MCCDC has concerns about the minimum river depth for AAVV riverine operations.

AAVV needs to be in about 11-13 feet of water to reconfigure (chine flaps sweep down three feet under the hull)...so, as an AAVV guy, I will want to know where the three fathom curve is (18 feet) off shore...that is where I come off plane and safely reconfigure...dependant upon tides, beach, hydrography. High-speed riverine operations will be predicated on mean river depth, known channels, etc. Dependant upon these factors...may be restricted to the transition mode (12 knots) for operations.⁷⁶

Possible Scenarios for Future AAVV Riverine Operations

Tom Clancy in his non-fiction effort *Marine* catalogs the organization, equipment and mission of a MEU. He offers technical data and provides an insightful commentary on the capabilities of present day MAGTF's. As an appendix to the factual explanation and description of a MEU Clancy develops a scenario entitled, "Ra's-e Hhalileh Mud Flats, Southeast of Bushehr Power Plant, Iran, 0210 Hours, December 28th, 2006," that illustrates the AAVV's potential capability for operating in a riverine environment conducting a raid that perfectly illustrates a type of riverine operation for the future MAGTF. In the scenario the AAVV platoon swims 25 nm from the ship over the horizon through a littoral penetration point and up a river to an inland objective. At low tide the river is merely mud flats and the AAVV's continue in the land mode at 40 mph as a diversion for the main effort. After serving as a base of fire using their cannons and supporting arms they withdrew via the mud flats, river and sea to the ship transitioning from land mode to high-speed water mode seamlessly. Returning to the ship before sunrise they had conducted a raid from the sea, OTH, in total darkness and returned to the sea OTH successfully.⁷⁷

In another scenario Clancy places a MEU at the mouth of the Batang River, on the Brunei/Malaysia border September 21st, 2008 in a riverine operation to secure a vital line of communication during a peace maintenance operation.

Major Hansen (AAVV unit leader) and the AAVV's retrograde from inland objectives after earlier having transited from the ship to the objective. The new objective was the mouth of a river 25 nm away. It took him less than an hour and he barely slowed down as they entered the river. Cruising up the Batang River at 20 knots they serendipitously maneuvered ashore and penetrated the enemy's rear area, overrunning their command post.

⁷⁶ Major Joel Ashinhurst USMC (Ret.) "AAVV's in Riverine Operations/COE", [ashingurstj@aaav.drpm.usmc.mil] personal e-mail to author 21 December 2001.

⁷⁷ Tom Clancy, *Marine*, page 290.

They planned, coordinated, and executed the operation by digital data links.⁷⁸

MCDP-3, "Expeditionary Operations" released in 1998, presents a case study similar to Clancy's scenarios, which illustrates the capability of the AAV for riverine warfare operations. Set in 2017-2018 the study centers on a fictional West African War and civil unrest on the coast from Lagos Nigeria to Conakry in Guinea where HIV, a malaria epidemic, tribal unrest, economic devastation, and complete implosion of nation states creates regional chaos and civil war. The 22nd MEU deploying from the Camp Lejeune is tasked by CINCEUR as part of a 15-nation coalition to send immediate military assistance and humanitarian aid to the region. AAVs and LCACs transit from the ship to the objective from OTH through the littorals of Atlantic Ocean and narrows of Lagos Harbor into the Lagos Lagoon, by passing the industrial city areas. Using water - ocean, lagoon and river as maneuver space and avenues of approach to achieve surprise and operational objectives.

The case study presented in MCDP-3 illustrates the power of the MAGTF in the littoral region especially using water, previously seen natural obstacles, for maneuver space against an enemy with a capability to cover urban areas, but incapable of countering and in some cases detecting, a maneuver element in AAV's moving from OTH at sea and through brown water to an objective. Using intelligence, specifically hydrographic reports, the MEU accomplished its mission.

The scenarios presented in Marine, by Clancy and in MCDP- 3, while they do not specifically focus on riverine warfare, they certainly give us some insight into future operations on and through rivers. History and the historical context of riverine operations in Vietnam reveals some important lessons learned, but do these lessons learned apply across the board to future riverine operations or do they only apply to replay of Vietnam between the Republic of South Vietnam and the United States versus Ho Chi Minh's North Vietnamese Communists and the Viet Cong? Marine operations in the riverine environment of I CTZ and the U. S. Army and Navy riverine operations in the south were based on the mission and character of fighting in Vietnam 1966-1970 and perhaps will not and cannot be repeated. Goldwater-Nichols, the Weinberg Doctrine and Maneuver Warfare Doctrine will enable the Marine Corps to fight smart and achieve objectives rapidly as seen

⁷⁸ Clancy, 294.

in Desert Storm.

Attrition warfare places the emphasis of objective on conquering and controlling key terrain to launch "out kill" the enemy. In maneuver warfare the enemy's strength is attacked indirectly in a way that would put him in a dilemma--to fight and die or to surrender. The dilemma must be so profound that it causes him to have such bad options that he shuts down and capitulates or is done in by his internal friction and external chaos of a combined arms and psychological tidal wave.

Recommendations for the Employment of the AAV in Future Riverine Operations

To begin with, recommendations for the employment of the AAV in future riverine operations, like the LVT in Vietnam, will be based on the capabilities and limitations of the platform, doctrine and creativity of the maneuver commander. The AAV will not replace PBRs, rubber boats, LCACs, or LCUs, but the AAV will provide the commander with operational reach and leverage at the tactical and operational level never before seen with assault amphibians. The French Dinassauts employed boats, LVTs and other craft successfully against the Viet Minh, but lacked helicopters that would have been a force multiplier. When the US Army and Navy teamed up in the Mekong Delta they employed boats, craft and helicopters successfully, but NVA and Viet Cong anti air warfare was vastly improved over the Viet Minh with the support of Russian and Chinese missiles made vertical assaults venerable.

Secondly, the AAV makes up for the shortfalls of previous Amtracs and would improve on the successes of the LVT in riverine operations in Vietnam if employed similarly in future riverine operations. A quantum leap from the LVT in Vietnam, the AAV with multi-spectrum signature reduction, increased land and water speed, digital communications, and increased firepower will provide the MAGTF with an ideal platform to support operations in and around rivers. There will be things to AAV can and can not do in future riverine operations.

Thirdly, in addition to the AAV the Marine Corps should develop a small unit riverine craft (SURC) to provide tactical mobility for a MAGTF Ground Combat Element (GCE) in a riverine environment. The craft should carry a 13 man rifle squad and a crew of two.⁷⁹ The bottom line from the lessons learned in Vietnam with the LVT is that they, by themselves were not the perfect platform to conduct riverine operations,

but when employed as part of the MAGTF and using combined arms, the LVT was suitable to support operations. The synergy that resulted from the combination of the full MAGTF against the enemy in the Rung Sat and along the Chu Viet River proved successful for the Marines from 1966-1970.

In summary, future MAGTFs, employing the LCAC, MV-22, and AAV will have never before seen flexibility and power to conduct OMFTS from OTH that will likely confuse and spin the enemy into a chaotic dilemma where they find it best to acquiesce to demands or attempt to fight. Upon decided to fight they will find themselves being destroyed from within by unseen forces. They will not be able to locate their enemy, but still suffer devastating effects to their center of gravity and quickly lose their critical capability to resist. The AAV will be ideal for raids in support of MAGTF and Joint Task Force objectives especially from OTH or up river and provide a wide range of military options.

Conclusion

In Conclusion, the AAV employed by future MAGTFs, will provide greater synergy than previous MAGTF's due to the speed of the AAV and the tempo which employing it would provide. The AAV will enable rivers, which were previously regarded as obstacles, to serve as maneuver space. Maritime patrolling and interdiction missions may be possible with AAV forces. Marines have always improvised, overcome and adapted to the situation with whatever means on hand. Until the AAV is fielded and in the hands of an 18 year old Private who is hauling 17 Marine Grunts led by a motivated Sergeant, we may not know the full capacity of the AAV in the riverine environment and how it could be employed across the spectrum of combat and MOOTW.

Future MAGTFs employing AAVs will be able to seamlessly transition from the ship to the objective through blue, green, and brown water instead of having to pause to conduct specialized riverine operations. AAVs will not be the single factor to success in future riverine operations if they are conducted. Successful riverine operations will require a variety of craft, boats, and aerial assets to provide the synergy that a rapidly increasing tempo can provide...something which the enemy can not cope. The AAV will provide the platform to support OMFTS and STOM doctrine allowing for the full integration of maneuver warfare principles into MAGTF expeditionary warfare that will be joint and likely combined with coalition forces.

⁷⁹ United States Marine Corps. Ground Combat Element Campaign Plan 2001. HQMC, PP &O, 2001, 18.

Any shortfalls or limitations to the AAV or doctrine will be made up with the ingenuity and creativeness of the Marines that employ them—it has always been that way.

The challenge to future war fighters, war planners and commanders is that there will likely not be a model to follow. Lessons learned from Vietnam riverine warfare with LVTs and Desert Storm with the AAVs may never be replicated. What Marines must do is plan for the future by analyzing the past, while trying to anticipate future. The AAV will provide a revolutionary platform and capability to put into practice theories of expeditionary warfare and possible scenarios in the blue, green and brown water.

LVTs, AAV, AAVs...one mission, one vision, one family.⁸⁰

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⁸⁰ Brigadier General James Fiegley, Opening Remarks for the 1998 AAV/AAV Operations and Training Conference. 1998.

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