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Does the Marine Corps Need Another Amphibious Vehicle?

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ABSTRACT

Title: Does the Marine Corps Need Another Assault Amphibious Vehicle?

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Summary: This research effort examines the Marine Corps' requirement to field a follow on replacement weapon system for the current Assault Amphibious Vehicle, Model 7A1. Focusing on the National Military Strategy and future Marine Corps missions in the New World Order, the author critically assesses the Corps' Advanced Amphibious Assault Program. Program alternatives are analyzed from both an operational effectiveness as well as cost point of view. The impact each alternative has on the Navy-Marine team's ability to execute over-the-horizon amphibious operations in the future forms the basis for the author's specific recommendations in this study.

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**DOES THE MARINE CORPS NEED ANOTHER
ASSAULT AMPHIBIOUS VEHICLE?**

As the war in the Persian Gulf so vividly demonstrated, the essential demands of our military forces-to deter conflict whenever possible but to prevail in those that do arise-are certain to endure. The forward presence of our warfighters provides the conduit in our alliance relationships and signals that, if required, we're prepared to defend our national interests with military action.

As we enter a period of declining defense budgets, debates will rage on the viability of sea-based forces and amphibious doctrine to cope with future threats. For the Navy, the handwriting is on the seawall. The National Military Strategy outlines a "Base force" consisting of 450 ships and cuts could continue beyond this level in the next decade. Critics warn that this downsizing seriously compromises America's maritime capability.

The New World Order, whatever it implies for military strategy and required forces, is going to mandate an effective integration of our nation's maritime projection forces-a robust Navy and Marine Corps team. The mission of sea-based forces must be redefined to reflect the new environment. More importantly, the team must match mission with capabilities at an affordable level.

For over 45 years, the Assault Amphibious Vehicle, or AAV,

has provided Marine infantry the means to conduct surface-borne amphibious assaults. Launched from amphibious ships, AAVs transport Marines to shore and once ashore provide them armor protected mobility. The current AAV is nearing the end of its planned service life and the Marine Corps is currently exploring alternative replacement systems. Before examining the requirement to field a follow on vehicle; however, the following questions need to be addressed:

- What strategic role will Naval amphibious forces play in the future?
- What threats will these forces encounter?
- What missions will Marine forces be assigned?
- Why do we need an amphibious assault capability?

STRATEGIC ROLE OF AMPHIBIOUS FORCES IN FUTURE

The United States is the preeminent maritime power in the world today. With the end to the cold war, the Soviet Union dismantled, and new nation states struggling for their identity in the community of nations, our world is undergoing unprecedented change. Despite the prospects of world peace, our National Military Strategy continues to rest on three pillars- deterrence, forward presence, and crisis response.¹ In the future, changes will have to be made in the way we execute this strategy. As we have already seen in the Philippines, the possibility of diminished access to foreign bases and overflight rights is virtually certain. As a result, control of the sea

will assume even greater significance.

Any future conflict which requires U.S. military intervention will likely involve the movement of forces and equipment across key sea lines. More than 95% of all the material for DESERT SHIELD and DESERT STORM came by ship.² We must be able to deploy substantial forces and sustain them in parts of the world where prepositioning of equipment will not always be feasible, where bases aren't available, and where there is a less developed economic base to support our forces once they have arrived.

Given the decreasing global support for U.S. basing and overflight rights, Naval forces may be the only military capability available to national security decision-makers in time of crisis. A review of the over 200 instances of US military intervention since WWII indicates 80% involved the use of Naval forces.³ Forward deployed Naval forces deter conflict and provide National Command Authorities with a variety of power projection options. Self - sufficient, combined arms forces that can deploy rapidly and loiter near or over the horizon from potential crisis spots will deter belligerent acts and provocations.⁴

Our Navy-Marine Corps team represents a flexible force in readiness whose aggregate usefulness to our nation includes:

- Employment options across the spectrum of conflict-
from peacetime presence to regional war;
- Ability, on short notice, to deploy to a wide range of

geographically dispersed areas; and,

- A forcible entry capability when required.

Without a strong maritime power projection capability, the U.S. will not be able to protect its vital interests-ensuring sea lines of communication remain open and access to the littorals of nations important for strategic resources and commerce is maintained.

THE THREAT

The current world situation makes it difficult to fully assess and project the threat to U.S. interests in the 21st century. Since the end to WWII, the global situation has evolved around the balance of power between the U.S. and what was the Soviet Union. However, nearly all conflicts occurred in the Third World - a trend that is certain to continue. In the past, the U.S. and Soviet Union could influence the resolution of regional wars through the use of various diplomatic and economic sanctions. But, the Soviet Union is now a loose coalition of separate nation states; all are experiencing tremendous financial difficulties and political instability may be on the horizon.

As the 21st century nears, the risks of war, including nuclear confrontation, between the so-called superpowers are receding. However, a new period of international frictions, tensions and conflict is rapidly opening. This period will see a realignment of interests, new alliances, and new forms and causes of violence including territorial disputes, economic disputes

between rich and poor, and disputes over access to the world's resources⁵. In short, we may not be looking at a kinder, gentler world.

As economic problems worsen, stockpiles of sophisticated weaponry become sources of revenue and their export to Third World countries will increase. As a result, qualitative differences in military capabilities between the Third World and traditional powers will likely decrease. A few dozen Third World countries now have advanced anti-ship missiles, mines and submarines - more can get them.

A new arms race is underway! Iran is buying Russian subs in an attempt to control the Strait of Hormuz. Saudi Arabia, in turn, wants to buy more F-15E fighters. Most disturbing are accounts that various republics of the former Soviet Union have started peddling conventional weaponry wherever there's hard currency. And, with our own defense budget falling, American arms salesmen are prowling for customers.

Threat forces of the future will have many similarities. Common threads in capabilities may include:

- More sophisticated surveillance and intelligence gathering equipment;
- Increased lethality and range of weapons; and,
- Enhanced ground and air mobility.⁶

Sophisticated surveillance and targeting systems can bring formerly secure areas into the battle area and achieving tactical surprise may be increasingly more difficult for our forces. Each

year the weapons of war become more accurate, destructive, numerous and available.⁷ High-tech precision guided weapons will proliferate the battlefield. Additionally, the widespread use of man-portable antiaircraft weapons may reduce our air mobility which will place increased emphasis on forcible entry by surface means.

Amphibious forces will try to avoid enemy strengths and seek opportunities to exploit weaknesses. To achieve the element of surprise, we need sufficient numbers of mobility assets to maneuver our forces on a battlefield where speed equates to survival.

FUTURE MARINE CORPS MISSIONS

The emphasis on maritime strategy and power projection from the sea will continue to focus the Marine Corps on maintaining quick-hitting, self-sustaining forces capable of conducting operations at all levels of conflict. The increased emphasis on combat power projection from the sea brings into sharp focus the continuing importance of "soldiers of the sea."⁸

Marine Corps operational forces are expeditionary, combined arms, air-ground task forces (MAGTF). The value of the MAGTF is measured in terms of presence, potential and power. Strategically mobile and immediately available, MAGTFs are capable of performing a wide variety of missions from special maritime operations to joint and combined operations. Noncombatant evacuation, in-extremis hostage rescue, humanitarian assistance

and amphibious raids are examples of the types of diverse missions which the MAGTF can execute.

The MAGTF is tailored to meet specific mission requirements. Infantry, armor, artillery, air and combat service support assets are organized under the command and control of one commander. It is this unique integration of warfighting capabilities which allows a Naval amphibious task force to rapidly and decisively project combat power ashore. Rapid, flexible deployment of task organized units will be the hallmark of the conventional capability needed into the next century.⁹ No other U.S. military force combines equivalent levels of forcible entry capability, combat power, and staying power than a MAGTF.

AMPHIBIOUS ASSAULT CAPABILITY

An offensive forcible entry capability requires this nation be prepared to conduct operations on short notice to protect national interests. It is in this context that the requirement to project amphibious forces anywhere in the world remains a vital capability in support of national security strategy.

The Marine Corps has a statutory responsibility to, "...develop in coordination with the Army, Navy, and Air Force, the doctrine, tactics and equipment employed by landing forces in amphibious operations."¹⁰ Amphibious forces can provide a peacetime presence and political leverage without necessarily being committed ashore. When a landing is necessary,

the amphibious assault exemplifies the essence of maneuver warfare; warfare where speed and flexibility are the cornerstones of winning. The amphibious assault concentrates superior combat power at a critical time and place to achieve tactical surprise and a favorable force ratio over an opposing force.

One need only recall the events of the Persian Gulf to counter those that say the amphibious assault has gone the way of the buffalo. An amphibious assault was planned during operation DESERT STORM as a means of tying down six Iraqi divisions. Fourth and Fifth Marine Expeditionary Brigades were poised and ready on 24 February to initiate the first amphibious assault since Inchon. The threat from the sea not only tied down Iraqi forces along the Kuwaiti coast, it in no small way contributed to the success of the ground assault into Kuwait by coalition forces.

In addition to Kuwait, Marines were prepared to exercise the amphibious assault option in Panama. Because the U.S. had overflight rights and secure bases to land at, an assault from the sea was not necessary. The important point is we had the option. Flexibility was the key to achieving military successes in Panama as well as Kuwait. We explicitly followed Lydell Hart's maxim, "Ensure that both plan and dispositions are flexible and adaptable to circumstances."¹¹

HISTORICAL PERSPECTIVE

After World War I, when events in the Pacific pointed to the possibility of war, Marines developed the amphibious warfare

concepts that were the foundations for U.S. and Allied victories in World War II. During the war, before the advent of the helicopter, the surface assault was the only option available for Marines to move from ship-to-shore. Drawing upon conventional infantry tactics, the concept of ship-to-shore movement stressed dispersion and speed.

The Marine Corps' primary means of projecting the landing force ashore was the Amphibious Vehicle. Affectionately known as "Alligators", these vehicles were launched from amphibious ships between five and ten thousand yards from landing beaches. Swimming at speeds of five to eight knots, "Alligators" were able to transport men and supplies over reefs and other obstacles through the use of tracks and water propulsion units.

Vulnerable to mines and small arms fire, amphibious vehicles nevertheless proved indispensable in providing Marines the requisite mobility necessary to win at places like Guadalcanal, Iwo Jima, Tarawa and Okinawa. During World War II, evolutionary Amphibians were produced on a yearly basis. By the end of the war almost 20,000 vehicles were produced.¹²

Amphibious vehicles carried "Leathernecks" ashore at Inchon. During the Korean War they were used primarily as logistics vehicles and proved their versatility in operations throughout the rugged, mountainous terrain of Korea.

During the 1950's, with the advent of the helicopter, amphibious doctrine was expanded to incorporate the vertical assault. The helicopter provided a quantum leap in capability by

extending the range Marine forces could deploy to. In fact, the helicopter provided an over-the-horizon (OTH) assault capability to the Navy-Marine team.

Marines now had two means available to satisfy amphibious assault mission requirements - - the helicopter and the amphibious vehicle. With a heliborne and surface assault capability potential enemies were faced with a significant targeting problem. No longer could enemy weapon systems be exclusively oriented on surface assault craft; the threat from the air had to be addressed. More importantly, heliborne assaults could reach deep into flank or rear positions forcing the enemy to disperse his forces in order to cover all possible landing zones.

To combat the surface assault, high-tech missile systems were developed to destroy Naval amphibious ships as they closed on the beach. The near shore (5000 yard) launch of amphibious vehicles, mandated by the vehicle's slow water speed, put ships in "Harms Way." The use of anti-ship missiles in the Falklands, light antiaircraft missiles in Afganistan, and our most recent experiences with naval mines in the Persian Gulf serve notice that the Third World now has the potential to seriously challenge larger, more modern forces.¹³ OTH amphibious assault tactics became essential to survival. Consequently, by the mid 1980's the Navy embarked on programs like Landing Craft Air-Cushioned (LCAC) to reach full OTH capability by the early 1990's.

Current Marine Corps amphibious doctrine calls for

coordinated heliborne and surface assaults into the objective area. The means available to accomplish the surface assault is the Assault Amphibious Vehicle 7A1 (AAV7A1) - - a full tracked, amphibious vehicle which was originally fielded in 1972.

Developed using 1960's technology, the AAV7A1 is capable of achieving a maximum water speed of 8 knots. The vehicle not only transports embarked Marine infantry from ship-to-shore during the assault, it provides mobility and armor protection once ashore. A product improvement program is now underway to enhance the AAV7A1's warfighting capability until a follow on system can be fielded.¹⁴ Despite product improvements, the vehicle has significant deficiencies in the areas of mobility, survivability, and firepower which prompted the Marine Corps in 1988 to submit to DOD a Mission Needs Statement for a replacement system. As a result, the Advanced Amphibious Assault (AAA) program was launched.

AAA PROGRAM BACKGROUND

The objective of the AAA Program is to field a replacement weapon system for the current AAV7A1. The system must provide the Marine Corps with an OTH, high speed, forcible entry amphibious assault capability for the 2005 time frame and beyond.¹⁵

The AAA Program is the Marine Corps' third attempt to design and field a replacement for the AAV7A1.

In 1979, the Commandant of the Marine Corps canceled the

ill-fated LVA Program - - a program which never made it through the research and development phase of the acquisition cycle. On the drawing board, the LVA was a high water speed amphibious vehicle. After 6 years and approximately \$20 million in cost, half of which was spent on a rotary engine, a comprehensive review in 1979 identified three major areas of concern:

- The hydrodynamics associated with high water speed created an extremely complex system and a maintenance burden for the crew and mechanics,
- The high water speed increased the space required to house the power plant making the LVA unacceptably large for combat operations ashore; and,
- The projected cost for the LVA (330 million in development and 1.4 billion in procurement) made it impossible for the Marine Corps to buy all the LVAs it wanted without suffering unacceptable shortfalls in other critical equipment areas.¹⁶

After canceling the LVA program in early 1979, in testimony before the House Armed Services Committee, the Commandant, General Louis H. Wilson, Jr., said, "...I felt the Marine Corps simply could not afford the vehicle complexity that the high water speed required. It would have been difficult to maintain in the field because of its complexity."¹⁷

In 1982 the LVT(X) Program was initiated. During concept exploration, contractors developed designs for a vehicle optimized for survivability ashore. Armor protection levels were maximized, along with a highly lethal weapons system. With a projected weight of well over 35 tons, it was estimated the vehicle could only achieve an 8 knot water speed. Because of its slow water speed and unaffordable price tag, 9 billion dollars to field 1300 vehicles, the program was canceled by the Commandant

in 1985.¹⁸ As a result, an aggressive Product Improvement Program (PIP) was launched to extend the AAV7A1's combat survivability out to 2000.

During the early 1980's the Navy-Marine team was laying the keel for the OTH concept of amphibious operations. To assist in the development of its mid and long range strategies, and to assess the contribution of the MV22 Osprey and the Landing Craft Air- Cushioned (LCAC), the Department of the Navy (DON) conducted the DON Lift Study in 1983.

DON Lift was a programmatic study designed to size the forces needed to deploy and employ the assault element of a Marine Expeditionary Force and a Marine Expeditionary Brigade from OTH. Based on the notional forces involved, a landing plan was developed, an optimum mix of MV22s and LCACs was determined, and shipping to embark the force was identified. As a programmatic study, DON lift did not consider combat attrition, nor was emphasis placed on the concept of operations ashore.¹⁹

Operations were conducted from OTH with the surface assault being initiated from 25 nautical miles from shore. AAVs were transported to shore on LCACs, two per vehicle, which doubled the LCAC requirements to move Marine forces ashore.

The DON Lift Study helped size the "600 Ship Navy" and, more importantly, validated the LCAC acquisition objective of 90 craft. In 1984, Major General Harold Glasgow, USMC stated in testimony before Congress that a combination of LCACs and MV22s allowed all the assault elements, including AAVs embarked on

LCACs, to be launched from OTH and arrive on shore within 90 minutes.²⁰ By supporting DON Lift, the Marine Corps signed up to the operational concept of LCACs delivering AAVs to shore during the amphibious assault.²¹

There were underlying reasons why both the LVA and LVT(X) Programs failed. First and foremost, Marine planners could not reach consensus on required operational capabilities. Many felt the future generation of amphibious vehicles should be optimally designed for survivability ashore; others felt high water speed should drive the design equation. Secondly, the lack of a mature technology base to reduce program risks hurt both programs. Third, with no consensus on a clearly defined operational requirement, both programs were easy targets for budget programmers who argued the Marine Corps simply could not afford either program. And finally, as Marine Commandant General Al Gray said in July of 1988, "We simply lacked the institutional fortitude to get either program through the acquisition obstacle course."²²

After assuming his post in July, 1987, General Gray established the AAA Program as the Marine Corps' top ground weapon development priority for the decade of the 1990's. Subsequently, a Mission Area Analysis (MAA) of ship-to-shore movement was completed. This study pitted a notional Marine amphibious force against a future projected threat force of 1995. Documented in the study were serious deficiencies inherent in the AAV7A1 -- deficiencies which centered principally around

inadequate armor protection, critically slow land and water speeds, and an inadequate on board weapons system. These findings prompted the Marine Corps in April of 1988 to submit to the Secretary of Defense a Mission Needs Statement which outlined critical AAV7A1 deficiencies and overall system requirements.

The AAA Program was reviewed by the Defense Acquisition Board (DAB) and Defense Resources Board (DRB). The findings of both boards were favorable and, subsequent to congressional funding approval, the Marine Corps received permission to transit Milestone O and enter into Concept Exploration. In his Program Decision Memorandum of July, 1988, the Under Secretary of Defense for Acquisition, Robert B. Costello, directed the Marine Corps to, "...investigate all options for placing Marines ashore, not just the development of another amphibious vehicle."²³

During the DAB and DRB hearings, several key issues surfaced. Marine officials were queried on the need to replace the AAV7A1 with another amphibious vehicle, especially in lieu of the fielding of the Navy's Landing Craft Air-Cushioned. LCAC was designed to lift heavy vehicles, including AAVs, from ship-to-shore during OTH amphibious operations and some officials viewed the fielding of another amphibious vehicle as a redundant capability. Others questioned the need to continue surface assaults in the 21st century. The viability of an "All-Air" delivery of amphibious forces was directed to be analyzed by the Marine Corps. Finally, although the Marine Corps argued a new vehicle was required to support OTH operations, many questioned

the requirement since the concept had not been fully developed by Navy and Marine doctrine developers. It appeared that unless the Department of the Navy could articulate an OTH concept, and the role an AAV would play in ship-to-shore movement and operations ashore, the program was in trouble!

During the Concept Exploration and Definition phase of the program, three critical issues needed to be addressed:

1. What role would the future generation of AAVs play in OTH amphibious operations?
2. Based on the OTH Concept, what were the program alternatives or options available to satisfy mission requirements? Was there an impact on the Navy's projected amphibious ship mix?
3. From a cost as well as an operational effectiveness point of view which program option best fulfilled the Marine Corps mission requirements?

DEVELOPMENT OF THE OTH CONCEPT

In March of 1991, the Commanding General, Marine Corps Combat Development Command published "OTH Amphibious Operations Operational Concept." This document promises to provide the basis for determining future amphibious assault requirements well into the next century.

Our Naval forces can no longer afford to exhaust combat power in a war of attrition. FMFM-1, "Warfighting", outlines the Marine Corps' philosophy of maneuver warfare: a philosophy equally adaptable to amphibious assaults and subsequent operations ashore.²⁴ The OTH concept enhances the flexibility inherent in amphibious operations by applying maneuver warfare concepts. Through the operational speed, tactical mobility, and

firepower of combined arms teams, the landing force can attack along multiple axes by air and surface means. In so doing, the landing force creates confusion, disrupts the enemy's planning cycle, compounds his targeting problem, and denies him the opportunity to attack concentrated and relatively immobile forces.²⁵

OTH operations are much more than as some have suggested, "A Tarawa assault launched from greater distances." There is no buildup of combat power or logistical support ashore in the traditional sense. In contrast, OTH doctrine calls for self-sustaining, highly mobile, combined arms teams to attack across multiple landing beaches and rapidly project inland. Landing as battalion landing teams, each team consolidates on the move and is resupplied by air from the Amphibious Task Force. As with traditional amphibious landings, vertical (Heliborne) and surface assaults can occur simultaneously or sequentially based on the enemy situation.²⁶

The key to a successful surface assault is having sufficient ship-to-shore assets to rapidly move combined arms-infantry, armor, engineer, and artillery-units ashore. Once ashore, these forces must possess the mobility assets to rapidly project inland. Hopefully, the landing plan will allow the force to avoid enemy strengths and attack weak, lightly defended areas. However, Marines must be prepared to "Kick down the Door" with survivable mobility assets if the situation so dictates.

IN SEARCH OF ALTERNATIVES

The AAA Program has been in the Concept Exploration and Definition phase of the acquisition cycle since August of 1988. During this critical phase of the program, an operational requirement has been developed by the Marine Corps' Warfighting Center in Quantico, Virginia -- a requirement which will continue to drive the design of the system. Based on the threat and the OTH operational concept, the following essential characteristics were identified in the Required Operational Capability (ROC) approved by the Commandant of the Marine Corps in April of 1991. The system will:

- Carry the Marine rifle squad with attachments (17-18 Marines)
- Provide all-around armor protection to embarked infantry
- Achieve a minimum water speed of 25 knots
- Achieve an overland cruising speed to keep up with the M1A1 tank
- Defeat Soviet type armored combat vehicles of the time period (BMP) with its main gun.

At this point, it would be wise to quickly review the differences between an armored personal carrier (APC) and an Infantry Fighting Vehicle (IFV). By definition, the AAV7A1 is an amphibious APC.

The Marine Corps' mechanized warfare principles emphasize maneuver of forces as a means of avoiding attrition style combat. Marine infantry mounted in AAVs must have equal mobility with tanks -- they are viewed as complimentary systems on the battlefield.²⁷ During movement to an objective area, AAVs

generally follow tanks or occupy overwatch positions. In the attack, the infantry in the AAV are dismounted at some position short of the objective, while the AAV with its weapon system supports by fire.

The philosophical position that the infantry fights best dismounted has driven the Marine Corps to support the fielding of amphibious APCs, like the AAV7A1, to support mission requirements. The differences between an IFV, like the Bradley, and the APC is one of degree, not of principle. The IFV concept is based on a heavier armored vehicle in which the infantry primarily fights from inside the vehicle, dismounting only when absolutely necessary. The IFV is also heavily armed and equipped with a weapons system capable of defeating certain enemy tanks. Generally smaller than an APC, the IFV relies primarily on its armament, not its infantry, to influence the battle.

Obviously, both the APC and IFV have strengths and weaknesses. The APC is clearly superior if numbers of infantry transported is important. For example, the AAV7A1 can transport three times (18) the number of infantry than its Bradley Fighting Vehicle (6) counterpart. However, the IFV with its increased armor protection levels is favored in a mechanized warfare environment where the enemy is likewise fighting mounted in vehicles.

Concentrating on surface means of delivery, the AAA Program Office examined a variety of options to replace the AAV7A1 which were generally grouped into three categories:

- Slow amphibious vehicles carried to shore from OTH on a high speed craft;
- Development of a new high speed AAV capable of self-deploying from OTH to shore; and,
- Non-amphibious vehicles carried to shore from OTH on a high speed craft.

SLOW SPEED AMPHIBIOUS VEHICLES

A slow speed amphibious vehicle cannot achieve water speeds in excess of 10 to 12 knots. Every AAV the Marine Corps has fielded since the first "Alligator" falls into this category. Why? Quite simply, technology has not, until recently, supported the development of high speed amphibious vehicles.

Launched from beyond visual and radar range, OTH operations will originate from 25 to 50 nautical miles offshore.²⁸ A slow amphibious vehicle travelling in moderate seas (2-3 foot swells) would require 3 to 4 hours to transit this distance. Fuel loss, coupled with the fatigue the crew and embarked infantry would experience, mandate faster ship-to-shore delivery systems be utilized.

Several delivery systems were examined by the AAA Program Manager during Concept Exploration. Industry surveys were conducted to analyze the cost and operational utility of several high speed craft.²⁹ No existing or projected delivery system was found to equal the capability of LCAC. More importantly, since the future amphibious ship mix has been designed to operate with LCAC, the addition of other high speed craft or sleds to carry AAVs is not supported within the DON. Aside from

operational considerations, there is no space to accommodate them within well decks -- well decks already preloaded with LCACs.

The Program Office analyzed the following slow speed amphibious vehicle options:

- AAV7A1. The current vehicle was analyzed reconfigured with major product improvements including bolt-on armor and an Upgunned Weapons Station equipped with a 40mm automatic grenade launcher.
- AAV7A2 (slow). This is a conceptual vehicle proposed by the David Taylor Research Center (DTRC), the DON lab facility which supports the AAA Program Office. The vehicle is based on the current AAV7A1 hull design; however, it is equipped with a new 30mm gun to improve its firepower and a more powerful rotary engine for improved mobility.
- AAAV (slow). Also a conceptual design from DTRC, the hull is made of composite material to improve ballistic protection. This vehicle is equipped with the same turret or weapon station as the AAV7A2 (slow)-30mm gun-and the same engine. The newly designed hull would be considerably smaller than either the AAV7A1 or AAV7A2 (slow) which equates to survivability on the battlefield.

HIGH SPEED AMPHIBIOUS VEHICLE

The Advanced Assault Amphibious Vehicle, or AAAV, is defined as a high speed amphibian capable of self-deploying from OTH to shore. Of all the potential solutions being considered, this one has generated the most visibility and widest range of interest both inside and outside the Marine Corps.³⁰ It is certainly the most technically challenging option, and the one with the least amount of empirical data readily available.³¹ In many respects, AAAV is considered the "vertical step" in assault amphibious vehicle development.

The important point to keep in mind is that until very

recently the technological risks associated with development of a fast amphibious vehicle were viewed by many as unacceptable. However, during the past 13 years significant progress has been made by DTRC. The development of composite hulls, lightweight track, and electrically driven high speed water jets have all greatly reduced vehicle weight. Additionally, the development of high horsepower engines, including rotary engines, now provides the power to propel future amphibious vehicles at high speeds on land and in water.

NON-AMPHIBIANS

The third category of possible options includes non-amphibian vehicles, vehicles incapable of operating in open ocean or surf zones. Like slow-swimming amphibian vehicles, non-amphibious vehicles require a high speed craft to transport them from ship-to-shore.

Six non-amphibian candidates were analyzed by the Program Office -- the Light Armored Vehicle (LAV)-25, the Army's M113A3, the Army's Bradley Fighting Vehicle, the Army's Future Infantry Fighting Vehicle (FIFV) and a notional future Marine Corps Armored Personnel Carrier, APC(X).

COST AND OPERATIONAL EFFECTIVENESS ANALYSIS (COEA)

To assist the AAA Program office in estimating the cost and operational effectiveness of AAA options, the Center for Naval Analyses (CNA) conducted a COEA in preparation for the Milestone

1 review which is currently scheduled for 4th Quarter FY 92.³² The operational effectiveness analysis was based on measures of effectiveness (MOEs) produced by force-on-force computer simulations using CNA's Amphibious Warfare Model.

Two scenarios involving both low and mid intensity conflict were used in the analysis. Each candidate system's operational effectiveness was measured during both ship-to-shore movement and operations ashore. Threat data for the 2005 time frame was developed by the Marine Corps Combat Development Command and validated by the Defense Intelligence Agency.

Notional Marine forces used in the analysis were organized and equipped based on the POM 92 equipment list and the projected force structure for FY 2000.³³ For example, M1A1 Tanks were used and the Marine infantry battalion was organized with three vice four Rifle Companies. To ensure connectivity with the 1991 DON Integrated Amphibious Operations and USMC Air Support Requirements Study, the amphibious ship mix, concept of operations and landing tables were mirror-imaged in the COEA. Critical MOE's evaluated in the analysis included:

- Rate of combat power build-up ashore
- Land and water speed (mobility)
- Troop carrying capacity
- Firepower effectiveness
- Armor protection levels (survivability)

As directed by the DAB, the "All Air" delivery of landing forces was analyzed. There are significant disadvantages to this

option. Most importantly, the force arrives on shore with no armor protected mobility assets. In a mechanized warfighting environment, this could prove disastrous. Second, delivering the forces ashore that previously comprised the surface assault element requires additional helicopter assets, roughly double, to achieve the same rate of combat power build-up ashore. Third, to accommodate this increase in helicopters additional deck spots on amphibious ships would be required. Redesigning the future amphibious ship fleet would be necessary to support this option.

Early in the COEA process the "All Air" option was briefed to a steering committee comprised of members representing the Marine Corps' Warfighting Center, the AAA Program Manager's Office, CNA, Headquarters Marine Corps and the Office of the Secretary of Defense (Program Analyses and Evaluation). The committee concurred that this option was operationally and fiscally unacceptable.

Concentrating on surface options, the number of LCACs and composition of the landing force was kept constant. Ship-to-shore delivery times were calculated to compute the rate of combat power build-up ashore.

The LAV-25, Bradley IFV and Future IFV were early casualties in the analysis. Why? Their troop carrying capacities were roughly one-third that of the other alternatives which resulted in significantly more LCAC runs to move the force ashore. For example, over 5 hours was required to move the Future IFV equipped force to shore. Keeping in mind the OTH concept and the

requirement to rapidly project the landing force inland, these longer delivery times result in "piece-mealing" combat power ashore. Heavy friendly casualties result. Additionally, the manpower costs associated with these options are unaffordable. With triple the amount of vehicles, triple the amount of crews and maintenance personnel are required to support them. This is unacceptable given the current downsizing trend in the Marine Corps today.

Throughout the ship-to-shore analysis one fact was made clear - the force that arrived on shore the quickest suffered the lightest casualties.

Getting ashore rapidly equates to survival. The enemy has less time to react and move his forces to friendly landing sites. The more time it takes to move a force ashore, the greater the opportunity for the enemy to direct air and artillery fires on friendly positions -- both result in heavy casualties.

AAAV (Slow) and APC(X), with their 18 troop carrying capacities, required fewer LCAC runs to move the force ashore and achieved quicker combat power build-up rates than the Bradley IFV of FIFV force. However, since AAAV (Fast) is a self-deploying high speed vehicle, it does not require an LCAC to transport it to shore. As a result, 50% more LCAC loads are available to move tanks, artillery and other combat support equipment ashore. The AAAV (Fast) will allow for the fastest combat power build-up ashore while requiring the fewest LCACs.³⁴

The impact each option would have on the future amphibious

ship mix was also analyzed by CNA. The present 65 amphibious ship fleet will likely shrink to 53 by 2000. Clearly, any AAA option which requires additional square footage within existing or programmed ships is probably not going to receive support within DON or DOD. This is the case with the LAV-25, Bradley IFV and FIFV options. CNA calculated the number of vehicles preloaded in LCACs, and the additional storage space required to store the remaining vehicles in the force. Anywhere from three to five additional ships would be required to support these options.

LCAC requirements for the AAV(Slow) and APC(X) are identical. Both vehicles carry 18 Marines. To land the force equipped with either vehicle requires the same number of LCAC trips to shore. As a result, both options require the same ship

With the AAV(Fast) option ship savings can be achieved. Why? Since your AAVs can independently swim to shore, they don't need LCACs which can therefore be preloaded with other heavy equipment. CNA's analysis indicated a savings of three amphibious ships could be achieved with the AAV(Fast) option.³⁵

During the "Operations Ashore" portion of the COEA, friendly forces engaged enemy forces in force-on-force scenarios. "Kill Data" was obtained by modeling the effects of artillery and the range and accuracy of direct fire weapons.

Because of their greater levels of armor protection, the Bradley IFV and FIFV were the most "survivable" options. In contrast, the LAV-25 and AAV7A1 were the most vulnerable because

of their minimum armor protection levels. All options equipped with the 30mm gun achieved superior engagement results when confronting threat armor vehicles.

AFFORDABILITY

Three options - the AAV(Fast), the AAV(Slow) and the APC(X) - emerged from the operational effectiveness portion of the COEA in close competition. All received cost estimates from CNA, as well as an Independent Cost Estimate from the Naval Center for Cost Analyses (NCA). Listed below are total program costs for each option. Development, procurement and operations/support costs for a 20 year life cycle were calculated. Costs were based on a notional fleet of approximately 950 vehicles and on FY91 constant dollars.³⁶

<u>Option</u>	<u>NCA</u>	<u>PM/CNA</u>
AAV(fast)	8.7B	10.1B
AAV(slow)	6.5B	8.2B
APC(X)	6.3B	7.3

In reviewing the above cost estimates, it's important to keep in mind the AAV(Fast) option saves three planned amphibious ships. At an approximate cost of 300 million dollars each, this is a significant savings.

Affordability will undoubtedly play a key role in the success or failure of the program. There are ways to drive

program costs down without sacrificing operational capability. Why not field a "Mixed Fleet" comprised of both fast and slow amphibious vehicles? For example, in the Persian Gulf the first mechanized ground unit deployed along the Kuwaiti border was a Maritime Prepositioned Force (MPF) - 7th Marine Expeditionary Brigade. Prior to being married up with their operators who were airlifted into theater, the brigade's AAVs were administratively off-loaded from Maritime Prepositioned Shipping. The AAVs assigned to MPF forces do not have to be configured for high speed OTH operations.

The AAA Program Office is now investigating a new alternative - the "Mixed Fleet" option.³⁷ Both high and low speed vehicles in the fleet would utilize a common hull, suspension system, and power plant. Additional rotary engines in the high speed variant would be required to achieve high water speed. MPF vehicles would be configured for slow speed and operational fleet units would be equipped with a combination of slow and fast swimmers. Common systems and components would simplify logistics support and training requirements.

And, the technology to support high water speed is here today! It's called the Propulsion Systems Demonstrator (PSD) - a 30-ton test vehicle which integrates state-of-the-art amphibious vehicle technologies.³⁸ PSD was built by AAI Corporation for the David Taylor Research Center. It travels at 45 mph on land using a diesel engine. In water, it utilizes its three-stage water jet drive system with a turbine engine. It's the same

engine found in the Army's Blackhawk helicopter. PSD has a troop carrying compartment designed to carry 18 Marines and can accommodate a 25mm gun in its weapon station. During the past several months, PSD has undergone extensive testing and recently attained water speeds of 28 knots (32 mph).

The AAA Program Manager is currently conducting cost estimates; however, initial indications are the "Mixed Fleet" approach will reduce overall program costs compared to either the AAV(Fast) or AAV(Slow) options.³⁹

ANSWERING THE QUESTION

Given our nation's increased reliance on Naval forces to provide forward presence and crisis response, the Marine Corps' requirement to replace its aging fleet of AAV7A1s will continue to be critical. We've taken a vehicle designed in the 1960's for a 10 year service life to the technology "fire wall." The Marine Corps has done its homework in defining operational requirements for a new amphibious vehicle which will fully support the OTH concept of amphibious operations.

Given today's ambiguous threat environment, there are those that will contend we no longer need an OTH amphibious capability. Although the threat of global confrontation between the superpowers has disintegrated, we still need to be prepared to deal with leaders like Saddam HUSSEIN, Kim-Il SUNG or even a junta in Haiti. With the proliferation of high-tech weapons into the Third World, it's important to remember, "It doesn't take a

smart man to fire a smart weapon." Near shore amphibious assaults invite catastrophe for the Amphibious Task Force.

The AAA Program will have a tremendous impact on our Industrial Base. As the military downsizes, defense contractors will diversify, merge, be purchased by foreign investors or simply go out of business. We are already starting to see the impact of program cancellations. There are a limited number of prime contractors involved in the production of tracked vehicles. In fact, only one - FMC Corporation in San Jose, California - has built assault amphibious vehicles for the Marine Corps during the past 45 years. Coincidentally, FMC is also the prime contractor for the Army's Bradley IFV. Given DOD's recent emphasis on the continuing importance of defense research and development efforts, we'd be well advised to ensure firms like FMC stay above water.

The future generation of AAVs must provide Marines the means to:

- Rapidly project combat power ashore from OTH;
- Support mobility and firepower requirements during operations ashore;
- Conduct riverine operations; and;
- If required, re-enter the surf zone and use littorals to envelop or by-pass enemy positions.

Perhaps no other weapon system in the Marine Corps' arsenal is more important to success on the battlefield than the AAV. It's critical we continue to protect our Marines with a vehicle that provides them with the speed, armor protection, and

firepower required to win on today's lethal battlefield.

We were lucky in the Persian Gulf. With over 700 AAVs deployed to theater, only two were lost - one to mines and one to enemy fire. The AAV7A1's inability to keep pace with our M1A1 Tank and its inadequate armor protection levels would surely have resulted in significant Marine casualties if SADDAM's warfighting machine had seriously engaged US forces.

1. Commandant of the Marine Corps(CMC), Marine Corps Long Range Plan (MLRP) 2000-2020 (Unclassified), June 1991, pp. 4-1 through 4-4. This plan projects Marine Corps roles and missions out to 2020. Based on Defense Guidance and the National Military Strategy, the MLRP, is a service plan. In section 4 of the MLRP, the National Security Environment is discussed including the importance of strategic and conventional deterrence, Maritime forward presence and crisis response.
2. Philip Gold, "Anchors Away," Naval Institute Proceedings, Oct. 7, 1991, p. 10.
3. Ibid, p. 13.
4. CMC, Over the Horizon Amphibious Operations Operational Concept, March 1991, p. B-1. This is a Fleet Marine Force reference publication which outlines the operational concepts supporting OTH amphibious operations.
5. Dr. Melvin Goodman, "Soviet-US Cooperation in Third World Conflict", NDU 1991 Topical Symposium, Nov. 14-15, 1991, p.6.
6. Major Mike Sullivan "AAA Program: The Requirement", Amphibious Warfare Review, Winter 1989, p. 21.
7. CMC, Marine Air-Ground Task Force Master Plan (MMP) 1992-2002, June 1991, p. 2-2. The MMP established the operational foundation for mid-range force development of MAGTFs. It translates long range goals promulgated in the Marine Corps' Long Range Plan into achievable objectives.
8. CMC, Marine Corps Long Range Plan 2000-2020, p. 4-3.
9. Colonel Eric L. Chase, USMC (Ret), "Protecting America: Marines Should Lead the Way," Marine Corps Gazette, December, 1991, p. 36.
10. National Security Act of 1947, Amended 1952 by Title 10, US Code. The Marine Corps is unique among the Services because its organization, size, structure and essential missions are defined by public law. The development of equipment to support amphibious operations is a mission specifically given to the Marine Corps by Congress.
11. B. H. Lydell Hart, Strategy, (New York, N.Y.: First Meridian Printing 1991) p. 336.
12. Colonel Frank Chase, USMC (Ret), "Seapower/Amphibious Warfare: The Weather Gage," Marine Corps Gazette, December 1991, p.26.

13. LtCol Jerome Bierly, USMC, "Over-the-Horizon Amphibious Operations", Marine Corps Gazette, July 1991, p.41.

14. 2005 represents the Item Exit Date for the current family of AAV7A1 vehicles. The family consists of three variants -- a personnel carrier, communications vehicle and recovery vehicle. The Product Improvement Program (PIP) was undertaken by the Marine Corps to correct critical vehicle deficiencies in the areas of firepower, mobility, and survivability. Originally fielded for a 20 year service life, the AAV7A1 will be 33 years old when a replacement system is fielded.

15. LtCol James Feigley, USMC, "The Advanced Amphibious Assault Program", Amphibious Warfare Review, Winter 1989, p.1.

16. LtCol Ky L. Thompson, USMC (Ret)", Cost, Complexity May Doom USMC's Advanced Amphibian," Armed Forces Journal, April, 1990, p.66.

17. Ibid, p. 68.

18. The Commandant of the Marine Corps, General Paul X. Kelley, had previously decided in 1982 to extend the service life of the AAV7A1. A Service Life Extension Program (SLEP) was initiated in 1983 and was subsequently completed in 1987. The Program was designed to extend the service life of the vehicle to 1995. The 1 billion dollars required to fund the SLEP was considered by CMC when the LVT(X) Program was canceled in 1985.

19. Thompson, Armed Forces Journal, p.68.

20. The 90 minute window to deliver the assault elements of the landing force was assumed by many to be a Marine Corps standard - it is not. DON Lift was programmatic and no attrition during the ship-to-shore movement was considered in the study. Enemy disposition and closure times on the beach must be considered when calculating optimum delivery times for assault elements - Tanks, Infantry, Artillery, AAV, LAV and Engineer units.

21. To date, insufficient Navy - Marine training has been conducted to validate this operational concept. Cracks to the LCAC's stern ramp, as a result of AAVs being off-loaded during near - shore amphibious operations, resulted in canceling testing in 1989. Modifications to strengthen the LCAC's ramp are underway at this time.

22. The author was present when CMC made this statement during AAA Program discussions conducted at Headquarters, United States Marine Corps in July of 1989.

23. In addition to expanding the scope of the program, Secretary Costello changed the program's title. The original title,

Advanced Assault Amphibious Vehicle (AAAV) Program, was changed in the Program Decision Memorandum to "Advanced Amphibious Assault Program."

24. CMC, OTH Amphibious Operations Operational Concept, p.3.

25. Ibid., p.8.

26. Ibid., p.12.

27. Mechanized warfare principles stress the symbiotic relationships between tanks and mounted infantry. Depending on the enemy situation and the terrain, AAVs will either lead or follow tanks. Mutual support is essential between both systems on the mechanized battlefield.

28. Bierly, Marine Corps Gazette, p.41.

29. Completed in July of 1990, this comprehensive study looked at several delivery systems including high speed sleds and surface effect ships.

30. Feigley, Amphibious Warfare Review, p.2.

31. Ibid., p.2. To obtain empirical data, two Conceptual Design and Studies are currently being conducted by AAI Corporation and FMC Corporation. Each firm will present their recommended design for a high speed amphibian during Concept Exploration. Studies will include human factors data, trade - offs, overall system performance parameters and manpower/training impacts.

32. Milestone I has slipped during Concept Exploration. As a result, Initial Operational Capability is now 2005 vice 2000 which was the original IOC proposed in the Mission Needs Statement to DOD in 1988.

33. Force structure data was derived from "MAGTF 2000", a USMC manpower study completed in July of 1990. Notional Marine Forces used in the COEA were built around Regimental Landing Teams consisting of three Battalion Landing Teams. Infantry, Tank, AAV, LAV, Engineer, and Combat Service Support units were cross-attached. Notional troop loads for AAVs were built around the Marine rifle squad with attachments (18 Marines).

34. Center for Naval Analyses, "AAA Program Cost and COEA: Ship-to-Shore Analysis", July, 1990, p. 45.

35. Ibid, p. 40.

36. DON, Naval Center for Cost Analysis, "Independent Cost Estimate for AAA Program," 8 April 1991, p.1 of Enclosure(1).

37. The "Mixed Fleet" option is a notional concept for a variable configured acquisition alternative. This alternative is a new, fully amphibious armored personnel carrier that can be fabricated or retrofited for either self-deploying high water speed or slow water speed. The efforts required for analysis are being performed by the David Taylor Research Center. Upgrading or configuring vehicles for high or low water speed would be accomplished with hydrodynamic and powerpack component changeover. The baseline design is identical for both variants.

38. The PSD is first and foremost a technology demonstrators -- not a prototype vehicle. PSD demonstrates the viability of integrating emerging technologies to produce a high speed amphibious vehicle.

39. Interview with AAA Program Assistant Program Manager, LtCol Jim Feigley, USMC, of 19 January 1991.