NEW OPTIONS FOR AMPHIBIOUS CONNECTORS

By foregoing plans to build a new Assault Amphibian Vehicle (AAV) and investing in current catamaran connectors such as the Landing Catamaran (L-Cat), Joint High Speed Vessel (JHSV), and combining the L-Cat and JHSV capabilities the Marine Corps can save billions of dollars, rapidly project combat power ashore from great distances, achieve greater simplicity in a difficult mission, and provide the Landing Force (LF) commander more maneuver avenues during the landing.
FUTURE WAR PAPER

TITLE: NEW OPTIONS FOR AMPHIBIOUS CONNECTORS

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF OPERATIONAL STUDIES

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AY 2011-12

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Approved: [Signature]
Date: 29 Mar 2012
EXECUTIVE SUMMARY

The U.S. joint force has not conducted joint forcible entry of a Corps sized force (Marine Expeditionary Force or Army Corps) since 1950 in Inchon, Korea. Even the landing at Inchon was less than a Division initially. The reasons for this are many, but the main reason is that the joint force does not have a connector strategy to answer some of the challenges relative to current and developing anti-access and area denial (A2AD) methods. A2AD threats may continue to drive the joint force further from the beach and the joint force as yet has no answer. However, if the joint force, specifically the United States Navy and United States Marine Corps, adopts a viable connector strategy (method and equipment procurement) then joint forcible entry is possible. By foregoing plans to build a new Assault Amphibian Vehicle (AAV) and investing in current catamaran connectors such as the Landing Catamaran (L-Cat), Joint High Speed Vessel (JHSV), and combining the L-Cat and JHSV capabilities the Marine Corps can save billions of dollars, rapidly project combat power ashore from great distances, achieve greater simplicity in a difficult mission, and provide the Landing Force (LF) commander more maneuver avenues during the landing. Joint forcible entry operations are possible given the proper dedication to developing connector solutions that address some of the challenges posed by A2AD threats and rapidly introducing a large force on a hostile shore from the sea.
DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

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Preface

I have always been interested in assaults from the sea found in history. It is the most challenging military operation conceivable and our nation has successfully done it time and again. Since I was a Sergeant I have been enamored with, studied, and even written a Master thesis on one of the ultimate joint forcible entry operations conducted at Iwo Jima.

Unfortunately, when most students of war and peace (military and civilian) think of joint forcible entry operations, Iwo Jima and the bloody struggle that accompanied this battle paint a horrific image of such operations. Iwo Jima is the exception vice the rule for joint forcible entry. The objective of forcible entry is always to land where the enemy is not, but the joint force must always be prepared to land in the face of the enemy. Currently, I am not sure the joint force possesses this capability and am also not sure if the joint force wants to invest in solutions. This paper is written to offer some solutions based on the connector strategy we use now and what I think the future connector strategy must resemble to make joint forcible entry possible. I have a decided weakness in that I have never spent time at sea, never even conducted a peaceful landing, and like many Marines have only stood on a United States naval vessel without ever sailing on one. Yet, as a Marine I believe it is my duty to think about and wrestle with how joint forcible entry can be done. I would like to thank Dr. Gordon Rudd for planting the connector idea in my head and giving his expertise, library of information, and patience. I would also like to thank some of the experts in this military science in Colonel Michael Morris, Mr. Glenn Palmer, and Captain Anthonie Scott who gave me information, feedback, and valuable critiques on my ideas.
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Introduction

As long as the United States remains a global leader and maritime power it will have to conduct landing operations and potentially forcible entry operations. Forcible entry is one of the most difficult military operations and requires tremendous planning, rehearsals, unique assets, and a committed focus to be successful in the age of modern warfare. In the past few decades the joint community, led by the U.S. Marine Corps and United States Navy, has advanced concepts such as Ship-To-Objective-Maneuver (STOM), Operational Maneuver From the Sea (OMFTS), and Seabasing as ways to deal with potential threats to landing operations, but when restricted to using current connectors these concepts are not viable across the range of military operations and will fail to meet the desired end.

Currently the connectors used during landing operations have limitations relative to overcoming anti-access and area-denial (A2AD) threats. Taken in concert with the incredible engineering problems faced in the development of the next amphibious combat vehicle, the USN and USMC are faced with the possibility of being denied access from the sea if a serious study is not conducted to develop the adequate means. The USMC and USN must develop an innovative connector strategy to project sufficient combat power from the sea during future forcible entry operations.

Force Size, Speed and Distance, and Simplicity

Forcible entry operations are a race to amass combat power ashore more quickly than a land based opponent can respond. The level of combat power required to win this race is also related to the risk that the Landing Force (LF) commander is willing to accept. For the purpose

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1 Connector for the purpose of this essay is any self-propelled craft capable of moving 20 STON (to include the connector's weight) of material and personnel from the ship-to-shore or shore-to-shore.
of this paper the three minimum requirements that should shape future amphibious connector strategy (methods and equipment procurement) are dominated by force size, speed and distance, and simplicity.

There are multiple standards that could be applied when discussing current or future forcible entry operations, but the three listed above can at least focus the argument. The USN/USMC needs the capability to land a Marine Expeditionary Force (MEF), equivalent to an Army Corps, for joint forcible entry on any foreign shore. JP 3-18 does not designate a force size required to conduct joint forcible entry operations. Marine Corps Strategy 21 defines the lowest organization capable of forcible entry as the Marine Expeditionary Brigade (MEB). As MEB is the minimum starting point, a MEB should not be the basis for planning, thus the criteria above for a strategy capable of landing a MEF.

Speed and distance can be argued from multiple vantage points, but must be defined in some form to frame the problem. Having multiple slow moving connectors may be sufficient provided risk to force can be mitigated. However, combined with the unpredictable sea, emerging A2AD threats, and chance involved with military operations, faster is usually better. The methods and connector assets must be able to offload a MEF's essential combat equipment within a six to eight hour period during darkness (speed). The starting point (distance) for offload must begin at a minimum of 18 nautical miles. The standard for connector speed is currently about 7-8 knots (average speed of a loaded Landing Craft Utility or LCU) which means the slowest future connector can only make one trip at 18 nautical miles from shore.

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ii 18 nautical miles is the mean distance beyond the horizon accounting for the variables of atmospheric refraction and elevation of terrain (80 meters) by human observation. http://blogs.discovermagazine.com/badastronomy/2009/01/15/how-far-away-is-the-horizon/

iii The current Assault Amphibian Vehicle (AAV) has a planning speed of five knots, but design requirements for the Amphibious Combat Vehicle (ACV) estimate a speed of 8.2 knots for its
The need for simplicity as a military principle of war becomes more necessary as the difficulty increases for a military operation. Forcible entry operations are difficult, so difficult that the last operation that landed a MEF sized force was the 1950 landing at Inchon, Korea. While many amphibious operations have happened and will happen, forcible entry operations require the joint force to change its current connector strategy. The ability to surge the number of connectors, crews that could quickly be trained to operate them, and the maintenance required of those connectors should be as simple as possible.

**Current Connectors**

The main connectors that the USN/USMC is planning to use in future landing operations are the Landing Craft Air Cushion (LCAC), Landing Craft Utility (LCU), and a replacement for the Assault Amphibian Vehicle (AAV) currently referred to as the Amphibious Combat Vehicle (ACV). Even when maximized, current USN/USMC connectors require 11-12 hours to offload a Marine Expeditionary Unit's (MEU) combat essential equipment. Against a near peer competitor with hostile intentions 12 hours to offload could prove disastrous. In order to understand the problem a closer look is required at each of the current connectors starting with USN then USMC connectors.

The LCAC is a hover craft designed to land equipment and personnel on the beach. It is relatively fast with a speed of 35 knots\(^iv\) and can be “overloaded” to carry an M1 Abrams tank weighing 72 tons. It is a remarkable connector that provides rapid transition from ship-to-shore.

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\(^iv\) The LCAC can reach speeds of 40 knots but as the distance from the shore increases the speed drops to 35 knots and it takes a considerable distance to reach top speeds.

or shore-to-shore and can access around 70% of the world's shores. The weakness of the LCAC is its inability to move a substantial amount of forces or equipment and its lack of simplicity.

The LCAC also has extensive maintenance requirements and a large maintenance footprint aboard ship. The longer the LCAC operates the fewer sorties it can generate and the more days LCAC operations must be suspended to maintain the craft. LCACs require a high degree of skill to operate the craft making it difficult to quickly train and surge new operators for MEF sized operations. The future plan for the LCAC, the LCAC-100, is a Service Life Extension Program (SLEP) to keep current LCACs in operation.

The LCACs complement for joint forcible entry operations used by the USN/USMC is the LCU 1600. The LCU is capable of carrying 147 tons and can reach speeds of around 11 knots though its top speed loaded is 7-8 knots. It is obvious that with this increased carrying capacity the LCU sacrifices speed, but this is not necessarily a weakness if risk to force can be mitigated. The LCU has a longer operating range than the LCAC and the unique need to keep it in the Navy is that it can be used to conduct salvage operations. From a practical standpoint, the LCU is dependable and made to last (average age of current assets is 41 years). The LCU’s future is a mixture of the SLEP and a slightly improved version (plans are not solidified for specific improvements).

The Marine Corps' connector in the assault phase of a joint forcible entry operation is the AAV. The plan to replace the AAV with the Expeditionary Fighting Vehicle (EFV) proved a painful and expensive saga for the Marine Corps, but the AAV is a necessary connector. The

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7 There is a discrepancy between the Program Management (PM) office and the Navy fact website regarding carrying capacity. The PM Brief shows 147 stons ("LCU Recapitalization Brief") while the Navy fact sheet states 170 tons.
main problems that led to the cancellation of the EFV were speed and armor. The concept was for the EFV to travel at 25 knots, but the added requirement of increased armor to deal with Improvised Explosive Devices (IED) created a significant engineering problem making the speed unattainable.\textsuperscript{vi}

The ACV or some version of an amphibious assault vehicle is in development to replace the AAV. The ACV has problems that relate directly to \textit{force, speed and distance}. Due to armor requirements the weight of the ACV is projected to be 40 tons. This is a 20,000 lb increase over the AAV (with attached armor) without troops.\textsuperscript{10} The USMC is already exceeding weight restrictions on amphibious ships forcing commanders to make tough decisions about what combat equipment to cut from each MEU. A heavier ACV will make such decisions more difficult for a MEU commander, much less a MEF commander.

To cut down on costs the Marine Corps seems to be restricted to a water speed of 8.2 knots due to the same engineering problem that plagued the EFV.\textsuperscript{11} One ACV from 18 nautical miles at 8.2 knots requires almost two hours travel from ship-to-shore in ideal conditions. While this is plenty of time relative to the aforementioned six to eight hour requirement, it is still a one trip capability, and the troops may not be in any condition to fight upon arrival. Based on current plans the ACV will only have a carrying capacity of 14-17 combat loaded troops vice the AAVs current carrying capacity of 21 troops.\textsuperscript{12}

What the AAV and ACV do that is so vital is provide access across most natural obstacles. Combined with the LCACs access to 70\% of the world’s beaches this is a powerful combination, but with limited numbers of amphibious ships and both connectors only a small

\textsuperscript{vi} In order to adequately displace water away from such a heavy vehicle requires horsepower (hp) almost four times greater than the current AAV. Marko, Michael Major, USMC, “Water Speed Analysis for the Amphibious Combat Vehicle.” Presentation by Marine Corps Systems Command, September 16, 2011.
force can be offloaded quickly. To land a MEF (Army Corps equivalent) requires combining all amphibious ships in the inventory (meaning no MEU would be able to operate) and various other ships.

The 11-12 hour offload example is from the 24th MEU standard configuration using five LCACs, two LCUs, and 15 AAVs assigned between its three amphibious ships. Between the various ships working simultaneously there are 36 LCAC loads, five LCU loads, and two waves of AAVs. The AAVs must be launched from 6,000 yards or less for safety reasons and carries less than 1/3 of the embarked Battalion Landing Team (BLT).13

However, with the proper connectors and method of employment, all the standards for force structure, speed and distance, and simplicity can be met. Two possibilities are already in development or in use: the Landing Catamaran (L-Cat) and Joint High Speed Vessel (JHSV). The L-Cat and JHSV\(^\text{vii}\) platforms can be used with amphibious ships, Maritime Pre-positioning Ships (MPS), or even commercial vessels to provide the MEF a viable forcible entry capability.\(^\text{viii}\)

The Way Ahead

First and foremost, the USMC needs to suspend plans for the ACV and refurbish the AAV. This is painful for Marines to think about, but the solutions presented will show it is necessary and in the best interest of securing a forcible entry capability. By divesting the money estimated for the ACV and investing in connectors, the Marine Corps can still make improvements in the AAV and create capability for the MEF as a whole. The AAV only needs to swim long distances during forcible entry operations and was designed to defeat near shore

\(^{\text{vii}}\) The JHSV will need modifications to operate with amphibious ships that will be discussed in this essay.

\(^{\text{viii}}\) In order to land a MEF requires a combination of L-Class amphibious ships, MPS, and commercial vessels due to current and future plans for L-Class ship building programs.
obstacles. The AAV needs help with speed and distance and a connector can provide this solution.

The first connector that can assist the AAV is the L-Cat. The L-Cat is a French military connector that recently took part in Exercise BOLD ALLIGATOR, a Joint and Multi-national amphibious exercise, at Camp Lejeune. It has a carrying capacity of 99 tons and a maximum speed of 25 knots. Its catamaran design allows it to reduce its draft to 0.8 meters allowing it to navigate to shallow waters and land on the beach. The L-Cat can operate in USN well decks or can be used with Roll-On-Roll-Off (RORO) discharge facilities. What is most distinctive about the L-Cat is the ability to off-load underway or at the beach from forward and aft of the vessel. Currently the L-Cat's width is narrow, but discussion with a manufacturing engineer has verified that it could be widened and still fit inside current USN well-decks. Widening the L-CAT makes it faster and more importantly, if the vehicle were widened it could fit four AAVs on it.

Since the L-Cat can be offloaded underway by lowering its ramps, AAVs can be brought closer to the shore at a speed much greater than an ACV can reach, then the AAVs could “splash” off the ramp thereby reducing the requirement to swim long distances. The AAV can then overcome any near beach obstacles in line with its original design. Given the proper number of L-Cat connectors it is feasible to land AAVs and make a return trip to assist in the ongoing offload. This marriage of connectors will also render huge savings to the Marine Corps.

Currently the Marine Corps plans to manufacture and purchase 573 ACVs at a total life cycle cost totaling of $19-20 billion. The initial cost of the AAV was $3 million per craft. Until the ACV is a reality, the AAV will undergo a SLEP so this increases the $19-20 billion cost to maintain these connector capabilities. If the Marine Corps kept the AAV and set aside $5 million to refurbish and update each AAV it will cost approximately $2.9 billion. The L-Cat
cost $20 million each and if it is adequately widened to carry four AAVs it will take 144 L-Cats to move all AAVs at once (provided AAV numbers and ACV numbers are the same).\textsuperscript{20} The total cost of this purchase is less than $3 billion. The total cost of an L-Cat and AAV procurement strategy is approximately $5.8 billion. Combing the AAV and L-Cat saves the Marine Corps around $14 billion dollars (See Appendix C). The marriage of the connectors saves money, reduces the speed and distance problem, and creates more options for the forcible entry commander.

The L-Cat/AAV combined capabilities create a greater amount of maneuver space for the LF Commander. An AAV or ACV will most likely swim in a direct line toward the landing site once it debarks from the ship to reduce navigational errors and conserve fuel. The limitations of an ACV will make it predictable and more targetable to the enemy. The L-Cat with AAVs aboard has a greater reach (distance) and can be used to deceive the enemy of the actual landing site with greater speed, and maximize dispersion of forces.

Loading the AAVs on an L-Cat in the well deck will take practice, but is similar to current well deck operations with current connectors and does not increase the complexity of amphibious operations. Another bonus is that the L-Cat is easier to operate (simplicity) than the LCAC and gives a similar capability. The Marine Corps can reassign force structure to assist the USN during forcible entry operations in operating L-Cats. While this seems costly in the current environment of force reductions, it is necessary and provides opportunities. Employing the L-Cat in Theater Security Cooperation (TSC) using Marine forces can provide opportunities to familiarize forces with operations and facilitate persistent forward presence of joint forces in support of Combatant Commander (COCOM) plans.
Using L-Cats in this manner also refocuses the Marine Corps on being a force from the sea that can be integrated with MEUs or other forward deployed engagement forces. It can provide a trained cadre that can rapidly expand L-Cat operators in the event that forcible entry is necessary. Unfortunately, landing a MEF is a force size problem since it requires multiple sorties to generate substantial combat power and moving large amounts of connectors to the forcible entry area is problematic. One possible solution for moving connectors is to design a mother ship for the connectors.

A mother ship can be designed based on the various connectors for moving the connectors in mass to the forcible entry area. The $14 billion\(^{ix}\) savings from the ACV program generated by an L-Cat/AAV solution can be invested in development of the mother ship. Because joint forcible entry involves all services, the USN and USMC might also invest with the Army and Air Force in a joint venture to build connector mother ships. Since all of the armed services require some of their equipment to be delivered from the sea, this will promote joint cooperation and cost savings. The L-Cats can then be used to introduce follow-on forces or even to assist in the operation of the Army’s Joint-Logistics-Over-The Shore (JLOTS). Still another option to assist in the force size problem is to combine the L-Cat with the JHSV.

The JHSV is a landing ship designed to carry 600 tons at a speed of 35 knots.\(^{21}\) Like the L-Cat, its catamaran design allows for access to multiple areas that deeper draft vessels cannot traverse. U.S. Combatant Commanders security engagement requirements have already assured the procurement of at least 12 JHSVs. The first JHSV, JHSV 1, was christened on 17 September.

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\(^{ix}\) L-Class ships cost from $1.8-$2.8 billion to manufacture so it is feasible to build between 6-7 L-Class ships or mother ships with the cost savings from foregoing the ACV.

2011. Initially planned for Army and Navy procurement, an agreement has been reached between the services to give the Navy all 12 JHSV assets.22

The design problem with the JHSV that limits its utility as a joint forcible entry connector is its requirement to be offloaded at a port via a narrow vehicle offload ramp. This design is a limitation that needs to be changed in current and future JHSV production. The JHSV was designed for a permissive environment, but like the L-Cat it is a catamaran and could be altered to mirror the L-Cats ability to land at the beach. This is a missing link from forcible entry reminiscent of the Landing Ship Tank (LST) used in large scale forcible entry operations in World War II (WWII) and Korea.

If the L-Cat ramp system is added to the JHSV (L-Cat/JHSV) then the vessel can deliver a large force or follow-on forces directly to the shore. This future connector could interface with MPS and commercial vessels using RORO facilities to deliver significant combat power ashore in a single lift. Because it can use RORO facilities, the lack of amphibious ships used for forcible entry operations can at least be mitigated. Since the JHSV is already a fully funded ship building program the changes could quickly be integrated on the planned building project.

Another possibility is to use the L-Cat/JHSV to assist in offloading L-Class amphibious ships. By designing a T-shaped ramp (T-ramp) that fits inside the well deck and locks the ship and ramp together, vehicles could be offloaded at multiple points by a combination of LCAC, LCU, L-Cat and L-Cat/JHSV. If properly conceived and developed the T-ramp can provide four points to marry connectors and equipment. Granted, this operation will take calm seas, but the possibilities for rapid offload and force projection is promising. This combination facilitates a more rapid offload of ships and provides increased speed and more distance, greater sea
maneuver space, and multiple offload options to the LF Commander’s bid to win the race to build combat power ashore (*force size*).

The combined L-Cat/JHSV variant can deliver an entire mechanized Marine infantry company ashore or simply shorten the distance a Marine company riding in AAVs needs to swim.\(^*\) An L-Cat/JHSV’s speed and littoral access provides further justification not to redesign the AAV saving billions of dollars in operating funds for the Marine Corps that can be used to build MEF power projection capability. To increase the logistical independence of forces landing via an AAV/L-Cat team or AAV/L-Cat/JHSV combination a fuel and ammunition carrying AAV can be designed. An AAV can carry over 10,000 lbs in troops and equipment which can be translated to providing fuel carrying capacity of approximately 800 gallons once a fuel pump system is added.\(^{23}\) Once inland a fuel AAV can be refueled via helicopter expedient refueling systems such as the Tactical Bulk Fuel Dispensing System (TBFDS). The same carrying capacity can also be adjusted to carry vital ammunition loads while awaiting follow-on logistical support if beach access is limited to AAVs or LCACs initially and these forces can also be resupplied via rotary wing assets.

Not only could the L-Cat/JHSV bring AAVs closer, but it could bring some of the larger combat systems ashore more quickly such as tanks and artillery. Normally heavier systems move ashore slowly, but their armor and mass fire capability respectively can be a decisive element in maneuver forces moving inland or simply establishing the lodgment area at the beachhead. A JHSV or L-Cat/JHSV can carry eight tanks, which is seven more tanks per sortie than the LCAC, LCU, or L-Cat. The JHSV can also be converted to carry seated personnel for long distance trips or can simply be used to transport large groups of personnel a short distance.

\(^*\) AAVs can “splash” at any point to defeat near beach obstacles just as they could with the L-Cat using the current JHSV design, but other vehicles will require direct beach access.
If properly planned for the JHSV could also be used as an emergency casualty evacuation platform in crisis situations or to provide additional medical triage capability to the joint force. This capability is applicable across a spectrum of contingencies.24

The L-Cat/JHSV’s ability to carry 600 tons of cargo, material, or personnel is useful in a variety of amphibious scenarios ranging from humanitarian assistance and disaster relief (HA/DR), to non-combatant evacuation operations (NEO), and all across the range of military operations (ROMO) including joint forcible entry. In short, an L-Cat/JHSV’s independent operational capability will provide a forward deployed asset capable of responding to crisis at a moment’s notice.

The final problem with the current employment of the JHSV is the use of civilian versus USN crews.25 If the JHSV is going to meet its true potential for use across the ROMO it must be piloted by the USN. The U.S. government will decide when and where joint forcible entry occurs, but the execution of the operation falls on the armed forces. Tying the JHSV to naval operations will allow for its use in multiple scenarios and COCOM requirements and build continued familiarity with the joint force. By making the slight changes of adding an L-Cat ramp and ensuring naval pilots are at the helm an L-Cat/JHSV provides an additional measure of simplicity to the LF Commander to win the race for combat power ashore.

Counterarguments

There are several counterarguments that can be made relative to the proposed concepts of this essay. First and foremost is that the L-Cat, JHSV, or L-Cat/JHSV will not assure the same level of access as the LCAC (70% of the world’s beaches). Foregoing the LCAC SLEP has not been suggested, but as it is limited in the amount it can carry and is highly technical, this vessel cannot be allowed to become the single point of failure or success. Being able to access 70% of
the world’s beaches by LCAC alone does not mean a force can use 70% of the world’s beaches for forcible entry operations. Furthermore, AAVs can be launched from the L-Cat or L-Cat/JHSV without having to travel long distances toward 70% of the world’s beaches, which is currently the greatest factor preventing a real joint forcible entry capability.

Other factors are just as important for selecting the best beach such as gradient, soil composition, and most importantly the supporting road network. Finally, if only one connector, the LCAC, can access a beach then the remainder of the follow on forces has to land at another location, forcing the LF commander to seize additional lodgments or a port.

Another important aspect of this counterargument is that current landing craft can do little to help move a MEF sized force quickly from the sea. While increasing the amount of L-Class amphibious ships is desired, the reality is that for the foreseeable future there will be a shortage of these assets. The lack of amphibious ships will not change in the near future and can no longer be used as the excuse for not maintaining the vital capability to impose U.S. national will when necessary.

There is also a traditional naval bias against aluminum in ships as it is more susceptible to stress and corrosion, but the JHSV was designed with this problem specifically in mind. The new aluminum ships are made of “marginalized” aluminum designed to avoid corrosion and provide a “tougher” version of aluminum. The commercial shipping industry is also using aluminum which means that JHSV repair can be accomplished world-wide vice limited naval installations26.

Implementing the proposed connector strategy makes joint forcible entry possible. Compounding the lack of current and future amphibious shipping is the need to purchase the
Marine Personnel Carrier (MPC)\textsuperscript{xi} which will only add additional weight to the Marine Air Ground Task Force (MAGTF). The proposed solutions will also assist in introducing the MPC and combat power ashore. The proposed connector strategy makes possible a MEF sized force that can cover incredible distances, at high speeds, maximizes simple connectors, and provides the LE commander multiple options and increased maneuver space.

**Conclusion**

The USMC and USN must develop an innovative connector strategy to project sufficient combat power from the sea during future forcible entry operations. Joint forcible entry requires a MEF sized force that can rapidly generate combat power from great distances and employs simple connector solutions. By cancelling the ACV program and using the cost savings to refurbish the AAV and invest in both the L-Cat and a combined L-Cat/JHSV, the Marine Corps can save billions of dollars and have a more capable joint forcible entry connector strategy. A2AD technology will continue to advance and drive U.S. forces further from land, but the recommended connector strategy removes the specter of distance, serves to maximize combat force potential, and mitigates risk. By using current accessible technology and investing in viable forcible entry connector strategy, the Marine Corps can provide what no other member of the U.S. Armed Forces provides to the nation in an assault from the sea.

\textsuperscript{xi} The Marine Corps plans to design and manufacture the Marine Personnel Carrier in concert with the ACV.

Appendix A
Landing Catamaran (L-CAT)

Beaching

Loading from LPD or Ro-Ro Ship


Appendix B
Joint High Speed Vessel (JHSV)


Appendix C
Cost Comparison

ACV PROGRAM ESTIMATE WITH LIFE CYCLE COST ESTIMATE (LCCE)

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<th>EQUIPMENT</th>
<th>ESTIMATED COST</th>
<th>NUMBER OF UNITS</th>
<th>TOTAL COST</th>
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<tr>
<td>PROPOSED ACV</td>
<td>~$10 MILLION/ACV + $9-10 BILLION LCCE</td>
<td>567</td>
<td>$19-20 BILLION</td>
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<td>AAV SLEP (Note 1)</td>
<td>$5 MILLION/AAV</td>
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<td>$2.84 BILLION</td>
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<td></td>
<td></td>
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<td>$21-22 BILLION</td>
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Note 1: 567 AAVs is an estimate of what the Marine Corps must keep in service until the estimated Initial Operating Capability (IOC) of 2022 for the ACV. The Marine Corps also plans to field the Marine Personnel Carrier (MPC) to replace a portion of the current AAV fleet.

AAV SERVICE LIFE EXTENSION (SLEP) AND L-CAT COST

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<th>TOTAL COST</th>
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<td>AAV (SLEP)</td>
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<td>567</td>
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</tr>
<tr>
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Glossary

A2AD – Anti-Access Area Denial
AAV—Assault Amphibian Vehicle
ACV – Amphibious Combat Vehicle
BLT – Battalion Landing Team
COCOM – Combatant Commander
HA/DR – Humanitarian Assistance Disaster Relief
JHSV — Joint High Speed Vessel
L-Cat — Landing Catamaran
LCAC – Landing Craft Air Cushioned
LCU – Landing Craft Utility
LF – Landing Force
MAGTF – Marine Air Ground Task Force
MEB – Marine Expeditionary Brigade
MEF – Marine Expeditionary Force
MEU – Marine Expeditionary Unit
MPC—Marine Personnel Carrier
NEO – Non-combatant Evacuation Operation
OMFTS – Operational Maneuver From The Sea
ROMO – Range Of Military Operations
STOM – Ship-To-Objective-Maneuver
USMC – United States Marine Corps
USN – United States Navy
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