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Marine Corps Amphibious Combat Vehicle (ACV): Background and Issues for Congress

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Summary

On January 6, 2011, after spending approximately $3 billion in developmental funding, the Marine Corps cancelled the Expeditionary Fighting Vehicle (EFV) program due to poor reliability demonstrated during operational testing and excessive cost growth. Because the EFV was intended to replace the 40-year-old Amphibious Assault Vehicle (AAV), the Pentagon pledged to move quickly to develop a "more affordable and sustainable" vehicle to replace the EFV. The Amphibious Combat Vehicle (ACV) is intended to replace the AAV, incorporating some EFV capabilities but in a more practical and cost-efficient manner. In concert with the ACV, the Marines were developing the Marine Personnel Carrier (MPC) to serve as a survivable and mobile platform to transport Marines when ashore. The MPC was not intended to be amphibious like an AAV, EFV, or the ACV but instead would be required to have a swim capability for inland waterways such as rivers, lakes, and other water obstacles such as shore-to-shore operations in the littorals. Both vehicles were intended to play central roles in future Marine amphibious operations. On June 14, 2013, Marine leadership put the MPC program "on ice" due to budgetary pressures but suggested the program might be resurrected some 10 years down the road when budgetary resources might be more favorable.

In what was described as a "drastic shift," the Marines decided to "resurrect" the MPC in March 2014. The Marines designated the MPC as ACV Increment 1.1 and planned to acquire about 200 vehicles. The Marines also planned to develop ACV Increment 1.2, a tracked, fully amphibious version, and at the time planned to acquire about 470 vehicles and fund an ongoing high water speed study. Although ACV Increment 1.1 is to have a swim capability, another mode of transport (ship or aircraft) would be required to get the vehicles from ship to shore. The Marines are reportedly exploring the possibility of developing a high water speed ACV 2.0, which could accompany tanks and light armored vehicles into combat.

On November 5, 2014, the Marines released a draft Request for Proposal (RFP) for ACV Increment 1.1. On November 24, 2015, the Marine Corps awarded BAE Systems and SAIC contracts to develop ACV 1.1 prototypes for evaluation. BAE's contract was for $103.8 million and SAIC's for $121.5 million, and each company was to build 16 prototypes to be tested over the next two years. Both BAE and SAIC delivered their prototypes early, and Engineering and Manufacturing Development (EMD) testing began mid-March 2017. In early December 2017, the Marines reportedly sent the ACV 1.1 down select request for proposals to BAE and Science Applications International Corporation (SAIC).

On June 19, 2018, the Marine Corps selected BAE Systems to produce the ACV. The initial contract—valued at $198 million—was for low-rate production of 30 vehicles to be delivered by the autumn of 2019. On April 10, 2019, during testimony to the Senate Armed Services Committee, Navy and Marine Corps leadership announced that during the fall of 2018, ACV 1.1 prototypes demonstrated satisfactory water mobility performance in high surf conditions and, in doing so, met the full water mobility transition requirement for ACV 1.2 capability. As a result, ACV 1.1 and ACV 1.2 were to be consolidated into a single variant—the ACV—which is intended to replace all AAVs.

Potential issues for Congress include the potential ramifications of the consolidation of the ACV 1.1 and ACV 1.2 programs and how the possible adoption of the Expeditionary Advance Base Operations (EABO) operational concept could affect the ACV program.

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Background

U.S. Code, Title 10, Section 5063, United States Marine Corps: Composition and Functions, dated October 1, 1986, states the following:

> The Marine Corps will be organized, trained and equipped to provide an amphibious and land operations capability to seize advanced naval bases and to conduct naval land campaigns.

In this regard, the Marines are required by law to have the necessary equipment to conduct amphibious operations and land operations. The ACV and MPC were considered integral systems by the Department of Defense (DOD) and Marine Corps to meet this legal requirement, as well as providing critical capabilities to execute the nation's military strategy.

On January 6, 2011, after spending approximately $3 billion in developmental funding, the Marine Corps—with "encouragement" from DOD—cancelled the Expeditionary Fighting Vehicle (EFV) program. The EFV was intended to replace the 40-year-old Amphibious Assault Vehicle (AAV), which currently transports Marines from ships to shore under hostile conditions. The Marine Corps cancelled the EFV due to excessive cost growth and poor performance in operational testing. Recognizing the need to replace the AAV, the Pentagon pledged to move quickly to develop a "more affordable and sustainable" vehicle to take the place of the EFV. The Amphibious Combat Vehicle (ACV) is intended to replace the AAV, incorporating some EFV capabilities but in a more practical and cost-efficient manner.

In concert with the ACV, the Marines were developing the Marine Personnel Carrier (MPC) to serve as a survivable and mobile platform to transport Marines when ashore. At present, the Marines do not have a wheeled armored fighting vehicle that can operate as a dedicated infantry carrier with Marine maneuver forces inland. The MPC was not intended to be amphibious like an AAV, EFV, or the ACV but instead would be required to have a swim[1] capability for inland waterways such as rivers, lakes, and other water obstacles such as shore-to-shore operations in the littorals. Because of a perceived amphibious "redundancy," some have questioned the need for both the ACV and MPC. In June 2013, citing budgetary pressures, the Marines reportedly put the MPC program "on ice" and suggested that it might not be resurrected for about 10 years.[2]

With the Marines involved in decades-long land conflicts in Iraq and Afghanistan and proliferating anti-access technologies such as guided missiles, some analysts questioned whether the Marines would ever again be called on to conduct a large-scale amphibious assault operation. In response to these questions and the perceived need to examine the post-Iraq and Afghanistan Marine Corps, the Department of the Navy and DOD studied the requirement to conduct large-scale amphibious operations and in early 2012 released a strategic vision for how amphibious operations will be conducted in the future. The primary assertion of this study was that the Marine Corps' and Navy's amphibious capabilities served a central role in the defense of the global interests of a maritime nation. The need to maintain an amphibious assault capability was viewed by Marine Corps leadership as establishing the requirement for the ACV and MPC (as discussed in greater detail below).

[1] An *amphibious capability* generally refers to a vehicle's ability to debark from a ship offshore at a considerable distance and then move under fire to shore. A *swim capability* refers to a vehicle's ability to traverse limited water obstacles such as streams, rivers, and smaller bodies of inland water.

[2] Lee Hudson, "Marines Put Marine Personnel Carrier on Shelf Due to Budget Constraints," *InsideDefense*, June 14, 2013.

Significance for Congress

Congress is responsible for authorizing and appropriating funds for all weapon systems programs, including the ACV. In its oversight role, Congress could be concerned about how the ACV enables the Marines to conduct not only amphibious operations but also operations ashore. Another possible congressional concern is to what extent a robust amphibious assault capability is a necessary component of U.S. national security. Cost is another issue of interest to Congress.

The Marines' Justification for the ACV and MPC

ACV

At present, the Marines use the AAV-7A1 series amphibious assault vehicle to move Marines from ship to shore. The Marines have used the AAV since 1971 and expect to continue to use it until replaced by the ACV. Over the years, the Marines claimed the AAV has become increasingly difficult to operate, maintain, and sustain. As weapons technology and threat capabilities have evolved since the early 1970s, the AAV—despite upgrades—is viewed as having capabilities shortfalls in the areas of water and land mobility performance, lethality, protection, and network capability. The AAV's two-mile ship-to-shore range is viewed by many as a significant survivability issue not only for the vehicle itself but also for naval amphibious forces.

MPC

Although the AAV has some armor protection and can operate inland to a limited extent, it is not intended for use as an infantry combat vehicle. The Marines do have the LAV-25, Light Armored Vehicle-25, an eight-wheeled armored vehicle that carries a crew of three and six additional marines. The LAV-25 is armed with a 25 mm chain gun and a 7.62 mm machine gun but is not fully amphibious, as it cannot cross a surf zone and would get to the beach via some type of connector such as the Landing Craft, Air Cushioned (LCAC). The LAV-25 has been in service since 1983. According to the Marine Program Executive Office (PEO) Land Systems, the LAV is not employed as an armored personnel carrier and usually carries a four-person Marine scout/reconnaissance team in addition to its crew.[3] In this regard, the MPC was viewed as necessary by Marine leadership for the transport and enhanced armor protection of Marine infantry forces.

Desired Operational Capabilities

ACV[4]

The Marines' 2011 Request for Information (RFI)[5] to industry provided an overview of the operational requirements for the ACV. These requirements included the following:

[3] Program Executive Office (PEO) Land Systems Marine Personnel Carrier Fact Sheet, 2010.

[4] Unless otherwise noted, information in this section is taken from the Amphibious Vehicle Request for Information (RFI) issued by the Marine Corps Systems Command on February 11, 2011.

[5] The Federal Acquisition Regulation defines an RFI as "a document used to obtain price, delivery, other market information, or capabilities for planning purposes when the Government does not **presently** intend to issue a solicitation. [FAR 15.202(e)]."

- The proposed vehicle must be able to self-deploy from amphibious shipping and deliver a reinforced Marine infantry squad (17 Marines) from a launch distance at or beyond 12 miles with a speed of not less than 8 knots in seas with 1-foot significant wave height and must be able to operate in seas up to 3-foot significant wave height.
- The vehicle must be able to maneuver with the mechanized task force for sustained operations ashore in all types of terrain. The vehicle's road and cross-country speed as well as its range should be greater than or equal to the M-1A1 tank.
- The vehicle's protection characteristics should be able to protect against direct and indirect fire and mines and improvised explosive device (IED) threats.
- The vehicle should be able to accommodate command and control (C2) systems that permit it to operate both at sea and on land. The vehicle, at a minimum, should have a stabilized machine gun in order to engage enemy infantry and light vehicles.

MPC[6]

The Marine Corps' 2011 Request for Information (RFI) to industry provided an overview of the operational requirements for the MPC. These requirements included the following:

- The vehicle must accommodate nine Marines and two crew members and have a "robust tactical swim capability (shore-to-shore [not designed to embark from an amphibious ship]) and be capable of operating at 6 knots in a fully developed sea."[7]
- The vehicle must be able to operate on land with M-1A1 tanks in mechanized task forces across the Marine Corps' mission profile.
- The vehicle shall provide protection for the occupants from the blasts, fragments, and incapacitating effects of attack from kinetic threats, indirect fire, and improvised explosive devices and mines.
- The vehicle shall be capable of firing existing Marine anti-structure and anti-armor missiles and should be able to accommodate existing command and control (C2) systems.

Expeditionary Advance Base Operations (EABO)

Defense officials noted the Marine Corps is "not currently organized, trained and equipped to face a peer adversary in the year 2025"[8] and enemies with advanced air and shore defense will make amphibious operations even riskier. To counter this, the Navy is developing the Expeditionary

[6] Unless otherwise noted, information in this section is taken from Annex A: Marine Personnel Carrier (MPC) Family of Vehicles (FOV) Requirements Set to the Marine Personnel Carrier Request for Information (RFI), February 17, 2011.

[7] Annex A: Marine Personnel Carrier (MPC) Family of Vehicles (FOV) Requirements Set to the Marine Personnel Carrier Request for Information (RFI), February 17, 2011.

[8] Jeff Schogol, "The Next Fight: The Commandant is Pushing the Corps to be Ready for a Violent, Violent Fight," *Marine Corps Times,* September 18, 2017.

Advance Base Operations (EABO) operational concept to address these concerns. EABO is described as follows:

> Expeditionary Advance Base Operations is a naval operational concept that anticipates the requirements of the next paradigm of US Joint expeditionary operations. The concept is adversary based, cost informed and advantage focused. EABO calls for an alternative, difficult to target forward basing infrastructure that will enable US naval and joint forces to create a more resilient forward based posture to persist, partner and operate within range of adversary long range precision fires. The alternative forward posture enabled by Expeditionary Advance Bases (EABs) is designed to mitigate the growing threat posed by the abundant quantity, expanded range and enhanced precision of potential adversary weaponry—particularly ballistic and cruise missiles designed to attack critical joint fixed forward infrastructure and large platforms. EABs provide a dispersed and largely mobile forward basing infrastructure that enables a persistent alternative force capability set that is similarly designed to be difficult to target and inherently resilient. The resilient, reduced signature infrastructure of EABs, combined with naval forces designed and structured to persist and operate within the arc of adversary anti-access/aerial denial (A2AD) capabilities enables naval commanders to conduct Expeditionary Advance Base Operations to support Joint Force Maritime Component Commander (JFMCC), and Fleet Commanders in the fight for sea control, by exploiting the opportunities afforded by key maritime terrain, particularly in close and confined seas. EABO advances, sustains and maintains the naval and joint sensor, shooter and sustainment capabilities of dispersed forces to leverage the decisive massed capabilities of the larger joint force with enhanced situational awareness, augmented fires and logistical support. The EABO Concept enables US naval forces to exercise 21st Century naval operational art, meet new enemy A2AD threats with new capabilities and operate and thrive in and around close and confined seas.[9]

In terms of Marine Corps amphibious assault operations, the adoption of EABO could reportedly result in "an entirely different approach to amphibious assaults as well as new weapon systems."[10] Noting that "missiles can now hit ships and landing craft while they are hundreds of miles from shore, making it far too dangerous for Marines to storm a beach with current capabilities,"[11] Marine officials are reportedly exploring ways to create temporary "bubbles" where Marines can get ashore. In response to these challenges, current and planned weapons systems might need to be modified to accommodate EABO operational concepts.

Past Programmatic Activities

2013 Decision to "Shelve" the MPC

As previously noted, in June 2013, citing budgetary pressures, the Marines reportedly put the MPC program "on ice" and suggested it might not be resurrected for about 10 years.[12] At the time of the decision, the Marines' acquisition priorities were refocused to the ACV as well as the Joint

[9] From Innovation Industry Day Announcement - Marine Corps Warfighting Laboratory - EABO 2019, February 2, 2018, https://www.fbo.gov/index?s=opportunity&mode=form&id=5ad0e3a3809bf73ddeda57b1bd32aaf1&tab=core&_cview=1.

[10] Eugene K. Chow, "How Marines are Rethinking the Art of the Amphibious Assault for the Next Big War," *The National Interest*, February 19, 2018.

[11] Ibid.

[12] Lee Hudson, "Marines Put Marine Personnel Carrier on Shelf Due to Budget Constraints," *Inside Defense*, June 14, 2013.

Light Tactical Vehicle (JLTV).[13] Although the Marines refocused budgetary resources to the ACV, difficulties in developing an affordable high water speed capability for the ACV continued to confront Marine leadership.[14]

MPC Becomes ACV 1.1[15]

In what was described as a "drastic shift," the Marines decided in March 2014 to "resurrect" the MPC and designated it as ACV Increment 1.1, acquiring about 200 vehicles. The Marines also planned to develop ACV Increment 1.2, a tracked version, and to acquire about 470 vehicles and fund an ongoing high water speed study. Although ACV Increment 1.1 would have a swim capability, a connector would be required to get the vehicles from ship to shore.

Plans called for ACV Increment 1.1 to enter the acquisition cycle at Milestone B (Engineering and Manufacturing Development) in FY2016, award prototype contracts leading to a down select to one vendor in FY2018, and enter low-rate initial production (LRIP).

Marines Release Request for Information (RFI) for ACV Increment 1.1[16]

On April 23, 2014, the Marines released an RFI for ACV Increment 1.1. Some of the required capabilities included the following:

> ... operate in a significant wave height of two feet and sufficient reserve buoyancy to enable safe operations; a high level of survivability and force protection; operate in four to six feet plunging surf with ship-to-shore operations and launch from amphibious ships as an objective; land mobility, operate on 30 percent improved surfaces and 70 percent unimproved surfaces; ability to integrate a .50 calibre remote weapon station (RWS) with growth potential to a dual mount 40 mm/.50 calibre RWS or a 30 mm cannon RWS; carrying capacity to include three crew and 10 embarked troops as the threshold, 13 embarked troops as the objective, carry mission essential equipment and vehicle ammunition; and the ability to integrate a command, control and communications suite provided as government furnished equipment....[17]

The RFI included a requirement for industry to deliver 16 prototype vehicles 9 months after contract award in April 2016 at a rate of 4 vehicles per month.[18] The Marines estimated ACV Increment 1.1 would cost about $5 million to $6 million per vehicle, about $10 million less than what the previous ACV version was expected to cost.[19]

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[13] For information on the JLTV, see CRS Report RS22942, *Joint Light Tactical Vehicle (JLTV): Background and Issues for Congress*, by Andrew Feickert.

[14] Christopher J. Castelli, "General: Marine Corps Could Shelve Development of High-Speed ACV," *Inside Defense*, October 25, 2013, and Jason Sherman, "Marine Corps Dials Back ACV, Capability, Defers High Water Speed Plans," *Inside Defense*, March 25, 2014.

[15] Information in this section is taken from Department of Defense Fiscal Year (FY) 2015 Budget Estimates, Navy, Justification Book, Volume 2, Research, Development, Test & Evaluation, Navy, Budget Activity 4, March 2014, pp. 417-421, and Lee Hudson, "Marine Corps Drastically Shifts Ground Vehicle Modernization Strategy," *Inside Defense*, March 14, 2014.

[16] Lee Hudson, "Marines Release Amphib Vehicle RFI, Seek Accelerated Schedule," *Inside Defense*, April 25, 2014.

[17] Ibid.

[18] Ibid.

[19] Lee Hudson, "Next-Generation Amphibious Vehicle Estimated to Cost $5-$6M Per Copy," *Inside Defense*, June 27,

Marines Release Draft Request for Proposal (RFP) for ACV Increment 1.1[20]

On November 5, 2014, the Marines reportedly released a draft RFP for ACV Increment 1.1. The Marines were looking for information from industry regarding program milestones, delivery schedules, and where in the program cost savings could be achieved. Plans were for two companies to build 16 prototype vehicles each for testing. Companies who competed for the two contracts included BAE Systems, General Dynamics Land Systems (GDLS), Lockheed Martin, and Scientific Applications International Corporation (SAIC).[21]

Additional Details on 2015 ACV 1.1 RFP[22]

Under the provisions of the RFP, the ACV 1.1 was envisioned as an eight-wheeled vehicle capable of carrying 10 Marines and a crew of 3 that would cost between $4 million to $7.5 million per copy—a change from the RFI estimate of $5 million to $6 million per vehicle. In terms of mobility, the ACV 1.1 would need to be able to travel at least 3 nautical miles from ship to shore, negotiate waves up to at least 2 feet, travel 5 to 6 knots in calm seas, and be able to keep up with the M-1 Abrams tank once ashore.

Proposals were due in April 2016 and the Marines reportedly planned to award two EMD contracts for 16 vehicles each to be delivered in November 2016. In 2018, the Marines would then down select to one vendor and start full production.

ACV 1.1 Fielding Plan[23]

The Marines reportedly planned to acquire **204** ACV 1.1s, to be allocated as follows:

- 1st Marine Expeditionary Force, Camp Pendleton, CA—**67**;
- 2nd Marine Expeditionary Force, Camp Lejeune, NC—**46**;
- 3rd Marine Expeditionary Force, Okinawa, Japan—**21**;
- Assault Amphibian School, Camp Pendleton, CA—**25**;
- Exercise Support Division, Marine Corps Air Ground Combat Center, Twenty Nine Palms, CA—**25**; and
- Program Manager, Quantico, VA, and Amphibious Vehicle Test Branch, Camp Pendleton, CA—**20**.

In April 2016 testimony to the Senate Armed Services Committee, the Deputy Commandant for Combat Development and Integration testified that the Marines' Acquisition Objective for the

2014.

[20] Information in this section is taken from Megan Eckstein, "Marines Expect ACV RFP in Spring; Will Choose 2 Winners for Prototype Production, Testing," *Defense Daily*, September 29, 2014, and Lee Hudson, "Marines Release Next-Gen Amphibious Vehicle Draft Request for Proposal," *Inside Defense*, November 6, 2014.

[21] Megan Eckstein, "Marines Expect ACV RFP in Spring; Will Choose 2 Winners for Prototype Production, Testing," *Defense Daily*, September 29, 2014.

[22] Information in this section is taken from Joe Gould, "Marine Amphibious Vehicle RFP Due in March," *Defense News*, February 16, 2015.

[23] Ibid.

ACV 1.1 remained at 204 vehicles, which would provide lift for two infantry battalions.[24] Full Operational Capability (FOC) for ACV 1.1 was planned for FY2020.[25]

Marines Award ACV 1.1 Contracts[26]

On November 24, 2015, the Marine Corps awarded BAE Systems and SAIC contracts to develop ACV 1.1 prototypes for evaluation. BAE's contract was for $103.8 million and SAIC's for $121.5 million, and each company was to build 16 prototypes. The Marines expected to down select to a single vendor in 2018. Initial operational capability (IOC) was expected by the end of 2020, and all ACV 1.1 vehicles were planned to be fielded by summer 2023. Plans were to equip six battalions with ACV 1.1s and 392 existing upgraded AAVs.

Both BAE and SAIC reportedly had a long history related to amphibious vehicles, as BAE built the Marines' original AAV and SAIC has built hundreds of Terrex 1 vehicles used by Singapore, and both companies had Marine Corps contracts to modernize AAVs.

ACV 1.1 was intended to have some amphibious capability but would rely on ship-to-shore connectors. ACV 1.2 is intended to have greater amphibious capability, including greater water speed and the ability to self-deploy from amphibious ships.

BAE planned to team with Italian manufacturer Iveco (which owns Chrysler and Ferrari). BAE's prototype would accommodate 13 Marines and travel 11.5 miles at about 7 miles per hour (mph) in surf and 65 mph on land. BAE's version would incorporate a V hull design intended to protect passengers from underside blasts and have external fuel tanks for increased safety. BAE intends to produce its prototypes at its York, PA, facility.

SAIC planned to team with Singapore Technology Kinetics to develop its prototype based on an existing design called Terrex. SAIC's version was said to travel 7 mph in water and incorporates a V hull design as well as blast-mitigating seats. It would carry a crew of 3 and could accommodate 11 Marines. SAIC's version plans for a Common Remote Weapons System (CROWS) (.50 calibre machine gun and a 30 mm cannon), which could be operated from inside the vehicle while buttoned up, therefore not exposing crewmen to hostile fire.

General Dynamics Land Systems (GDLS) Protests Contract Awards to the Government Accountability Office (GAO)[27]

On December 7, 2015, it was reported that GDLS would protest the award of the ACV 1.1 contract to BAE and SAIC, claiming the Marines asked for particular capabilities and then evaluated vendors by a different set of standards.

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[24] Statement of Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command and Mr. Thomas P. Dee, Deputy Assistant Secretary of the Navy, Expeditionary Programs and Logistics Management before the Subcommittee on Seapower of the Senate Armed Services Committee on Marine Corps Modernization, April 13, 2016, p. 5.

[25] Ibid.

[26] Dan Parsons, "Marine Corps Awards BAE, SAIC $225 Million Amphibious Combat Vehicle Contracts," *Defense Daily,* November 25, 2015; Lee Hudson, "BAE and SAIC Both Win Contracts for USMC Next-Gen Amphib Vehicle," *Inside Defense,* November 24, 2015; Jen Judson, "BAE, SAIC Named as Finalists in Marines ACV Competition," *Defense News,* November 24, 2015; and Lance M. Bacon, "Inside the Amphibious Vehicles that Won the Marines' $225M Contracts," *Marine Corps Times,* January 4, 2016.

[27] Jen Judson, "General Dynamics Protests ACV Contract Awards to BAE and SAIC," *Defense News,* December 7, 2015, and Dan Parsons, "In ACV Protest, GD Says Marines Corps Kept Requirements Hidden" *Defense Daily,*

GAO Denies GDLS Protest[28]

On March 15, 2016, GAO denied GDLS's protest, noting that "the Marine Corps' evaluation was reasonable and consistent with the evaluation scheme identified in the solicitation."[29] The Marines reportedly stated that the protest put the ACV 1.1 program about 45 days behind schedule but anticipated the ACV 1.1 would still be fielded on time.[30]

BAE Systems and SAIC Deliver ACV 1.1 Prototypes Early and EMD Testing Begins[31]

BAE and SAIC reportedly delivered their ACV 1.1 prototypes, with BAE delivering its first prototype in December 2016 and SAIC delivering its prototype in February 2017. EMD testing began the week of March 13 and was scheduled to last eight months.

Marine Corps Down Select Final Proposals[32]

In early December 2017, the Marines reportedly sent the ACV 1.1 down select request for proposals to BAE and SAIC. Plans called for operational testing to start in January 2018, with the Marines anticipating announcing a contract winner in June 2018 for the delivery of 204 ACV 1.1s over a four-year period.

Annual Required GAO Report on the ACV Program[33]

In accordance with the provisions of the FY2014 National Defence Authorization Act (P.L. 113-66) Section 251, GAO submitted its annual report to Congress on the ACV program in April 2018. GAO reviewed program cost estimates, updated schedules, and program assessments of test results and production readiness, and compared ACV acquisition efforts to DOD guidance and GAO-identified best practices.[34] GAO found the following:

> The first version of the Amphibious Combat Vehicle (ACV 1.1) is on track to meet development cost goals with no additional anticipated delays for major acquisition milestones. With regard to costs, the development phase of ACV 1.1 is on pace to not exceed cost goals that were established at the start of development, based on a recent Navy estimate, the ACV program office, and reporting from the contractors.[35]

December 9, 2015.

[28] Jen Judson, "GAO Denies General Dynamics' Amphibious Combat Vehicle Protest," *Defense News,* March 15, 2016, and Lee Hudson, "Following GAO Bid Protest, ACV 1.1 is Delayed but Will be Fielded On Time," *Inside Defense,* July 19, 2016.

[29] Ibid.

[30] Ibid.

[31] Lee Hudson, "BAE Systems, SAIC Will Receive Incentive Fee from Marines for Delivering Amphib Vehicles Early," *Inside Defense,* February 22, 2017, and "Marines Kick Off Next-Generation Amphibious Vehicle EMD Testing," *Inside Defense,* March 21, 2017.

[32] Lee Hudson, "Marine Corps Sends Final Solicitation to BAE, SAIC for Next-Gen Amphib Vehicle," *InsideDefense.com,* December 13, 2017.

[33] Government Accountability Office (GAO), Amphibious Combat Vehicle: Program Should Take Steps to Ensure Manufacturing Readiness, GAO-18-364, April 2018.

[34] Ibid. Executive Summary.

[35] Ibid.

GAO recommended the Marine Corps (1) not enter the second year of low rate production for ACV 1.1 until after the contractor has achieved an overall Manufacturing Readiness Level (MRL) of 8 and (2) not enter full-rate production until achieving an overall MRL of 9.[36] DOD partially concurred with this recommendation but noted that it was "reasonable to proceed at lower MRL levels if steps are taken to mitigate risks."[37]

BAE Wins ACV Competition[38]

On June 19, 2018, the Marine Corps selected BAE Systems to produce the ACV. Reportedly, the initial contract—valued at $198 million—would be for low-rate production of 30 vehicles to be delivered by the autumn of 2019. Eventually, 204 vehicles are to be delivered under the ACV 1.1 phase of the project. BAE will also produce the ACV 1.2 variant and, all told, the entire ACV 1.1 and 1.2 project is expected to deliver 700 vehicles, and, if all options are exercised, the total contract will reportedly be worth $1.2 billion.

Navy Awards BAE Contract for ACV Lot 2[39]

In December 2018, the Navy reportedly awarded BAE Systems a $140 million contract modification to build 30 Low Rate Initial Production (LRIP) ACVs as part of Lot 2, with the first vehicles expected to be delivered in the summer of 2020. Lot 1 was still scheduled to start delivery in the summer of 2019.

Director, Operational Test and Evaluation (DOT&E) FY2018 Annual Report[40]

In DOT&E's December 2018 FY2018 Annual Report, it was noted

- During the operational evaluation (OA), the ACV-equipped unit demonstrated the ability to maneuver to an objective, conduct immediate action drills, and provide suppressive fires in support of dismounted infantry maneuver in a desert environment. The ACV-equipped unit was able to maneuver in the littorals; embark aboard a landing craft air cushioned (LCAC), transit the open ocean and surf zone, and debark from the LCAC. The ACV demonstrated water mobility and the ability to self-deploy from the beach, cross the surf zone, enter the ocean, swim, and return to the beach.
- Based on data from the OA, reliability is below the program reliability growth curve (58 hours Mean Time Between Operational Mission Failures [MTBOMF]).

[36] Manufacturing Readiness Level (MRL) 8 is defined by GAO as "pilot line capability demonstrated; ready to begin low-rate production," and MRL 9 is defined as "low-rate production demonstrated; capability in place to begin full-rate production."

[37] Ibid.

[38] Matthew Beinart, "Marine Corps ACV Deal with BAE Systems Expected to Total $1.2 Billion, 700 Vehicles," *Defense Daily,* June 20, 2018, and Courtney McBride, "BAE Systems Wins Competition for U.S. Marine Corps' ACV 1.1," *Jane's Defence Weekly,* June 27, 2018, p. 5.

[39] Information in this section is taken from Mallory Shelbourne, "Navy Awards BAE Systems $140 Million Contract Modification for ACV Lot 2," *InsideDefense.com,* December 7, 2018.

[40] Information in this section is taken from *Director, Operational Test and Evaluation (DOT&E) FY 2018 Annual Report*, December 2018.

BAE vehicles demonstrated 24.9 hours MTBOMF. There were no systemic problems identified that indicate a major redesign is required.

- The ACV section was successful in 15 of 16 missions and demonstrated the capability to negotiate terrain in the desert and littorals, operate with tanks and light armored vehicles, and maneuver to achieve tactical advantage over the opposing threat force. ACV crews, supported infantry, and the opposing force noted that the vehicles performed better than the legacy vehicle in a wide variety of areas.[41]

In terms of recommendations, DOT&E noted the Program Manager, Advanced Amphibious Assault should do the following:

- Modify the infantry troop commander's station to make it easier to move between the hatch and seat.
- Assess the capability of all existing Marine Corps recovery assets to recover the ACV.
- Investigate options for preventing damage to steering/suspension when encountering battlefield debris, such as concertina wire.[42]

Director, Operational Test and Evaluation (DOT&E) FY2019 Annual Report[43]

In DOT&E's December 2018 FY2019 Annual Report, it was noted

> ACV reliability is below the expected reliability growth estimate. Based on Reliability Growth Testing, ACV demonstrated reliability was 27 percent of its planned growth estimate. The program intends to implement several engineering change proposals throughout the EMD phase to improve reliability. The suspension and steering subsystems remain the primary drivers of reduced reliability.[44]

DOT&E recommended the Marines

> Improve ACV reliability by implementing corrective actions on LRIP vehicles to reduce the failure rate and maintenance demand.[45]

ACV 1.2 Requirements

Ship-to-Shore Requirements for the Next ACV Version[46]

According to reports, the Marines envisioned that the successor to ACV 1.1—the ACV 1.2—would have a threshold requirement of 12 miles from ship-to-shore. If this threshold could be

[41] Ibid., pp. 119-120.

[42] Ibid., p. 120.

[43] Information in this section is taken from *Director, Operational Test and Evaluation (DOT&E) FY 2019 Annual Report*, December 2019, p. 114.

[44] Ibid.

[45] Ibid.

[46] Lee Hudson, "Marines Reveal ACV 1.2 Will Have Threshold Requirement of 12 Miles," *Inside Defense*, March 22, 2016.

achieved, it could help to reduce the vulnerability of U.S. naval vessels supporting Marine amphibious operations to enemy shore fire.

ACV 1.1 and ACV 1.2 Consolidated[47]

On April 10, 2019, during testimony to the Subcommittee on Seapower of the Senate Armed Services Committee, Navy and Marine Corps leadership noted

> During the fall of 2018, ACV 1.1 prototypes demonstrated satisfactory water mobility performance in high surf conditions, and in doing so met the full water mobility transition requirement for ACV 1.2 capability. Subsequently, the Milestone Decision Authority Assistant Secretary of the Navy for Research, Development and Acquisition (ASN (RD&A)) approved the consolidation of increments one and two into a single program to enable continuous production of ACVs to completely replace the AAV. The next key acquisition event is the Full Rate Production decision scheduled for the third quarter of FY 2020 following Initial Operational Test & Evaluation. ACV remains on schedule to achieve Initial Operational Capability in the fourth quarter of FY 2020.

With the consolidation of ACV variants into a single variant, there will likely be a number of programmatic changes and potential ramifications for the ACV and ACV 2.0 programs.

Navy Awards BAE Contract for ACV Lot 3[48]

Reportedly, the Navy awarded BAE Systems a $119.9 million contract modification on October 29, 2019, for the purchase of 30 ACVs under LRIP Lot 3. This contract was for the ACV command variant.

ACV 2.0[49]

Reportedly, the Marines plan to develop an ACV 2.0, capable of carrying 10 to 13 Marines plus crew, capable of high water speeds and deployment from ships far from the coast. ACV 2.0 is planned to be capable of operating on land alongside tanks and light armored vehicles. According to the Marines

> ACV 2.0 serves as a conceptual placeholder for a future Decision Point (~ 2025, or sooner) at which time knowledge gained in the fielding and employment of the first phase of ACV (1.1 and 1.2), the state of the naval connector strategy, and science & technology work towards a high water speed capable self-deploying vehicle will support an informed decision.[50]

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[47] Statement of the Honorable James F. Geurts, Assistant Secretary of the Navy for Research, Development and Acquisition ASN (RD&A) and Lieutenant General David H. Berger, Deputy Commandant Combat Development and Integration & Commanding General, Marine Corps Combat Development Command Before the Subcommittee on Seapower of the Senate Armed Services Committee on Fiscal Year 2020 Navy Modernization Programs, April 10, 2019, p. 5.

[48] Mallory Shelbourne, "Navy Awards BAE Systems $119.9 Million Contract Modification for ACV LRIP Lot 3," *Inside Defense*, October 30, 2019.

[49] Daniel Goure, "Why the U.S. Marines Amphibious Combat Vehicle Program Works, *The National Interest,* May 2, 2017.

[50] Marine Corps Combat Development Command, https://www.mccdc.marines.mil/Resources/Amphibious-Combat-Vehicle/High-Water-Speed/, accessed September 26, 2018.

Department of Defense FY2021 Budget Request[51]

The FY2021 presidential budget request includes RDT&E and Procurement funding requests in the Base Budget, as well as FY2021 requested quantities. The Marines did not request ACV Overseas Contingency operations (OCO) funding in FY2021.

Table 1. FY2021 DOD Budget Request—ACV

Funding Category	Base Budget	Base Budget	OCO Budget	OCO Budget	Total Request	Total Request
	$M	Qty	$M	Qty	$M	Qty
RDT&E	41.8	—	—	—	41.8	—
Procurement	478.9	72	—	—	478.9	72
TOTAL	**520.7**	**72**	—	—	**520.7**	**72**

Source: Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, Program Acquisition Cost by Weapon System: United States Department of Defense Fiscal Year 2021 Budget Request, February 2020, p. 3-11.

Notes: Numbers may not add due to rounding.

$M = U.S. Dollars in Millions; Qty = FY2021 Procurement Quantities.

Potential Issues for Congress

The Consolidation of the ACV 1.1 and ACV 1.2 Programs

While from an overall programmatic perspective, the consolidation of the ACV 1.1 and ACV 1.2 variants could be viewed as a favourable programmatic outcome, there are likely ramifications that might be of interest to policymakers. Potential issues include the following:

- Will the consolidation of ACV 1.1 and ACV 1.2 result in an overall cost savings?
- Will this consolidation permit the acquisition of additional ACVs because of potential cost savings?
- With the consolidation and the stated intent to replace AAVs, what is the revised timeline for the replacement of AAVs and will this result in cost savings from not having to upgrade and maintain AAVs longer than previously intended?
- How will the consolidation of ACV 1.1 and ACV 1.2 affect the ACV 2.0 program?

Expeditionary Advance Base Operations and the ACV

If the Navy and Marine Corps decide to adopt Expeditionary Advance Base Operations (EABO) as an operational concept, it could possibly have implications for the ACV program, including the following:

- At the weapon systems level, would EABO require any changes to the vehicles themselves, such as enhanced survivability, lethality, or Command, Control,

[51] Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, Program Acquisition Cost by Weapon System: United States Department of Defense Fiscal Year 2021 Budget Request, February 2020, p. 3-11.

- Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) features?
- If changes are required to facilitate EABO, how would this affect the program's overall acquisition timeline and cost?
- If EABO does not require any technical changes in the ACV program, would the adoption of EABO modify the Marines' current procurement quantities of ACVs?
- If EABO requires different procurement quantities for the different ACV versions (more or fewer), how might this affect program timelines and program costs?

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