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The Honorable Herbert H. Bateman
Chairman
The Honorable Norman Sisisky
Ranking Minority Member
Subcommittee on Military Readiness
Committee on National Security
House of Representatives

This report discusses the current status of the Navy's and the Marine Corps' capability to conduct amphibious assaults, improvements being made to that capability, the cost of those improvements, and how they will affect future budgets. The information in this report should be useful to your Subcommittee in its deliberations on the readiness of Navy and Marine Corps forces for amphibious assaults and the funding needed to modernize this capability.

We are sending copies of this report to other interested congressional committees; the Secretaries of Defense and the Navy; the Commandant, U.S. Marine Corps; and the Director, Office of Management and Budget. Copies will also be made available to others on request.

If you or your staff have any questions about this report, please call me on (202) 512-3504. Major contributors to this report are listed in appendix II.

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Analysis

Executive Summary

Purpose

Throughout their history, the Marine Corps and the Navy have conducted amphibious operations, including complicated major assaults or invasions of enemy-held territory. Recently, the Marine Corps has adopted a new concept for performing amphibious operations in the future, and planned new systems are important to effectively implementing it. In response to a request from the former Chairman, Subcommittee on Readiness, House Committee on Armed Services, GAO (1) reviewed the status of the Marine Corps' and the Navy's amphibious fleet, (2) identified the changes the Marine Corps and the Navy are planning to make to more effectively conduct amphibious operations, and (3) identified what the planned changes will cost and how they will affect future defense budgets.

Background

Amphibious operations include, but are not limited to, assaults, raids, noncombatant evacuations, and humanitarian assistance. To effectively conduct these operations, the Marine Corps must transport Marine personnel and equipment ashore in a quick, concise manner. The high complexity of major amphibious assaults necessitates many Navy and Marine elements working together: amphibious ships from which to launch an assault; helicopters and landing craft to move troops, equipment, and supplies ashore; command and control systems to enable communication; mine countermeasures to clear a path to the shore; and naval surface fire support to suppress enemy forces.

The Marine Corps has conducted amphibious operations throughout its history, including numerous assaults throughout the Pacific during World War II. Since World War II, the Marines have conducted one large-scale amphibious assault—the landing at Inchon, Korea, during the Korean War. During the Persian Gulf War, an amphibious task force was embarked on ships for a large-scale amphibious assault. Although an amphibious assault was not conducted because of the additional time required to clear mines, the potential for damage to the Kuwaiti infrastructure, and the risk of casualties and loss of equipment, the threat of an amphibious assault held several Iraqi divisions in place, so that they could not be used for inland operations. In addition, amphibious forces have been used on a smaller scale on numerous occasions, including during the Cuban missile crisis, the Vietnam War, the invasion of Grenada, and the peace operations in Somalia and Haiti.

In concert with naval forces, the Marine Corps also provides (1) forward presence around the world and (2) the ability to rapidly respond to crises. The Marines believe that in the next century the Pacific will supplant

Europe as the region of the world most important to the United States, increasing the importance of naval expeditionary forces and their amphibious capability.

The Secretary of Defense's 1995 defense planning guidance requires that the Navy and the Marine Corps have available 2.5 Marine Expeditionary Brigades of amphibious lift, including lift for vehicles—such as tanks, amphibious assault vehicles, and artillery—as well as four other categories of lift.

The Marine Corps is developing a new warfighting concept that emphasizes speed and maneuverability of its amphibious forces and places them at less risk than its current doctrine. Under this concept, for an amphibious assault, ships would be stationed 25 to 50 miles offshore, allowing them more range to defend against missiles, aircraft, and small boat attack, and the troops with their equipment would maneuver from ship to shore. The concept is intended to maximize surprise and give the Marines better control of a confrontation with the enemy. To most effectively implement the new concept, the Marine Corps is planning to procure various types of new equipment.

Results in Brief

The Marine Corps and the Navy currently have the capability to conduct amphibious operations, but the current amphibious fleet has reduced vehicle lift capability and other equipment has operational limitations that limit their effectiveness. To modernize their capability and allow them to effectively implement the new warfighting concept, the Marine Corps and the Navy plan to buy new amphibious ships, aircraft, and other systems. However, this modernization has been delayed and costs have increased.

The Marine Corps and the Navy estimate that it will cost about $58 billion to modernize the amphibious force over the next 25 years. GAO's analysis of the Department of Defense's fiscal years 1996-2001 Future Years Defense Program showed that the Navy and the Marine Corps plan to spend a much larger share of their procurement funds to buy upgraded equipment for amphibious operations than has been the case for most of the past 40 years. Beyond fiscal year 2001, the Navy and the Marine Corps will need to continue allocating a large share of available procurement funds for amphibious equipment to avoid delays. This could be a major challenge for the Navy because between fiscal years 2002 and 2005 there is more than a $16-billion gap between the projected shipbuilding budget and the cost estimate to build all the ships planned for these years.

Amphibious programs are competing for funding with other major planned procurements, such as the Navy's F/A-18E/F combat aircraft, DDG-51 destroyer, additional surface combatants, and a new attack submarine, the Air Force's F-22 tactical aircraft, and the Army's Apache helicopter. If the Congress determines the amphibious capability requirements to be valid and wishes to support the planned amphibious programs, three options seem plausible: increase Navy and Marine Corps procurement funding, spend less on other Navy or other services' planned procurements or other parts of the defense budget, or implement some combination of the first two options. These are the trade-offs that the Congress and the senior Department of Defense leadership will have to decide.

Principal Findings

Acquiring New Equipment Has Taken Longer Than Planned and Costs May Increase

Although the Marine Corps and the Navy currently have the capability needed to conduct amphibious operations, the services plan to improve equipment that is key to carrying out the Marines' new warfighting concept. The Navy plans to buy 13 new amphibious ships for $10.8 billion, which would bring vehicle lift capability back to the 2.5 Marine expeditionary brigade level required by the defense planning guidance. According to a Navy official, some eventual increases are expected in the ships' procurement cost due to inflation. The Navy originally planned to buy these ships between 1996 and 2003. However, to save money in the short term, the Navy delayed purchasing the ships until 1998 to 2005. The Congress funded procurement of two of the amphibious ships in the fiscal year 1996 Department of Defense Appropriations Act, which is several years earlier than the Navy planned to procure them. Table 1 shows the current equipment status and planned improvements.

Table 1: Current Status of and Planned Improvements to Amphibious Equipment

Equipment	Current status	Planned improvements
Amphibious ships	Net reduction of 17 active ships since fiscal year 1993 has resulted in reduced vehicle lift capability. Planned construction of most new ships has slipped.	The Navy has developed an amphibious enhancement plan to cover vehicle lift shortfall and 13 new ships are planned to be available by 2009.
Amphibious assault vehicle	Slow water speed makes vehicle more vulnerable to enemy fire and unsuitable for the Marines' new warfighting concept.	A replacement vehicle is being developed and will be available starting in 2008. In the interim, the Marines are considering a major overhaul of the current vehicle.
CH-46E helicopter	Speed, range, and troop-carrying capacity are limited, and it needs intensive maintenance.	A tiltrotor aircraft (MV-22) is being developed to replace the CH-46E, and it will be available starting in 2001. An interim overhaul to the CH-46E is planned and others may be needed.
Command and control systems	Current communication equipment has limitations making it less than optimal to support the Marines.	Communication equipment is being procured to provide improved compatibility and better communication over the horizon.
Mine countermeasures	Capability to clear mines and obstacles close to shore and on the beach is limited.	Research and development is underway to improve mine countermeasures, but in some areas, such as detecting mines, technology is still being developed.
Naval surface fire support	Current ships have 5-inch guns that lack the range and lethality to support the new warfighting concept.	The Navy is pursuing improvements to increase range, accuracy, and lethality needed for the new warfighting concept.

Services Plan to Upgrade and Replace Much Current Equipment

Ship-to-shore Equipment

The Marines plan to replace their 25-year-old amphibious assault vehicles and the CH-46E helicopters, which are used to move troops, equipment, and supplies from ship to shore, because of their age and limited capabilities. Although the readiness ratings for both pieces of equipment remain acceptable to high, they can create risks during amphibious assaults and are not compatible with the Marines' new warfighting concept. Both are slow, vulnerable to enemy fire, and limited in their range. Also, the helicopter can carry only a limited number of troops.

The Marine Corps plans to replace the amphibious assault vehicle with 1,013 advanced amphibious assault vehicles for $6.7 billion, including a $456-million increase due to a 2-year procurement delay. With a water speed of 23 to 29 miles per hour, the new vehicle could be launched from amphibious ships 25 miles or more offshore and reach shore far more quickly than the current vehicle. This improved mobility would reduce the risk to Navy ships from missiles, aircraft, boats, and mines. Until the new vehicle is fielded, beginning in 2008, the Marine Corps anticipates spending more to maintain the current vehicle. Therefore, the Marines are considering a service life extension program that they estimate will cost $473 million, but believe will reduce normal depot-level maintenance, thereby more than offsetting its cost.

The Marine Corps plans to replace its CH-46E and CH-53D aircraft with 425 MV-22 tiltrotor aircraft over a 25-year period, beginning in 2001, for $36.5 billion. The CH-46E, the Marines' primary medium-lift aircraft, has a cruise airspeed of 110 knots with a mission radius of 75 miles. It can carry nine troops. The Marine Corps has been using the CH-53D, originally a heavy-lift aircraft, because of the reduced inventory of CH-46Es due to attrition. The Marine Corps plans to overhaul the CH-46E for $160 million and is considering over $1 billion in other overhauls that may be needed to keep the CH-46E in safe and effective condition until the MV-22 is available.

Supporting Capabilities

Supporting capabilities play a major role in the success of amphibious operations, particularly assaults. The Navy and the Marine Corps are making efforts to improve three of these supporting capabilities: communication systems, mine countermeasures, and naval surface fire support. These improvements will be important to fully implement the Marines' new warfighting concept.

The Navy and the Marine Corps are buying improved communication systems to better support amphibious operations. The radios the Marines now use ashore are not compatible with the Navy's shipboard radios, and they cannot communicate over the horizon because of their short range. Department of Defense officials said they have been able to work around these limitations.

The Navy has begun several programs to improve its limited shallow-water mine countermeasures. Some of its programs are using existing technology to develop countermeasures that will be ready before 2000. Other longer term programs depend on advanced technologies that are still being developed. With its current capabilities, amphibious assaults against a heavily mined area appear to place troops and equipment at serious risk.

The Navy plans to upgrade its 5-inch gun and develop a longer range precision-guided munition to improve fire support for amphibious forces. Until the 5-inch guns are upgraded, the Navy plans to use more tactical air support.

Funding Amphibious Programs Will Require a Larger Share of the Procurement Budget

The remaining cost to develop and buy the new amphibious ships, advanced amphibious assault vehicle, and MV-22 is $58 billion over 25 years. (See table 2.)

Table 2: Cost to Complete Selection of Amphibious Programs

Then-year dollars in billions

Program	Quantity planned	Development cost	Procurement cost	Total cost
Amphibious ship	13	$ 0.1	$10.8	$10.9
Advanced amphibious assault vehicle	1,013	0.9	6.7	7.6
MV-22	425	2.5	36.5	39.0
Total		**$3.5**	**$54.0**	**$57.5**

Source: Developed by GAO from December 1994 selected acquisition reports and other information provided by the Department of Defense.

The Congressional Budget Office estimated that the military services as a whole face a potential shortfall of $11 billion to $25 billion per year between 2000 and 2010, compared with the funding projected for the 1999 budget year in the fiscal years 1995-99 Future Years Defense Program. For the Navy and the Marine Corps, the estimated shortfall was $4 billion to $13 billion per year from 2000 to 2010. Although the administration has since increased projected funding by several billion dollars per year through fiscal year 2001, the increase appears insufficient to overcome these shortfalls.

The amphibious ships' portion of Navy shipbuilding procurement for fiscal year 2001 will consume one of the highest percentages of funding for such ships in the 40-year period beginning in 1962 and will probably continue to require substantial shares of Navy shipbuilding procurement funding through fiscal year 2005. Between fiscal years 2002 and 2005, there is more than a $16-billion gap between the Department of Defense's projected shipbuilding budget and the Navy's estimate for building all the ships planned for those years.

The MV-22's share of the Navy's aircraft procurement budget is projected to be about 10 percent each fiscal year from 1997 to 2001 and is likely to require a substantial share for many years after 2001. Since fiscal year 1962, the proportion of the budget spent for aircraft for amphibious operations exceeded 7.5 percent in only 2 years and was below 5 percent in most years. The Marine Corps procurement budget for fiscal year 1996, $459 million, is far less than would be required to procure the advanced amphibious assault vehicle. While that budget is projected to double by fiscal year 2001, GAO estimates that it would have to almost triple over the present level to fund the advanced amphibious assault vehicle when procurement begins late in the next decade.

Agency Comments and GAO's Evaluation

The Department of Defense concurred with a draft of this report. The Department's comments appear in appendix I.

Contents

Abbreviations

AAV	Amphibious assault vehicle
AAAV	Advanced amphibious assault vehicle
DOD	Department of Defense
FYDP	Future Years Defense Program
LCAC	landing craft, air cushion
MEB	Marine expeditionary brigade
OMFTS	operational maneuver from the sea
SINCGARS	Single Channel Ground and Airborne Radio System

Introduction

The Marine Corps provides expeditionary forces to project combat power ashore in support of naval campaigns or in advance of Army and Air Force units. Power can be projected ashore through amphibious operations as well as by flying in the Marines to join equipment offloaded from its maritime prepositioning ships. In concert with naval forces, the Marine Corps also provides (1) forward presence around the world and (2) the ability to rapidly respond to crises. The current amphibious fleet can deploy about one-third of fleet Marine forces at any one time; the other two-thirds deploy by air and other ships.

Marine Corps Functions

Title 10 of the United States Code directs that the Marine Corps, among other things, be organized, trained, and equipped to provide fleet marine forces of combined arms, together with supporting air components, for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign. As such, together with the Navy, the Marine Corps is statutorily charged with functions that demand that it preserve and perfect the national amphibious capability.

Amphibious Operations Are an Important Marine Corps Function

Conducting amphibious assaults is a primary function of the Marine Corps. Amphibious operations include, but are not limited to, assaults, raids, noncombatant evacuations, and humanitarian assistance. An amphibious assault is a principal type of amphibious operation that involves establishing a force on a hostile or potentially hostile shore. It involves projecting force from the sea to displace shore defenders, take and hold the beachhead, and mount offensive action further inland toward an ultimate objective. A major assault stresses resources the most because it is against a defended beach and generally involves a large number of troops and equipment. Major amphibious assaults are among the most complex military operations. They require the coordinated use of diverse capabilities, including amphibious ships from which to launch an assault, helicopters and landing craft to move troops, equipment, and supplies ashore, naval surface fire support to suppress enemy forces, mine countermeasures to clear a path to the shore, and integrated command and control systems.

The Marine Corps has conducted amphibious operations throughout its history, including numerous assaults throughout the Pacific during World War II. Since World War II, the Marines have conducted one large-scale amphibious assault—the landing at Inchon, Korea, during the Korean War.

During the Persian Gulf War, an amphibious task force was embarked on ships for a large-scale amphibious assault. The force conducted feints and raids when the ground offensive began and was ready to execute a major amphibious assault. However, according to the Department of Defense's (DOD) Final Report to Congress on the Conduct of the Persian Gulf War, an amphibious assault was not conducted because of the additional time required to clear mines, the potential for damage to the Kuwaiti infrastructure, and the risk of casualties and loss of equipment. However, according to the report, the threat of an amphibious assault held several Iraqi divisions in place so that they could not be used for inland operations.[1] In addition, amphibious forces have been used on a smaller scale on numerous occasions, including during the Cuban missile crisis, the Vietnam War, the invasion of Grenada, and the peace operations in Somalia and Haiti.

Since the Persian Gulf War, the Navy and the Marine Corps have shifted their strategy from focusing on a global threat to influencing events in the world's littoral regions—areas next to oceans and seas that are within direct control of, and vulnerable to, the striking power of sea-based forces. In addition, the Marine Corps has undertaken an effort called Vision 2015 to predict future requirements 20 years hence. Vision 2015 predicts that the Pacific will supplant Europe as the region of the world most important to the United States for economic reasons. With the Pacific's vast distances and resulting long transit times, Vision 2015 asserts that strong naval forces will be needed in the region.

Amphibious Operations Are Complex Because a Variety of Equipment Is Needed

Several types of equipment are needed to conduct amphibious operations. Amphibious ships transport troops and equipment throughout the world. Once amphibious ships reach the area of operations, amphibious vehicles, landing craft, and aircraft move troops and equipment ashore. Maritime prepositioning ships, stationed in three locations throughout the world, carry equipment that could be used to support an amphibious task force. However, the ships are used primarily to support troops that are flown into a benign airfield to be married up with the equipment from the ships. Various types of supporting equipment for command and control, mine countermeasures, and naval surface fire support are also essential to the success of an amphibious operation.

[1]Although the amphibious assault was not conducted, the troops and equipment in some of the amphibious ships were offloaded in Saudi Arabia and used in the ground campaign. The remaining Marines on amphibious ships could have been offloaded if additional combat forces were required.

Amphibious Ships

Amphibious ships carry Marine Corps troops and equipment throughout the world for two primary purposes: forward presence and crisis response. The Chairman, Joint Chiefs of Staff, requires the Navy to provide forward presence in three areas of responsibility—the Mediterranean Sea, Indian Ocean, and Western Pacific. The Navy and the Marines require 12 amphibious ready groups to meet part of this requirement. Each group consists of either three or four ships and carries a Marine expeditionary unit of about 2,800 Marines and sailors and their equipment. Amphibious ships also transport troops and equipment for crisis response, such as to major regional conflicts, as well as smaller operations. In crisis response, these ships carry the assault echelon of the Marine expeditionary force.[2]

The lift capability—that is, the space available on a ship and the weight that can be carried—of amphibious ships consists of five components: troops, vehicles, cargo, helicopters, and landing craft.

- Troop space is defined as the accommodations available to carry embarked troops.
- Vehicle space is defined as the quantity of square feet available to carry vehicles such as tanks, amphibious assault vehicles (AAV), and trucks.
- Cargo space is defined as the quantity of cubic feet available to carry cargo such as food, water, and ammunition.
- Helicopter space is defined as the number of landing spots on the flight deck or in the hangar deck.
- Landing craft space is defined as the number of craft—such as landing craft, air cushion (LCAC)—that can be carried in the ship's well deck.

The Navy currently operates five different types of amphibious ships. One type is the amphibious assault ship, also known as a big deck ship, because it serves as a floating airfield for helicopters and AV-8B Harrier jets. There are three classes of this type of ship—Amphibious Assault Ship (helicopter), known as the LPH; Amphibious Assault Ship (general purpose), known as the LHA; and Amphibious Assault Ship (multipurpose), known as the LHD.

A second type of ship is the amphibious transport dock, known as the LPD-4, that has secondary aviation support and carries vehicles, cargo, and troops. There is one class of this type. A third type of ship is the dock landing ship, known as the LSD, which performs functions similar to the amphibious transport dock ships. There are three classes of this type—the

[2]A Marine expeditionary force consists of approximately 50,000 troops and the equipment and supplies to sustain it for up to 60 days.

LSD-36, LSD-41, and LSD-49. A fourth type of ship is the tank landing ship, known as the LST, which is designed to allow vehicles to roll directly off the ship onto the beach. There is one class of this type. A fifth type of ship is the amphibious cargo ship, known as the LKA, which carries heavy equipment and supplies. There is one class of this type. The Navy plans to place a new ship in the fleet—the LPD-17—that would replace three types of ships—the LPD-4, LST, and LKA—and the LSD-36 class of ship.

Maritime Prepositioning and Amphibious Forces

While some Marine expeditionary forces deploy on amphibious ships, other Marines are transported by air and assemble with equipment and supplies carried by maritime prepositioning force ships.[3] A maritime prepositioning force can perform many of the same missions as an amphibious force, such as reinforcing an amphibious assault after the initial landing, or occupying or reinforcing an advanced naval base. Marines using this equipment and these supplies are not in the initial amphibious assault waves because a secure environment is required to unload the maritime prepositioning ships. Therefore, maritime prepositioning forces can be used as follow-on forces and are not a substitute for amphibious assault forces.

The maritime prepositioning force consists of a total of 13 commercial charter ships in three squadrons located in the Mediterranean Sea (4 ships), Diego Garcia in the Indian Ocean (5 ships), and Guam in the Pacific Ocean (4 ships). Each squadron's ships provide enough ground combat equipment, combat support equipment, and sustainment supplies to support a Marine expeditionary brigade (MEB).[4] The equipment and supplies are prepositioned on the ships for 30 months at a time. Then, on a rotational basis, one ship at a time unloads all its equipment and supplies for maintenance at Blount Island Command in Jacksonville, Florida. The equipment and supplies are reloaded, and the ship sails back to its original location for another 30-month deployment.

Ship-to-Shore Movement

The landing force—troops and equipment—is transported to shore by amphibious vehicles, landing craft, and aircraft. The Marine Corps' primary means of transporting troops on water is the AAV, which converts

[3]Maritime prepositioning was developed in the 1980s, in part, because of the Navy's limited amphibious lift capability.

[4]An MEB consists of approximately 17,000 troops and the equipment and supplies to sustain it for up to 30 days.

from a water to a land vehicle. The AAV provides mobility, firepower, and armor protection for troops. The Marine Corps currently has 1,322 AAVs.

The Navy and the Marine Corps use two different types of landing craft—the LCAC and the landing craft, utility—to transport heavy equipment such as tanks and artillery from ship to shore during an assault. These landing craft are also used to transport supplies and troops. LCACs are the primary heavy equipment craft used for the surface assault. They are high-speed (over 40 knots) amphibious landing craft that use a cushion of air under their hulls to glide over water, beach, land, and obstacles up to 4 feet in height. The LCACs can land on 70 percent of the world's beaches, whereas the landing craft, utility can only land on 17 percent. The Navy has 81 LCACs, with another 10 to be delivered by 1998, which will bring the total to 91. The Navy and the Marine Corps continue to use the landing craft, utility, which is a World War II-type of flat-bottomed craft. These craft carry troops and equipment to the shore where they beach, unload the payload, and retract off the beach. Their maximum speed is about 12 knots. The Navy has 35 landing craft, utility.

Troops and equipment are also transported from ship to shore by aircraft. The Marine Corps' current medium-lift helicopters—the CH-46E and the CH-53D—are the primary troop transport aircraft. The CH-46E entered Marine Corps service in 1964 and has been out of production since 1971. The Navy procured 624 CH-46s for the Marine Corps, but 382 have been lost, primarily in Vietnam, resulting in an inventory of 242 CH-46s as of the start of fiscal year 1995. To make up for the reduced inventory of CH-46s, the Marines now use their inventory of 52 CH-53D helicopters, even though they were originally designed as heavy lift helicopters to primarily transport supplies and equipment. According to a Marine Corps official, the CH-53D helicopters were first delivered to the Marine Corps in 1966 and have been out of production since about 1971. The Marines plan to replace it with the MV-22 by 2015.

In 1981, the Marine Corps replaced the CH-53D as the heavy lift helicopter with the CH-53E. At the end of fiscal year 1995, the Marines had 146 CH-53Es to transport heavy equipment, such as artillery, trucks, and light armored vehicles, from ship to shore and retrieve crash-damaged aircraft, such as the AV-8B Harrier jet and the CH-46E helicopter. The CH-53E can also transport 55 troops per helicopter.

Supporting Capabilities Are Critical to Amphibious Assaults

In order for the Marine Corps and the Navy to conduct successful amphibious operations, particularly amphibious assaults, certain supporting capabilities are essential. These include command and control systems, mine countermeasures, and naval surface fire support.

An amphibious operation requires reliable command and control systems that can operate in a hostile environment and provide communication between all elements of the amphibious task force. These communication systems include those used by amphibious ships, helicopters, and ground forces to control ship-to-shore movement, assault vehicles and landing craft, naval surface fire support, and tactical air operations.

Naval mines can pose a significant threat in littoral environments. In an amphibious assault, mines must be cleared—particularly in water less than 40 feet deep and on the beach—to bring troops and equipment from ship to shore. Mine countermeasures involve preventing or reducing damage from mines, including hunting for and clearing mines with various types of equipment.

Navy surface combatant ships provide fire support for amphibious operations. They provide supporting firepower for amphibious operations, including suppressing and destroying enemy air defenses and artillery, delaying and disrupting enemy movement to oppose a landing, and responding to calls by troops under attack during an operation.

Marine Corps Has Developed New Amphibious Warfighting Concept

The Marine Corps plans to augment its current doctrine for amphibious assaults with a new warfighting concept, called operational maneuver from the sea (OMFTS). Although the current doctrine includes elements of maneuver warfare, amphibious assaults today would consist of more attrition-style warfare[5] than the Marines would like to use because its current equipment does not facilitate maneuver warfare. Because the planned new equipment and aircraft will increase capabilities, the Marines can better incorporate maneuver warfare concepts, which will allow them to exploit weaknesses or gaps in the enemy's defenses and surprise the enemy.

[5]Attrition-style warfare involves direct confrontation with the enemy where one force wears down the other and eventually defeats it.

Current Warfighting Doctrine

Under the Marine Corps' current warfighting doctrine, the mission objective for amphibious operations is accomplished in stages. The first stage involves maneuvering the ships. The second stage is moving the landing force from the assembly area to the shore, known as the ship-to-shore movement. The third stage is to maneuver ashore, including establishing a lodgement—a secured area of land where combat power can be built up. The lodgement is used as maneuver space to conduct combat operations toward inland objectives, as well as a base for building up combat power and sustainment capability ashore. Examples of mission objectives on land are to free a city from enemy control, secure an airfield, or destroy a communication facility held by the enemy.

The current doctrine is, in large part, based on the capabilities of the current equipment—such as the AAV and the CH-46E—responsible for moving troops from ship to shore. For example, due to the AAV's slow-water speed (8 miles per hour), the current doctrine states that AAVs should be launched from about 3 to 9 miles from shore to land within 1 hour to (1) build up combat power ashore and (2) prevent the troops' fighting capability from diminishing during travel time. Likewise, due to the CH-46E helicopter's constrained speed and range, only relatively shallow insertions into enemy territory can be made during the initial assault waves. As a result of these capabilities, amphibious ships are usually stationed no more than 25 miles from shore, putting them at increased danger from antiship missiles, according to Marine Corps officials.

New Warfighting Concept

Unlike the current doctrine for amphibious assaults, OMFTS is designed to conduct an assault as a single, seamless maneuver from the ships directly to the assigned objective. OMFTS emphasizes maneuver warfare more than current doctrine because new equipment and aircraft—such as the advanced amphibious assault vehicle (AAAV) and the MV-22—that the Marines and the Navy plan to procure and the LCAC that the Navy is procuring will provide greater speed and maneuverability and force the enemy to defend significantly more shoreline. Also, under OMFTS, amphibious ships would be stationed approximately 25 to 50 miles offshore, or over the horizon, thereby allowing the ships to stay out of some missiles' range and provide more time to react to missiles that have a range of 25 miles or more. According to a Marine Corps official, OMFTS will become doctrine as the Marines field the new equipment and aircraft needed to fully implement it.

Objectives, Scope, and Methodology

The former Chairman, Subcommittee on Readiness, House Committee on Armed Services, asked us to (1) review the status of the Marine Corps' and the Navy's amphibious forces, (2) identify the changes the Marine Corps and the Navy are planning to make to more effectively conduct amphibious operations, and (3) identify what the planned changes will cost and how they will affect future defense budgets.

To review the status of the Marine Corps' and the Navy's amphibious capability and related improvements, we interviewed knowledgeable officials about amphibious capability at the Office of the Secretary of Defense; the Joint Staff; Assistant Secretary of the Navy for Research, Development, and Acquisition; the Chief of Naval Operations; Navy, Atlantic Fleet; Navy, Pacific Fleet; Naval Air Station, Patuxent River, Maryland; Naval Base, Norfolk, Virginia; Naval Amphibious Base, Little Creek, Virginia; Naval Station, San Diego, California; Marine Corps Headquarters; Marine Corps Combat Development Command; Marine Corps Systems Command; Marine Corps Forces, Atlantic; Marine Corps Forces, Pacific; Marine Corps Base, Camp Lejeune, North Carolina; Marine Corps Base, Camp Pendleton, California; Blount Island Command, Jacksonville, Florida; and Military Sealift Command.

We reviewed relevant documentation on the cost, schedule, and capabilities of the current and planned ships, equipment, aircraft, and systems. We did not evaluate the cost estimates of the new programs; instead, we reported the official estimates from the services. We also reviewed documents, such as the bottom-up review; defense planning guidance; the Navy's and the Marine Corps' Forward From the Sea, Operational Maneuver From the Sea, and amphibious shipping plans; and cost and operational effectiveness analysis reports.

To determine the resources projected to be available in future defense budgets, we interviewed officials and obtained funding estimates from the Office of the Chief of Naval Operations and Marine Corps Headquarters. We also determined the proportion of Navy and Marine Corps budgets allocated to amphibious operations by analyzing DOD's 1996-2001 Future Years Defense Program (FYDP)—a database providing DOD planning assumptions for those years. To determine funding trends for amphibious operations, we analyzed FYDP data from 1962 through 2001, which we converted to constant dollars to adjust for inflation. We focused on the development and procurement costs for major amphibious capabilities, such as ships, medium-lift aircraft, and amphibious vehicles.

We also interviewed officials at three warfighting commands—Atlantic, Pacific, and Central—to obtain their views on whether they have sufficient amphibious capability to carry out their assigned responsibilities.

We conducted our review from February 1994 to September 1995 in accordance with generally accepted government auditing standards.

Replenishing Amphibious Ship Inventory Will Be Expensive and Take Longer Than Planned

As a result of the military downsizing and a Navy and Marine Corps plan to accelerate the decommissioning of amphibious ships, the amphibious fleet has been significantly reduced. Carrying out this plan would have resulted in retaining fewer amphibious ships than needed to meet the 2.5 MEBs of amphibious lift required by the defense planning guidance. To restore lift to the required level, the Navy and the Marine Corps developed a revised plan that includes relying on seven ships in an inactive status. However, Navy officials believe that they may not be able to reactivate the ships quickly.

The Navy plans to procure 13 new amphibious ships at a cost of $10.8 billion. The Navy's schedule for completing procurement of the ships has slipped by 2 years. The Congress, however, advanced the procurement of 2 of the 13 new ships in the fiscal year 1996 DOD Appropriations Act. As the 13 new ships are phased in and older ships are phased out, vehicle lift will reach 2.5 MEBs by 2009, meeting the level directed by the defense planning guidance.

Amphibious Fleet Has Been Significantly Reduced

According to a Navy official, at the end of the Persian Gulf War in 1991, the amphibious fleet had 62 ships, but declined to 54 by 1993 as part of the military downsizing. In August 1993, the Navy and the Marine Corps agreed to accelerate the fleet downsizing to save money and accelerated the decommissioning of 21 ships from fiscal years 1993 to 1995.[1] At the same time, the Navy took delivery of 4 new ships it had ordered before 1993, changing the fleet's size from 54 to 37 ships during this period. The Chief of Naval Operations and the Commandant of the Marine Corps agreed in 1993 that temporarily reducing amphibious lift was a prudent risk to provide funds for modernizing the fleet by procuring the 12 LPD-17 amphibious ships. The Commandant said the plan was acceptable only if the LPD-17 procurement remained on schedule, and the Chief of Naval Operations agreed.

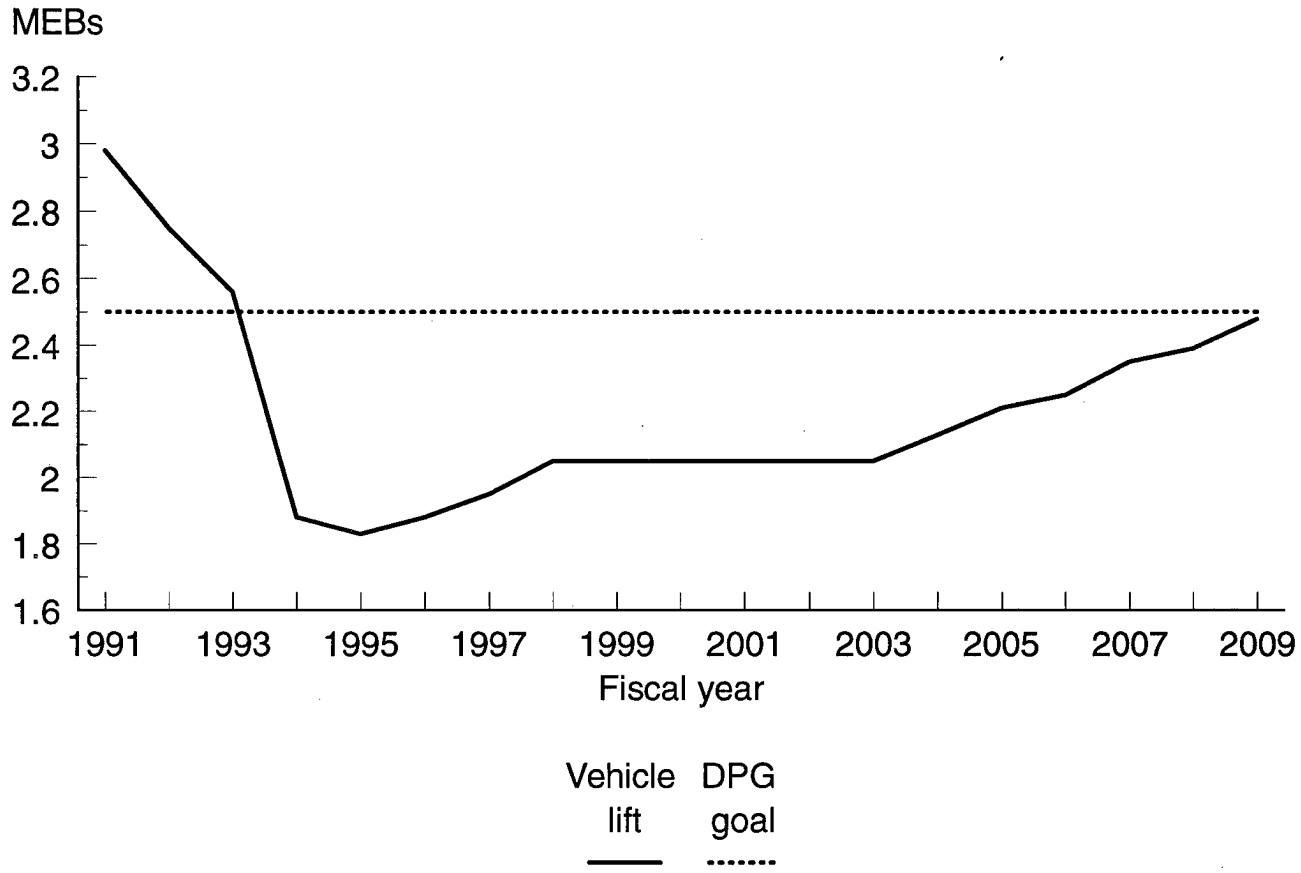
In 1990, the Navy and the Marine Corps established an amphibious lift requirement of three MEBs to meet their forward presence and crisis response missions. In fiscal year 1992, due to fiscal constraints, the FYDP established a goal of 2.5 MEBs. The Secretary of Defense's 1995 defense planning guidance affirmed this fiscally constrained 2.5-MEB goal.

[1]Navy officials said they could not tell us how much money would have been saved by accelerating the decommissioning of 21 ships because the Navy did not retain the data.

As discussed in chapter 1, amphibious lift consists of five components: troops, vehicles, cargo, helicopters, and landing craft. Vehicle lift is important to transport tanks, armored vehicles, artillery, and trucks, all of which are essential to establish combat power ashore in an assault. Vehicle lift is the only one of the five components that fell short of 2.5 MEBs from fiscal years 1993 to 1995. Vehicle lift which, according to a Navy official, stood at 2.90 MEBs at the end of the Persian Gulf War, declined to 2.56 MEBs as the size of the amphibious fleet fell from 62 to 54 ships from the end of the Gulf War to 1993. As a result of the accelerated decommissioning plan, vehicle lift declined further—to 1.88 MEBs—in fiscal year 1995. As discussed in the next section of the report, the Navy developed a revised plan in August 1994, called the amphibious enhancement plan, to rectify this decline.

If the accelerated decommissioning plan had continued, vehicle lift was scheduled to reach 2.48 MEBs by fiscal year 2009, virtually meeting the defense planning guidance level of 2.5 MEBs. (See fig. 2.1.) The planned vehicle lift shortage between 1994 and 2009 would have meant that the Navy and the Marines would not have had sufficient lift to deploy all the equipment needed to fully support 2.5 MEBs.

Figure 2.1: Projected Vehicle Lift Under Accelerated Decommissioning Plan



Before the accelerated decommissioning plan, vehicle lift would have remained at or above the 2.5-MEB level through 2007, then fallen slightly below 2.5 MEBs, to 2.45 MEBs, in 2008 and 2009.

Navy Developed Amphibious Enhancement Plan to Address Vehicle Lift Shortage

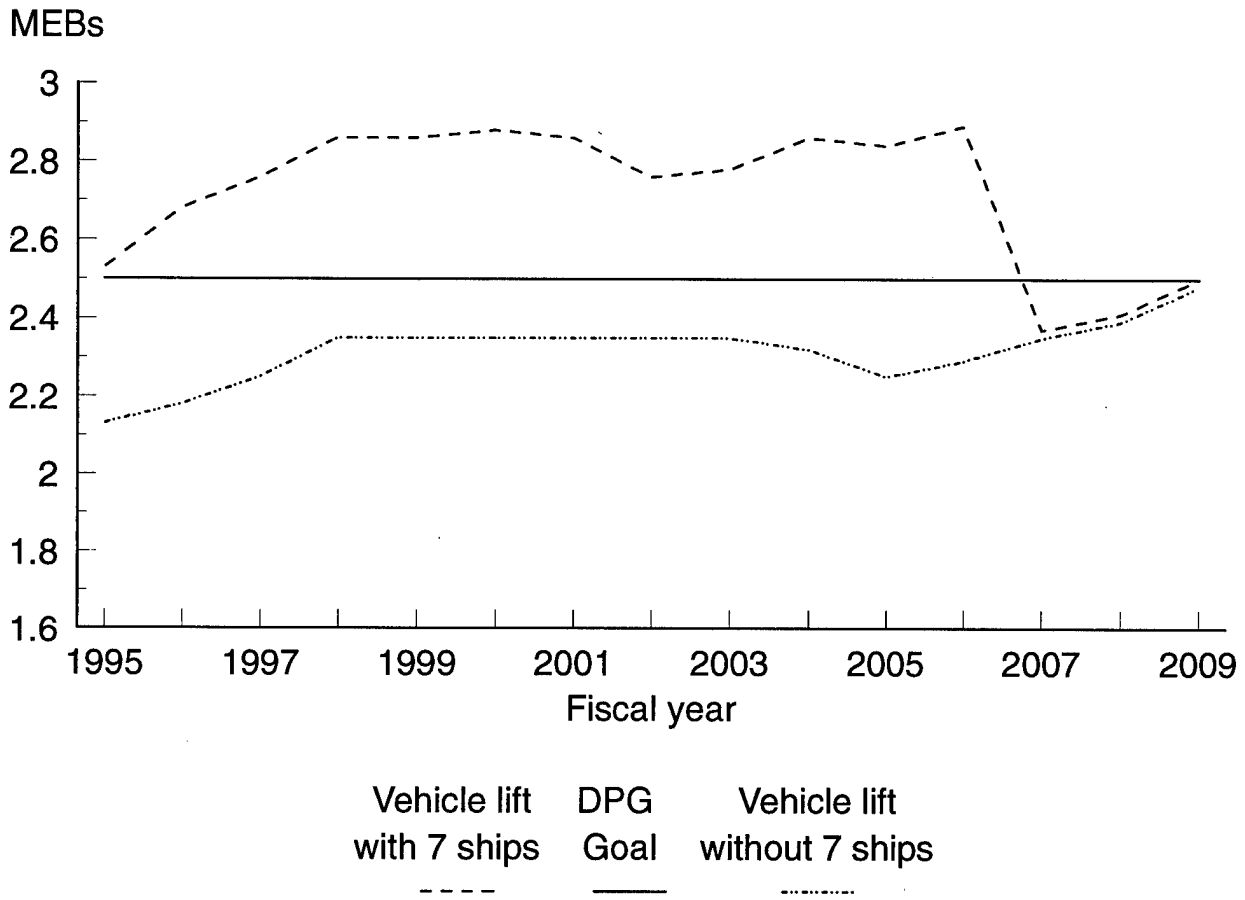
The Congress has been concerned about the reduction in amphibious lift. The Senate report on the fiscal year 1995 National Defense Authorization Act expressed concern about the reduction in amphibious lift capability due to the retirement of amphibious ships. Subsequently, the Congress

authorized the transfer of nine amphibious ships to various foreign countries, and it made the transfers conditional on maintaining amphibious lift capability for at least 2.5 MEBs. As an interim measure to ensure this minimum lift capability, the Navy developed the amphibious enhancement plan in August 1994.

The plan called for increasing vehicle lift from 1.88 MEBs at the beginning of fiscal year 1995 to 2.62 MEBs by the end of fiscal year 1995. The plan increases the number of ships in the amphibious fleet by placing two previously decommissioned LKA ships in a reduced operating status with the Military Sealift Command (which are planned to be available within 5 days) and retaining seven ships—four LSTs and three LKAs—in an inactive status, called maintenance category B, which are planned to be available within 180 days of the order to reactivate them. The two ships scheduled to be with the Military Sealift Command are in the process of being reactivated. There has, however, been a delay in implementing the plan. The first ship is now scheduled to complete reactivation in September 1996 and the second ship in December 1996. The other seven ships have been placed in maintenance category B.

Without the seven ships in the inactive status, vehicle lift would stand at only 2.13 MEBs as of the end of fiscal year 1995 and the highest level reached through 2008 would be 2.39 MEBs. Figure 2.2 compares vehicle lift under the amphibious enhancement plan with and without these seven ships. According to a Navy official, it may be difficult to reactivate the ships within 180 days because the Navy has not reactivated ships in this category before. In addition, Navy officials indicated that the longer a ship remains inactive, the longer it takes to reactivate, often because more extensive environmental work has to be done and older systems need to be replaced with newer systems. In addition, officials said that the 180 days excludes the time needed to tow the ship to the shipyard (up to 14 days).

Figure 2.2: Vehicle Lift Under Amphibious Enhancement Plan With and Without Maintenance Category B Ships



The Congress, in enacting the fiscal year 1996 DOD Appropriations Act, funded two amphibious ships in fiscal year 1996 that the Navy had postponed to later years. A Navy official said that, by March 1996, the Navy will determine the impact of this change on the ships that make up the amphibious enhancement plan and the Navy's ability to meet the required 2.5 MEBs of amphibious lift.

Navy Had Delayed Procurement of 13 Amphibious Ships

To recapitalize (i.e., modernize) the amphibious fleet, the Navy currently plans to buy 13 new ships—12 LPD-17s and 1 LHD-class big deck ship, the LHD-7. Because of budget constraints, and after the accelerated decommissioning plan was agreed to, the Navy delayed each ship's procurement date. (See table 2.1.) According to a Navy official, the Navy did not reassess the risk of delaying the LPD-17 production schedule.

Table 2.1: Procurement Schedules for LPD-17 and LHD-7 Ships Prior to Passage of the Fiscal Year 1996 DOD Appropriations Act

	LPD-17 ship schedule		LHD-7 ship schedule	
Fiscal year	Original[a]	Current	Original[a]	Current
1996	1		1	
1997				
1998	2	1		
1999	2			
2000	2	2		
2001	2	2		1
2002	2	2		
2003	1	2		
2004		2		
2005		1		
Total	**12**	**12**	**1**	**1**

[a]Procurement schedule at time of accelerated decommissioning plan.

As previously mentioned, as part of the fiscal year 1996 DOD Appropriations Act, the Congress provided funding for the first LPD-17 ship and for the LHD-7 ship, 2 and 5 years earlier, respectively, than the Navy's current procurement plan. The lead ship is now expected to be delivered in fiscal year 2002. The 1996 DOD Appropriations Act did not affect the balance of the LPD-17 procurement schedule. Each of the other 11 LPD-17s will be delivered about 4 years after their respective procurement contract award dates. The last of the 12 LPD-17s is scheduled for delivery in 2009.

According to a Navy official, the estimated cost to procure the 12 LPD-17 ships, starting in fiscal year 1996, is approximately $9.4 billion, with some eventual increase expected due to inflation. By March 1996, the Navy expects to know by how much the $9.4 billion will increase. The estimated cost to procure the LHD-7 is $1.4 billion. The total cost of procuring the 13 ships is now estimated at $10.8 billion (then-year dollars).

As the 12 LPD-17 ships and the LHD-7 are phased into the fleet, the Navy plans to phase out the 9 ships in the amphibious enhancement plan. As this process takes place, vehicle lift will fall slightly below 2.5 MEBs in fiscal years 2007 and 2008, and then increase to 2.5 MEBs by fiscal year 2009, after all 13 new ships have entered the fleet.

The Navy is required to provide 12 amphibious ready groups for forward presence, allowing one to be present in the western Pacific Ocean, Indian Ocean, and Mediterranean Sea at all times. According to the Navy, 12 amphibious ready groups are needed to allow the Navy and the Marine Corps to maintain their established personnel and operating tempo targets. At present, there are only 11 amphibious ready groups, which creates a 19-day gap in coverage for the Central Command's area of responsibility (South West Asia and West Africa), during which the ability to respond to an emerging crisis would be limited.

In addition to providing vehicle lift, the 12 LPD-17s and the LHD-7 will contribute to having 12 amphibious ready groups. The LHD-7 is particularly important because there will only be enough big deck ships for 11 amphibious ready groups until it enters the fleet as scheduled in 2001.

Maritime Prepositioning Force Is Available to Support Amphibious Operations

The equipment and supplies on the maritime prepositioning ships are used for several purposes, including supporting responses to crises and reinforcing an amphibious assault. For example, in responding to the crisis in Somalia, after the Marine expeditionary unit had landed, ships from the prepositioning squadron in Diego Garcia were sent to provide equipment and supplies.

The Marine Corps considers maintaining the equipment prepositioned on the ships to be a high priority. As of July 1995, 97.8 to 100 percent of major items on the 13 ships, such as weapons and vehicles, were considered ready for use. Also, 91.1 to 100 percent of the required equipment and supplies were available on the 13 ships. The availability of equipment and supplies is measured against the list of items that the Marine Corps determines are most needed on the ships.

The size of the 13 ships limits the quantities of equipment and supplies prepositioned to less than the Marine Corps believes it needs. This is because (1) some of the equipment has increased in size, (2) the required quantities for some equipment have increased, and (3) the Marine Corps

believes it needs additional prepositioned capabilities—such as an expeditionary airfield, a Navy mobile construction battalion, a command element augment package, and a fleet hospital. The Marine Corps already has these equipment items, so procurement funds will not be needed for them. To preposition these items, the Marine Corps said it needs three additional ships, one for each squadron. The Congress authorized up to three additional ships and appropriated $110 million in fiscal year 1995 to acquire and convert one ship.

Conclusions

The Navy and the Marine Corps agreed to accept increased risk over the next decade by reducing the amphibious fleet in the short term to provide funds for long-term amphibious ship needs. Reducing the number of amphibious ships has reduced vehicle lift, a critical component in total amphibious lift, to levels below what is called for in the defense planning guidance. The risk associated with this temporary reduction was judged to be acceptable as long as LPD-17 procurement remained on schedule. However, the Navy has delayed procuring new amphibious ships because of budget constraints, which has prolonged the period of risk.

To address the decline in amphibious lift, the Navy and the Marine Corps developed an amphibious enhancement plan. Achieving the goals of this plan depends, in large part, on reactivating seven amphibious ships in a maintenance category requiring reactivation within 180 days. Navy officials said that it may be difficult to meet this time frame. Therefore, the Navy and the Marine Corps may, for all practical purposes, not be able to achieve the plan's goals.

Navy and Marine Corps Plan to Modernize Equipment to Improve Amphibious Capability and More Effectively Implement OMFTS

To improve amphibious capability and more effectively implement the new warfighting concept, OMFTS, the Navy and the Marine Corps plan to modernize ship-to-shore and supporting equipment. The modernization includes procuring the AAAV and the MV-22 Osprey aircraft, as well as improving supporting equipment for mine countermeasures, command and control systems, and naval surface fire support.

Marine Corps Plans to Replace the AAV With the AAAV

The Marine Corps is developing the AAAV to replace the AAV as its primary combat vehicle for transporting troops on land and from ship to shore. The AAAV must satisfy many operational requirements, which will provide increased capabilities compared to the AAV and improve the ship-to-shore movement, thus allowing the Marine Corps and the Navy to more effectively implement OMFTS. Table 3.1 compares selected AAAV requirements with the AAV's current capabilities.

Table 3.1: Comparison of Selected AAAV Requirements With AAV's Current Capabilities

Function	AAAV requirement[a]	AAV capability
Water speed	23-29 miles per hour	6-8 miles per hour
Cross-country land speed	Keep up with main battle tank, which travels at about 30 miles per hour	15-20 miles per hour
Range on water	65 miles	45 miles
Range on land	300 miles	300 miles
Troop-carrying capacity	18 combat-equipped troops	18 combat-equipped troops
Survivability (armor protection)	Survive 14.5mm bullets without attaching enhanced armor plating to vehicle's hull	Can only survive 14.5mm bullets if enhanced armor plating has been attached to vehicle's hull
Lethality (main armament)	Defeat light armored combat vehicles of 2005-2025 time frame during day and night while moving	40mm and .50 caliber machine guns, which cannot defeat light armored combat vehicles of today

[a]Because the AAAV is in an early development stage, we were not able to assess whether its requirements will be met.

The AAAV's required maximum water speed (23 to 29 miles per hour) will make it much easier to implement OMFTS because AAAVs will be able to transport troops the 25 miles from ship to shore in an hour. Marine Corps officials said the current AAV's 8-mile-per-hour water speed makes implementing OMFTS extremely difficult and risky because AAVs need 3 or more hours to travel 25 miles from ship to shore. Taking this long to reach

shore would delay the buildup of combat power ashore, increase the AAV's exposure to enemy fire, and degrade the troops' combat effectiveness because of the adverse conditions in the AAV's troop-carrying compartment.

According to a Marine Corps official, to overcome the AAV's limited water speed, the Marines have two primary options for transporting troops in AAVs from ship to shore during an amphibious assault: (1) bring the amphibious ships carrying the AAVs within several miles of the shore and let them swim in from there or (2) station ships 25 to 50 miles out to sea and bring AAVs in from there on LCACs. Both alternatives have drawbacks. Bringing the ships close to shore places them at greater risk from precision-guided missiles, aircraft, boats, and mines. Therefore, when a high enemy threat is present, the Navy and the Marines plan to use LCACs to transport AAVs to shore. However, this diverts LCACs from their primary mission of transporting heavy equipment, such as tanks and artillery, thus decreasing the Marines' ability to build combat power ashore quickly and counter enemy forces. Because of the AAAV's 25-mile-per-hour water speed, LCACs would not be needed to carry the AAAVs to shore.

The Marine Corps has a requirement to procure 1,013 AAAVs. Prior to December 1994, the cost to develop and procure AAAVs was estimated at $7.2 billion (then-year dollars). Due to budget constraints, DOD reduced AAAV funding in the FYDP by $189 million in December 1994. As a result, the Marine Corps extended the demonstration and validation phase 22 months and delayed procurement by 2 years, which increased the program's cost by $456 million, to $7.6 billion. As a result, low-rate initial production has been delayed from fiscal year 2003 to 2005; initial operational capability from fiscal year 2006 to 2008; and full operational capability—fielding all required AAAVs to the active assault amphibian battalions and the maritime prepositioning squadrons—from fiscal year 2012 to 2014.

Due to the AAAV schedule delays, the Marines must use the AAV longer than planned. Although the AAV's readiness ratings are acceptable, according to a Marine Corps official, the AAV's maintenance costs are increasing. For example, depot-level maintenance is now needed every 4 years, 400 hours, or 4,000 miles, whereas, it used to be every 6 years, 600 hours, or 6,000 miles. Therefore, to ensure that the AAV can continue to operate safely and effectively until the AAAV is delivered, the Marine Corps is considering upgrading the AAV with a service life extension program. If the extension program is not implemented, depot-level maintenance is projected to be needed even more often—every 3 years, 300 hours, or 3,000 miles.

If approved, the service life extension program, which would start in fiscal year 1998 and end by fiscal year 2001, would include replacing the engine and suspension and rebuilding other parts to improve reliability, maintainability, and readiness. The program is estimated to cost $473 million—$243 million to procure the engine and suspension and $230 million in labor to rebuild the vehicle and procure other parts. The Marines believe the program will allow depot-level maintenance to return to once every 6 years, 600 hours, or 6,000 miles, which would result in spending $933 million less than currently estimated for operations and maintenance in fiscal years 1998 through 2010. Therefore, the Marine Corps believes the program would result in net savings of $460 million from fiscal years 1998 to 2010. Despite the substantial savings, the Marines are not sure that they will implement the program because it requires spending $473 million by fiscal year 2001, a 4-year period, whereas, the $933 million for depot-level maintenance is spread out over a 13-year period.

MV-22 Aircraft Planned to Replace Existing Medium-Lift Helicopters

The Marine Corps plans to replace its CH-46E and CH-53D medium-lift helicopters with the MV-22 Osprey tilt-rotor aircraft. According to the Marine Corps, the MV-22's improved capabilities will allow the Marines to implement OMFTS more effectively and with less risk. Table 3.2 compares selected MV-22 requirements with the CH-46E's current capabilities. The Navy and the Marine Corps plan to procure 425 MV-22s at an estimated cost of $36.5 billion (fiscal year 1996 to completion in then-year dollars). The Navy plans to procure the aircraft over a 25-year period, primarily due to the $1 billion per year funding cap that DOD placed on the program. Production of the MV-22 is scheduled to begin in fiscal year 1997. The Marine Corps plans to have initial operational capability in fiscal year 2001. Full operational capability is planned for fiscal year 2018.

Table 3.2: Comparison of Selected MV-22 Operational Requirements With CH-46E Current Capabilities

Function	Marine Corps minimum requirements (MV-22)	CH-46E current capabilities[a]
Cruise airspeed	240 knots	110 knots
Internal payload capacity	24 troops or 8,000 lbs. of cargo	9 troops or 1,700 lbs. of cargo
External payload capacity	10,000 lbs.	4,000 lbs.[b]
Mission radius with internal payload	200 nautical miles	75 nautical miles
Mission radius with external payload	50 nautical miles	75 nautical miles
Refueling	Capable of being refueled in flight	Cannot be refueled in flight
Self-deployability	2,100 nautical miles with one refueling in flight	None
Range	1,200 nautical miles	236 nautical miles[c]

[a]The current capabilities are less than the original capabilities because of the weight restriction imposed on the helicopter.

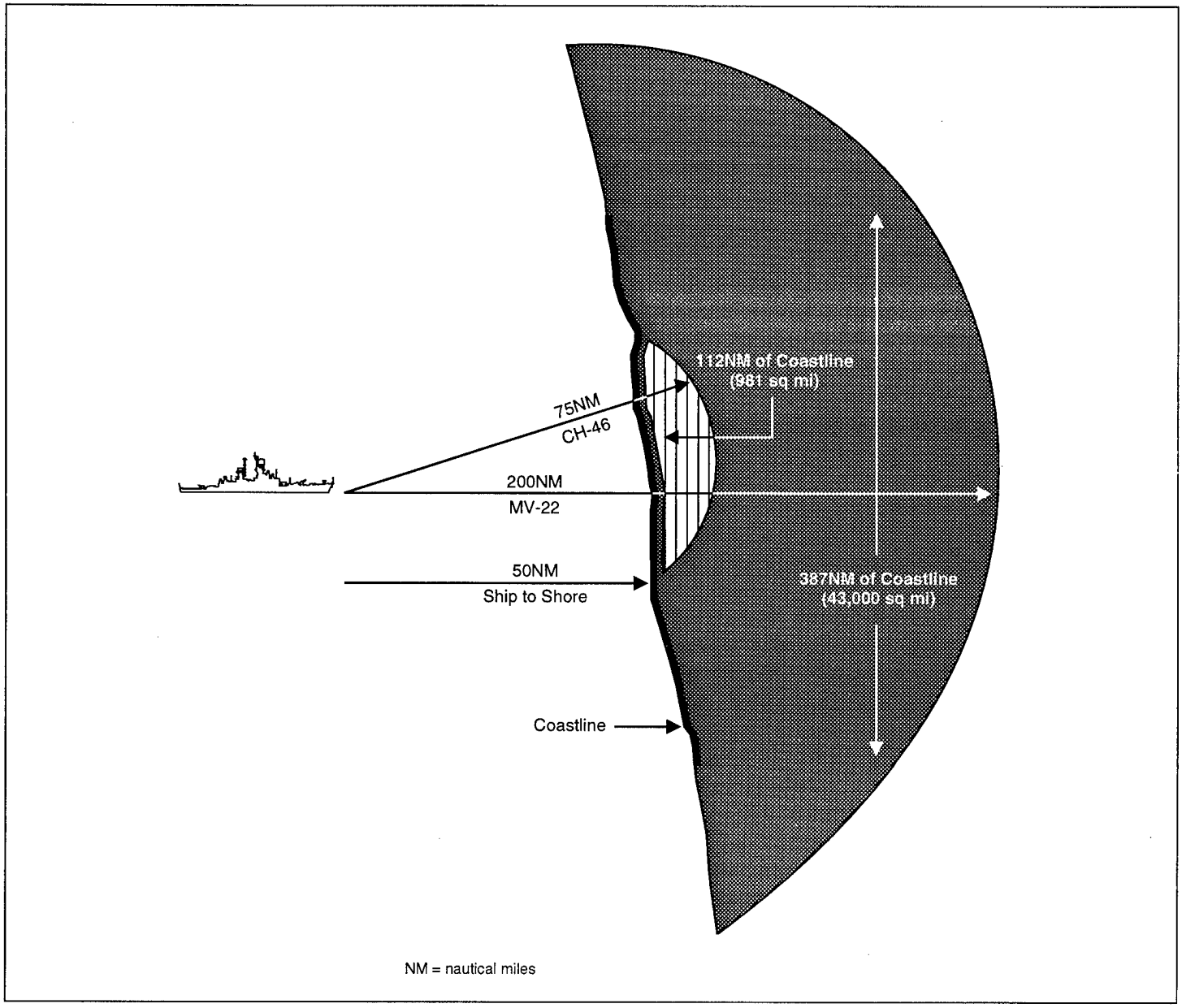
[b]The maximum average external payload that can be carried depends on factors such as the outside ambient temperature, altitude, humidity, and wind speed and direction.

[c]Some aircraft have external fuel tanks that extend the range to 411 nautical miles, but reduce the payload that can be carried.

The MV-22 is a tilt-rotor, multimission aircraft, currently being developed, which is designed to take off and land vertically like a helicopter and fly like a fixed-wing aircraft. The MV-22's missions include transporting Marines in the initial and follow-on stages of an amphibious operation, transporting supplies and equipment, evacuating casualties, and tactical recovery of aircraft and personnel.

The MV-22's greater speed will provide more maneuverability; build up combat power ashore more quickly because it carries more Marines per aircraft; and allow amphibious ships to be stationed further out to sea, such as 50 miles, because of its longer mission radius. For example, the MV-22's required mission radius is 200 nautical miles versus the CH-46E's capability of 75 nautical miles. If aircraft were launched from 50 miles out to sea, the enemy would have to defend a significantly greater land area against the MV-22 because of its greater mission radius and about three times the length of coastline than it would if the Marines used the CH-46Es. Figure 3.1 illustrates how much more area the enemy would have to defend if the Marines were to use the MV-22 versus the CH-46E.

Figure 3.1: Comparison of Mission Radius With Internal Payload of the MV-22 and the CH-46E Launched From 50 Nautical Miles at Sea



To ensure that the CH-46E continues to fly safely and effectively until it is replaced by the MV-22, the Marine Corps plans to institute an upgrade program and may institute up to two others, which could cost up to

$1.2 billion. The CH-46E has been out of production for over 20 years and requires additional effort to keep it flying safely. Nevertheless, the CH-46E's readiness ratings remain high.

According to a Marine Corps official, if all three upgrade programs are implemented, they are expected to restore the aircraft to its original capability, increase its service life, and keep it safe for flying until 2018, when the MV-22 is fully operational. None of the planned programs will increase the helicopter's capability beyond what it was originally. According to the Marine Corps, without at least the planned upgrade and one of the other two upgrades under consideration, the helicopters will begin to be taken out of service starting in 2010, because they will no longer be safe to fly. Although the CH-53D helicopters are almost as old as the CH-46Es, the Marine Corps has no plans to upgrade them.

The three programs that may be necessary to keep the CH-46E flying safely and effectively are the dynamic component upgrade, super-scheduled depot-level maintenance, and service life extension. The Marine Corps has decided to implement the dynamic component upgrade. It is conducting a service life assessment of the CH-46E to determine if it needs to do the super-scheduled depot-level maintenance and/or the service life extension program. The cost of the assessment is $3 million and is scheduled to be completed by July 1996. Table 3.3 describes the three upgrade programs.

Table 3.3: CH-46E Upgrade Programs

Then-year dollars in millions

Program	Cost[a]	Start	Complete	Description
Dynamic component upgrade	$160.2	12/95	9/99	Replace rotor head, drive system, transmission and rotor controls
Super-scheduled depot-level maintenance	145.2	Undecided	Undecided	Extend service life of fuselage by 3.5 years
Service life extension	895.4	Undecided	Undecided	Extend service life of fuselage by 20 to 25 years
Total	**$1,200.8**			

[a]Based on 242 CH-46E aircraft.

From 1989 to 1994, the average CH-46E maintenance hours per flight hour increased by about 50 percent. Also, because of problems with the shafts

in the drive systems, the Navy now requires a mandatory maintenance inspection every 10 hours in peacetime and wartime and restrictions on the weight that a CH-46E can carry. The dynamic component upgrade program will replace the rotor heads, drive systems, and other related parts on each helicopter, which will eliminate the 10-hour maintenance inspection and weight restriction. The program is fully funded and is scheduled for fiscal years 1996 through 1999. At a cost of $662,000 per aircraft, the total cost for 242 aircraft is $160.2 million.

The Marine Corps will decide whether the super-scheduled depot-level maintenance program and/or service life extension program are needed, based on the service life assessment, as well as the MV-22's delivery schedule. The sooner the MV-22 is delivered to the squadrons, the fewer CH-46Es that will need to undergo either of these two upgrade programs. The super-scheduled depot-level maintenance program may be needed to extend the service life of the aircraft's fuselage by 3.5 years. At a cost of about $600,000 per aircraft, the program's total cost would be $145.2 million. The service life extension program may be needed to extend the life of the aircraft's fuselage by 20 to 25 years. The estimated cost of the program is $3.7 million per CH-46E. If all 242 helicopters undergo a service life extension, the total estimated cost would be $895.4 million.

Navy and Marine Corps Efforts to Improve Supporting Equipment

The Navy and the Marine Corps are taking actions to improve the supporting equipment needed for amphibious assaults—including mine countermeasures, command and control systems, and naval surface fire support. Because mines can be a significant problem for an assault, the Navy has initiated efforts to improve its mine countermeasures capability since the Persian Gulf War. The Navy and the Marine Corps are procuring improved communication systems to support amphibious operations because current systems lack some of the needed capabilities. The Navy plans to upgrade its 5-inch gun and develop a precision-guided munition to provide much greater range than the current gun.

Navy Is Developing Shallow-Water Mine Countermeasures

Mines can be a significant deterrent to amphibious assaults because they are hazardous to amphibious ships and landing craft and could prevent ships from getting close enough to shore to launch the assault force and fire their guns to support the assault. Studies done for the Navy indicated that shallow-water mine countermeasures need significant improvement and identified this as a high priority. Available capabilities for use in water

less than 30 feet deep include Navy special forces swimmers and explosive ordnance disposal. According to Marine Corps officials, until additional mine countermeasures capabilities are provided, conducting amphibious assaults in a heavily mined area would place troops and equipment at risk.

During the Persian Gulf War, the mine threat contributed to the decision not to conduct an amphibious assault. Mine countermeasures were principally needed to clear a path to the Kuwaiti coast for naval gunfire support and a possible amphibious assault. The amphibious task force was deployed and prepared to conduct an amphibious assault. However, clearing the Iraqi mines to prepare for an assault was estimated to take 10 to 14 days. This was one of the reasons that the U.S. Central Command decided not to conduct the assault.

After the Persian Gulf War, the Navy emphasized improving shallow-water mine countermeasures and issued a mine warfare plan that identified providing efficient, effective, and speedy mine countermeasures in shallow water and on the beach to support amphibious assaults as having great urgency. Also, the Marine Corps and the Navy are working on a concept paper that will stress mine detection and avoidance, while efforts are continuing to develop improved capability to clear mines.

In 1991, the Navy began a program for clearing shallow-water mines and beach obstacles. The program's projected funding from fiscal years 1996 through 2001 is $179 million for research and development and $85 million for procurement. Several projects are planned to start procurement by 2000, including line demolition charges and distributive explosive technology (i.e., nets) to clear mines and light and medium obstacles. Others are currently in development, and procurement is not planned to begin until after 2000. Examples include an advanced, lightweight mine sweeping system and a system to breach heavy obstacles in the surf and on the beach. These projects will take additional time to complete because more development work is needed to obtain the best approaches and technologies. The Navy is also considering buying modularized kits that can be mounted on LCACs to allow them to carry the new shallow-water equipment and is focusing its development projects toward using this equipment from LCACs.

Improved Communication Systems for Command and Control Are Being Procured

The Navy and the Marine Corps are procuring improved communication systems to support amphibious operations because current systems lack some of the needed capabilities. These capabilities include systems that are compatible with each other and that can communicate over the horizon. However, DOD officials said they have been able to work around these limitations. Since the Persian Gulf War, some improvements have been fielded. Because an amphibious assault is complex and requires significant coordination and OMFTS requires over-the-horizon capability, current communication systems would increase the risk of an assault to troops and equipment.

The Navy is upgrading communication capabilities on surface ships, including amphibious ships. The Navy is

- providing satellite communication to ensure reliable global communication to and from flagships, including LHAs and LHDs;
- procuring improved high-frequency radios that allow over-the-horizon communication, as well as provide a backup to satellite communication;
- acquiring a shipboard single channel ground and airborne radio system (SINCGARS), which is the same radio the Marines use, to provide ship-to-shore communication; and
- buying a relay to be flown on helicopters that will allow communication over the horizon using SINCGARS.

The planned procurement costs for these systems is about $101 million from fiscal years 1996 to 2001.

From 1996 to 2001, the Marine Corps plans to spend about $269 million to procure SINCGARS, microcomputers for tactical combat, position location reporting systems, and advanced field artillery tactical data systems. SINCGARS will be the Marines' primary equipment for battlefield communication for command and control and fire support because it (1) improves voice and data communication capability on the ground, (2) allows the Marines to communicate between ship and shore with the Navy's SINCGARS equipment, and (3) is compatibile with Army and Air Force equipment.

Navy Plans to Improve Surface Fire Support

The Navy has 5-inch guns on its destroyers and cruisers that can provide fire support for amphibious assaults. In 1992, the Navy decommissioned the last of its battleships, which had 16-inch guns, providing a 26-mile maximum range. Because the current 5-inch guns have a 13-mile maximum

range, the Navy has to bring its surface combatant ships closer to shore in order to reach the targets. However, bringing the ships closer to shore increases their exposure to missiles, aircraft, boats, and mines. In addition, because the 5-inch gun fires about a 70-pound shell, whereas, the 16-inch gun fired shells up to 2,700 pounds, the 5-inch gun shell does not have the explosive power of the 16-inch gun shell. Due to the limitations of the 5-inch gun, the Navy plans to use tactical aircraft to provide fire support for amphibious assaults.

We recently reported on the Navy's surface fire support program.[1] The Navy plans to upgrade its 5-inch gun and develop a precision-guided munition with an effective range of 41 to 63 nautical miles, which will allow the ships to remain further out to sea. The Navy plans to field the upgraded gun from fiscal years 2001 to 2006 on 18 new destroyers built during that time and one other destroyer or cruiser. The 5-inch guns on existing destroyers and cruisers may also be upgraded. The Navy included $270 million in the FYDP for fiscal years 1996-2001 for research and development for the upgraded 5-inch gun and precision-guided munition.

Conclusions

The Marine Corps has the amphibious assault vehicles, aircraft, and supporting equipment necessary to conduct amphibious assaults and other operations. Because of the equipment's operational limitations, the Navy and the Marine Corps are modernizing it to reduce the risk of conducting such operations. Although the planned modernization will require large capital investments, without the entire amphibious package, which is greater than the sum of the individual components, the risk of an assault would not be reduced as much as it could be.

[1]Naval Surface Fire Support: Navy's Near-Term Plan Is Not Based on Sufficient Analysis (GAO/NSIAD-95-160, May 19, 1995).

Amphibious Programs Will Require a Larger Share of Procurement Budgets for Many Years

The projected costs for major amphibious programs will be $58 billion over the next 25 years and will require increased proportions of Navy and Marine Corps procurement budgets. Amphibious programs are competing with other Navy and the Marine Corps procurement programs, as well as other services' programs. We found that the funding projected to acquire amphibious ships, aircraft, and vehicles will take a much larger proportion of procurement funding than has been the case for most of the last 40 years.

Acquiring amphibious ships is projected to require substantial shares of the shipbuilding budget until 2005. There is more than a $16-billion gap between the projected budget and the estimated cost of all ships planned to be built from 2002 to 2005. Procuring the MV-22 is projected to require about 10 percent of the Navy's aircraft procurement budget for fiscal years 1997 to 2001 and is likely to require substantial shares of the budget for many years after 2001. We estimate that the Marine Corps procurement account would have to almost triple over the present level to fund the AAAV when procurement begins late in the next decade.

Three Major Systems Estimated to Cost $58 Billion

The remaining projected cost to develop and buy the new amphibious ships, AAAV, and MV-22 is $58 billion. (See table 4.1.) This investment is planned to occur over the next 25 years, which means that the cost per year averages $2.3 billion. The Marine Corps believes this is a modest annual investment to maintain this capability because it represents less than 1 percent of the current annual defense budget.

Table 4.1: Cost to Complete Acquisition of Major Amphibious Systems

Then-year dollars in billions

Program	Quantity planned	Development cost	Procurement cost	Total cost
Amphibious ship	13	$ 0.1	$10.8	$10.9
AAAV	1,013	0.9	6.7	7.6
MV-22	425	2.5	36.5	39.0
Total		**$3.5**	**$54.0**	**$57.5**

Source: Developed by GAO from December 1994 selected acquisition reports and other information provided by DOD.

Congressional Budget Office Reports on Budget Shortfalls

In 1994, the Congressional Budget Office analyzed each of the military services' budget plans through 2010. Using the 1999 budget year in the fiscal years 1995-1999 FYDP as a benchmark, it projected a total shortfall for all the services of $11 billion to $25 billion per year from 2000 to 2010. Since this analysis, DOD has issued the 1996 FYDP, covering fiscal years 1996 through 2001, which increased projected funding levels. For example, for fiscal year 1999, the projected budget increased from $253.8 billion in the 1995 FYDP to $257.3 billion in the 1996 FYDP. However, the Navy faces large procurement requirements in the future because of low procurement budgets in recent years, according to a Congressional Budget Office official.

In its November 1994 report on the Navy,[1] the Congressional Budget Office observed that three key factors influence the Navy's long-term costs: the number of forces (ships and aircraft); plans for modernizing the forces with new weapons; and the expected cost of those weapon systems. Although the size of the fleet is declining, the Navy is still developing expensive new ships and aircraft that it will begin purchasing in the late 1990s and the next decade. This has resulted in a gap between the projected Navy budget and the amount that the Congressional Budget Office estimated would be needed for the 330-ship Navy. Using the 1999 fiscal year in the 1995 FYDP, it projected a shortfall of $4 billion to $13 billion per year from 2000 through 2010—5 to 15 percent of the Navy's budget.

Amphibious Programs Will Require Larger Proportion of Procurement Funds

The major amphibious programs will require a larger proportion of the Navy's and the Marine Corps' projected procurement budgets than has been the case for most of the last 40 years. The percentage of funding needed for amphibious programs will increase greatly toward the end of the 1996-2001 FYDP period, requiring more than 10 percent of the fiscal years 2000 and 2001 budgets for the first time since 1966.[2]

Amphibious Share of Navy Shipbuilding Will Increase Significantly

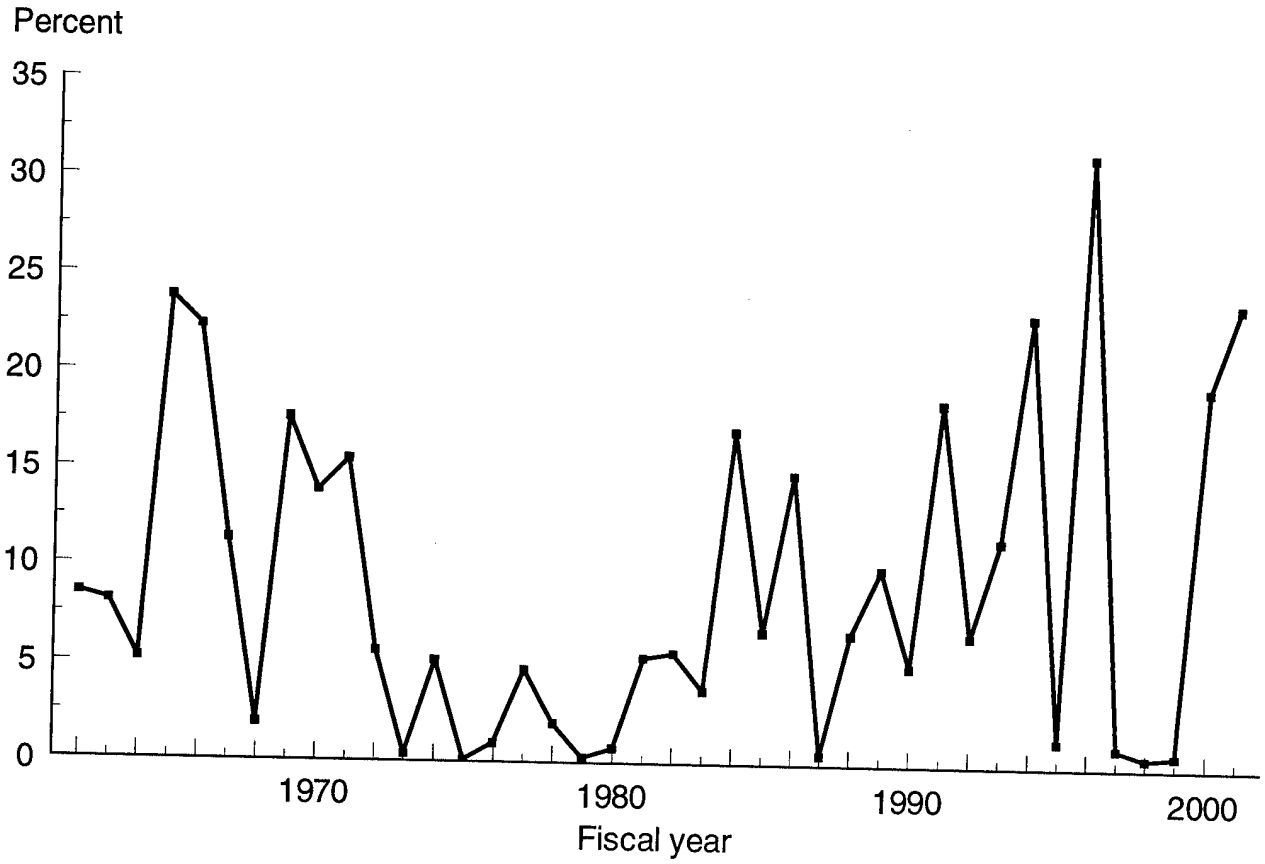
As discussed in chapter 2, the Navy plans to procure two amphibious ships in fiscal year 1996, two in fiscal year 2000, and two in fiscal year 2001. These ships are funded from the shipbuilding and conversion portion of Navy procurement funds. For fiscal year 1996, the proportion of the Navy

[1]The Costs of the Administration's Plan for the Navy Through the Year 2010, Congressional Budget Office (Nov. 1994).

[2]We examined the period from fiscal year 1962 to 2001, using 1962 as the starting point because the FYDP database that DOD provided us covers the period from 1962 through 2001.

shipbuilding procurement account that is used to buy amphibious ships would be the highest percentage since at least fiscal year 1962. Procurement funds budgeted for amphibious ships through fiscal year 2001 are projected to reach 24 percent of the Navy's shipbuilding budget in 2001. (See fig. 4.1.)

Figure 4.1: Proportion of Navy Shipbuilding Procurement Funds Spent for Amphibious Programs

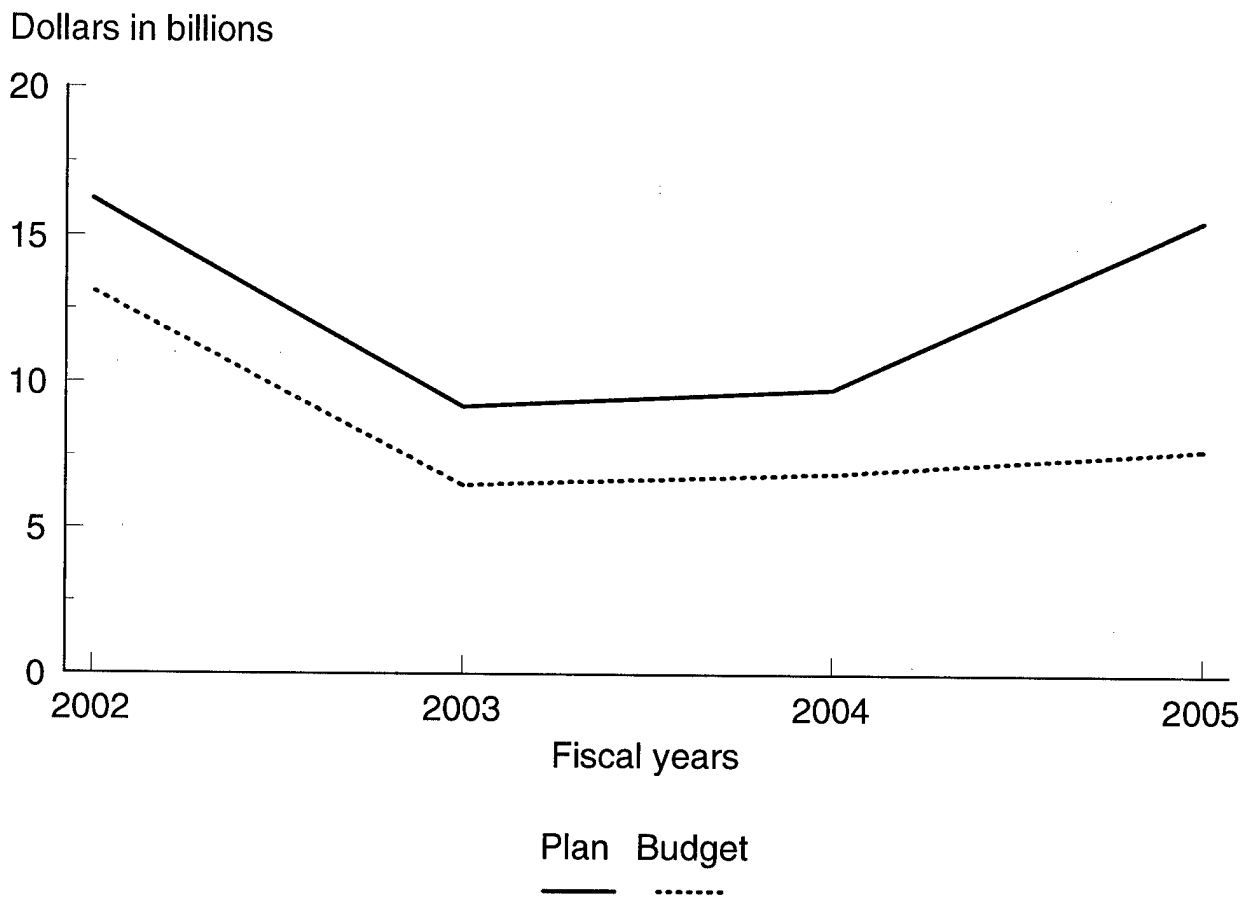


Source: Developed by GAO from historical FYDP data beginning in fiscal year 1962, the fiscal years 1996-2001 FYDP, and the fiscal year 1996 DOD Appropriations Act.

The funding budgeted through fiscal year 2001 includes 6 of the 13 amphibious ships the Navy plans to procure from fiscal years 1996 to 2005.

The Navy plans to procure two additional amphibious ships in each of fiscal years 2002, 2003, and 2004, and one amphibious ship in fiscal year 2005. Navy shipbuilding procurement funding is projected to increase from fiscal year 2001 to 2002, primarily to fund the acquisition of an aircraft carrier, and then decline to lower levels. However, the Navy estimates that the building costs planned in these years will be substantially higher than its projected shipbuilding budget. (See fig. 4.2) The gap between the two for fiscal years 2002 through 2005 totals $16.5 billion. This suggests that funding for the ships between these years will continue to require substantial shares of the Navy shipbuilding budget and will pose a challenge because of other competing ship procurements.

Figure 4.2: Comparison of Long-Range Estimates for Shipbuilding Procurement Funding and Estimated Shipbuilding Costs (Fiscal Years 2002-2005)

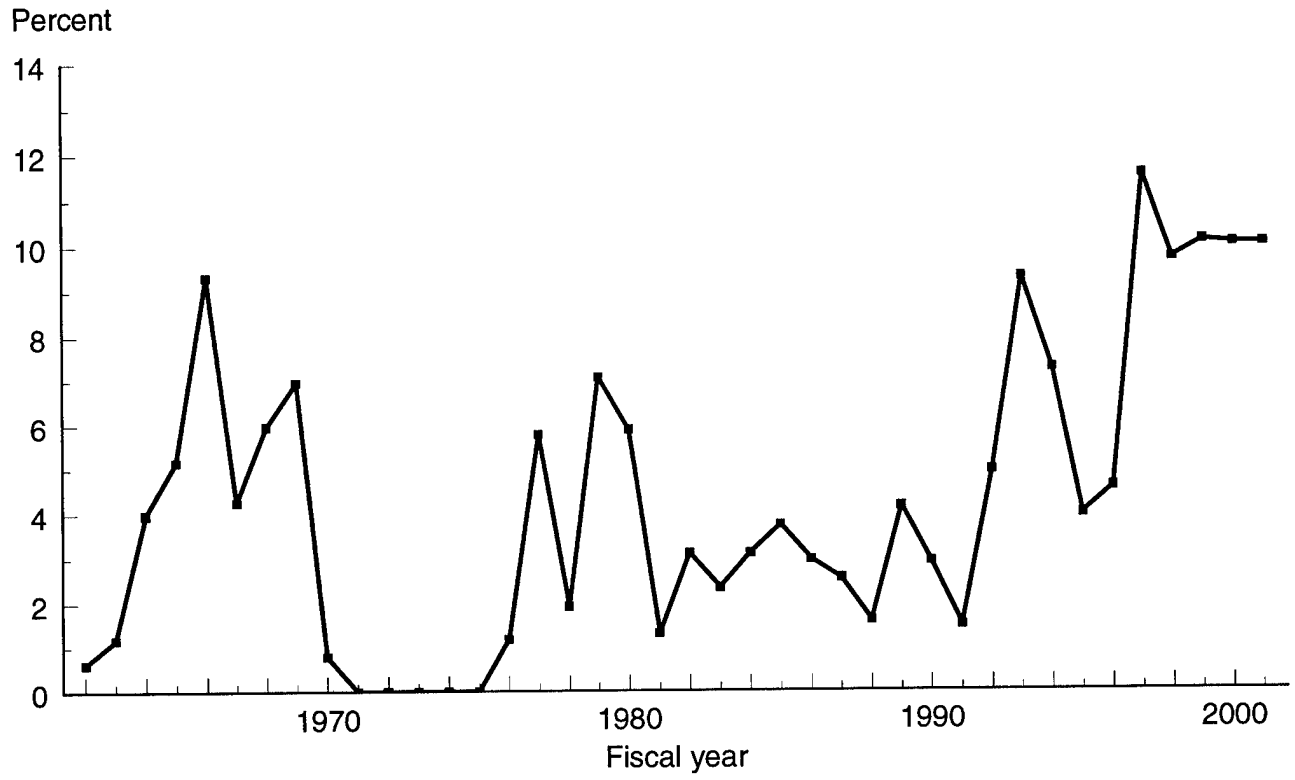


Source: Navy Programming and Surface Warfare Offices.

MV-22 Share of Navy Aircraft Funding Will Also Increase Significantly

The MV-22 is funded from the aircraft portion of Navy procurement funds. Since fiscal year 1962, the portion of the Navy procurement budget spent on amphibious aircraft has exceeded 7.5 percent only twice and was below 5 percent in most years. (See fig. 4.3.) Beginning in fiscal year 1997, funding for the MV-22 is projected to be about 10 percent of the Navy's aircraft procurement budget through 2001.

Figure 4.3: Proportion of Navy Aircraft Procurement Funds Spent for Amphibious Programs



Source: Developed by GAO from historical FYDP data beginning in fiscal year 1962 and the fiscal years 1996-2001 FYDP.

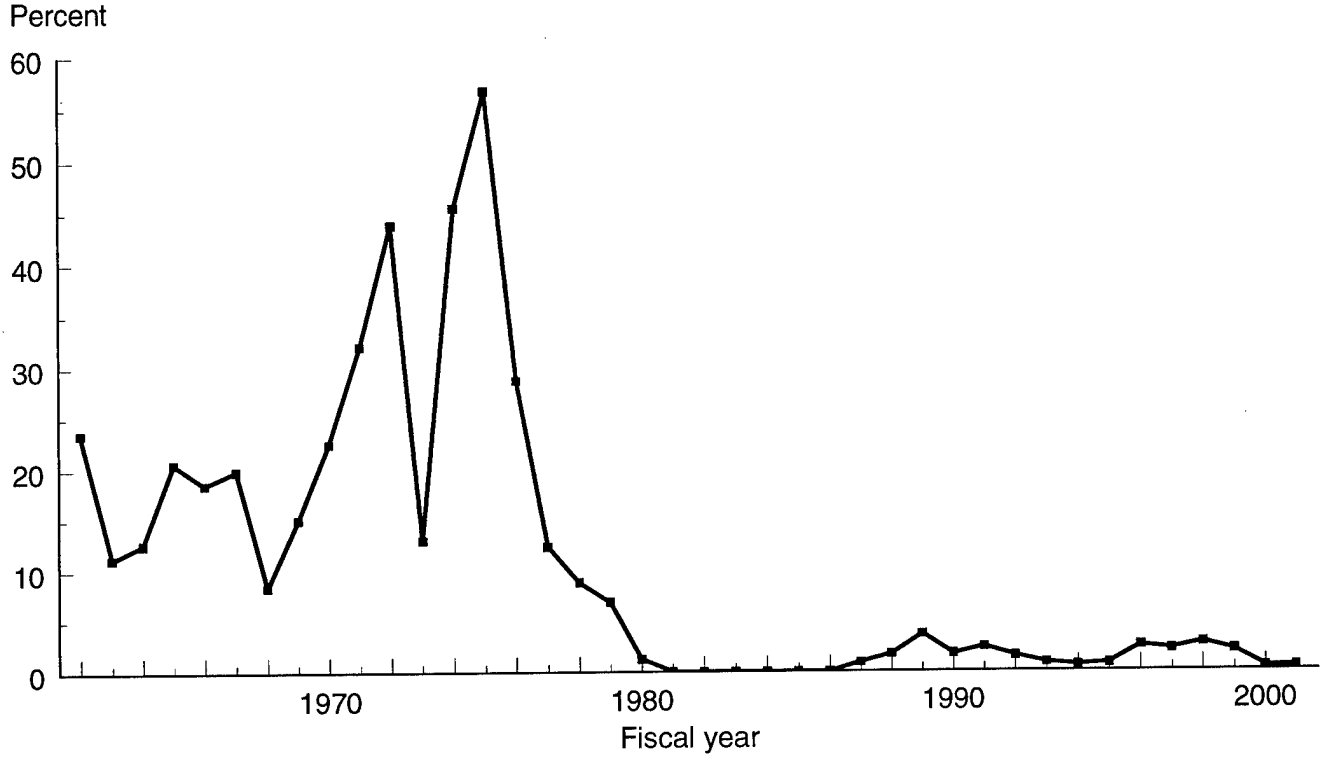
As discussed earlier, the Navy plans to procure the MV-22 aircraft over a 25-year period. Navy aircraft procurement funding is projected to decline after fiscal year 2000 and not reach fiscal year 2000 levels again until fiscal year 2007. This suggests that funding the MV-22 will continue to require substantial shares of Navy aircraft procurement for many years in addition to funding other aircraft procurements, including the F/A-18E/F aircraft.

Marine Corps Needs to Almost Triple Procurement Funding for the AAAV

The two largest categories in the Marine Corps procurement appropriation are currently (1) communication and electronics equipment and (2) ammunition. From fiscal years 1996 through 2001, less than 3 percent of the Marines Corps' procurement budget each year is planned for major amphibious programs because amphibious vehicles are not now being procured. (See fig. 4.4.)

The Marine Corps procurement budget is projected to double from $459 million in fiscal year 1996 to $918 million in fiscal year 2001. However, more procurement funding will be needed when AAAV acquisition begins late in the next decade. Cost estimates show that $874 million (constant dollars) will be required in 2008 and over $700 million will be required in each of the three following years. We estimate that the procurement budget would have to almost triple over the present level—from $459 million to $1.3 billion in fiscal year 2008 and to $1.2 billion in fiscal years 2009 to 2011—to allow the Marines to procure the AAAV, while continuing to procure other required items, such as ammunition. The Marines believe they need $1.1 billion to $1.5 billion per year (in constant dollars) to recapitalize the force, based on projected force structure and equipment needs.

Figure 4.4: Proportion of Marine Corps Procurement Funds Spent for Amphibious Programs



Source: Developed by GAO from historical FYDP data beginning in fiscal year 1962 and the fiscal years 1996-2001 FYDP.

Amphibious Programs Will Compete for Funding With Other Major DOD Programs

Navy and Marine Corps amphibious programs will compete with many other major defense programs for procurement funding. For example, major procurements include the Air Force's F-22 advanced tactical fighter and C-17 cargo aircraft; the Army's Apache Longbow helicopter and Javelin missile system; and the Navy's new attack submarine and F/A-18 E/F Hornet combat aircraft. Table 4.2 shows the estimated procurement costs for some of DOD's major programs and years to complete from 1996.

Table 4.2: Procurement Costs and Years to Complete for Selected Major Programs

Then-year dollars in millions

Program	Completion costs	Years to complete
Longbow Apache Helicopter	$8,278	16
F/A-18 E/F Aircraft	83,351	19
DDG-51 Destroyer	29,575	13
F-22 Aircraft	53,807	18

Source: Developed by GAO from December 1994 selected acquisition reports.

To increase funding for amphibious programs, three choices seem plausible: (1) increase Navy and Marine Corps procurement funding, (2) spend less on other Navy or defense planned procurements or other parts of the defense budget, or (3) implement some combination of the first two choices.

Both the administration and the Congress plan to increase future defense funding. The administration plans to increase overall defense funding by $12.6 billion between fiscal years 1996 and 1999, but plans to reduce procurement funding by $27 billion by eliminating, reducing, or deferring to 2000 and beyond planned weapon systems modernization. In fiscal years 2000 and 2001, the administration plans to increase procurement funding above the 1999 level.

In the fiscal year 1996 concurrent budget resolution approved by the Senate and House in June 1995, the Congress plans to increase defense funding by $35.6 billion above the administration's plan between fiscal years 1996 and 1999, in part, for the procurement of weapons. The budget resolution then envisions reducing defense spending $11.4 billion below the administration's plan in fiscal years 2000 and 2001. Since the planned amphibious programs' procurement spans more than 20 years, we believe that increases in the next few years may benefit the planned procurement of some amphibious ships whose procurement had been deferred, but reduced defense funding could adversely affect planned procurement of the MV-22 aircraft and the AAAV, as well as some of the amphibious ships whose procurement had always been planned after fiscal year 2001.

Within procurement funding, the administration examines its priorities as it prepares each new defense budget. As discussed earlier in this report, planned procurement of amphibious ships and the AAAV have been delayed as a result of budget decisions. Other decisions could have been made, however. For example, we reported that because the Air Force does not

urgently need the F-22 aircraft and the concurrency between development and production is high, the Congress could choose to restrict production planned in fiscal years 1999 and 2000.[3] This would save $2.5 billion in those 2 fiscal years. We also reported that due to a variety of factors, the Congress might consider canceling plans to buy the third Seawolf submarine and defer acquisition of a new generation submarine to 2003. This would save $8.6 billion between fiscal years 1996 and 2000. These savings could be made available to fund other programs or be taken out of the budget and so not add to the deficit.

Conclusions

The Marine Corps and the Navy estimate that it will now cost about $58 billion to modernize the amphibious force. DOD's current FYDP indicates that through fiscal year 2001, the Navy and the Marine Corps plan to allocate a higher percentage of their procurement funds for amphibious equipment than has been the case for most of the past 40 years. Beyond fiscal year 2001, the Navy and the Marine Corps will need to continue to allocate a large share of available procurement funds for amphibious equipment to avoid delays. This could pose a challenge for the services because of the many programs that will compete for procurement funds.

If the Congress determines the amphibious capability requirements to be valid and wishes to support the planned amphibious programs, three options seem plausible: increase Navy and Marine Corps procurement funding; spend less on other Navy or other services' planned procurements or other parts of the defense budget; or implement some combination of the first two options. These are the trade-offs that the Congress and the senior DOD leadership will have to decide.

Agency Comments and Our Evaluation

DOD concurred with our draft report. It suggested that because of the dynamics of the planning, programming, and budgeting system and congressional action, the charts in the report should clearly state the source and date of data. We agree and have added this information.

Regarding our discussion of the competition for funds, DOD stated that programs we cite, such as the Navy's F/A-18E/F and the Air Force's F-22, are not directly linked to the amphibious mission area capabilities. It also stated that major funding trade-offs across service programs are made at the highest levels within DOD and that DOD sees no basis for us to cite what

[3]Addressing the Deficit: Budgetary Implications of Selected GAO Work for Fiscal Year 1996 (GAO/OCG-95-2, Mar. 15, 1995).

it describes as apparently arbitrary potential sources of funds. We stated in this chapter that the administration examines its priorities as it prepares each new defense budget. Our discussion regarding this matter is intended to illustrate the choices available to DOD and the Congress and draws from our past reports in identifying different decisions that could be made.

Comments From the Department of Defense

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ACQUISITION AND TECHNOLOGY

04 JAN 1995

Mr. Richard Davis
Director, National Security Analysis
National Security and International
Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Davis:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "MARINE CORPS: Improving Amphibious Capability Would Require Larger Share of Budget Than Previously Provided," dated November 21, 1995 (GAO Code 701031), OSD Case 1053. The DoD concurs with the draft report.

The DoD significant points are addressed below. Minor comments are editorial in nature and have been provided informally.

The funding charts throughout the report reflect the funding estimates included in the FY 1996 President's Budget through completion of the program. However, due to the dynamics of the planning, programming and budgeting system and Congressional marks, the numbers presented in the report have recently changed or are in the process of changing. The charts should clearly state the source and date of data to avoid confusion.

The report concludes that amphibious programs will be competing for funding with other major procurement programs and cites the Navy's F/A-18E/F and DDG-51, the Air Force's F-22, and the Army's AH-64D. It suggests that if more funding is required for the Marine Corps' amphibious programs, then the programs cited could potentially be affected. The GAO selection of these programs is not directly linked to the amphibious mission area capabilities. Major funding tradeoffs across Service programs are made at the highest levels within the Department. We see no basis for the GAO to cite apparently arbitrary potential sources of funds to increase Marine Corps amphibious mission capability, and we recommend the GAO not do so.

The DoD appreciates the opportunity to comment on the draft report.

George R. Schneiter
Director,
Strategic and Tactical Systems

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