

Department of the Navy

Overview

The Department of the Navy (DoN) includes the active components of the Navy and Marine Corps, the Navy Reserve, the Marine Corps Reserve, and all federal civilians employed by the Navy or Marine Corps. It is the second-largest military department by number of military personnel and has the second-largest operation and support (O&S) budget. Because of its sizable acquisition funding, however, it has a larger total budget than any other military department.

The integration of the Navy and Marine Corps in a single department reflects the historical relationship between those two services. Marines originated as sea-based soldiers, who were transported on naval vessels, engaged in hand-to-hand combat during sea battles, and provided armed landing parties for operations on shore (as well as deterring mutinies). Although marines no longer routinely provide detachments for U.S. Navy surface combatants, the Marine Corps still defines itself in part as “soldiers of the sea, providing forces and detachments to naval ships and shore operations.”¹ Unlike the other military departments, which are responsible for a single service, the Department of the Navy oversees the budgets of both the Navy and Marine Corps, and the two services are tightly integrated in a way that the other armed services are not. (That integration is discussed in detail in a special-topic entry on page 70.)

The Navy is the branch of the military responsible for providing all of the United States’ naval power and a significant portion of its airpower. The largest and most powerful conventional unit in the Navy is a carrier strike group (CSG), formerly called a carrier battle group. A CSG consists of an aircraft carrier, its associated aircraft (known as a carrier air wing), and a group of accompanying ships. The Navy’s long-term

plans call for maintaining 11 carrier strike groups over much of the next 30 years.²

In addition to aircraft carriers, the Navy has about 100 surface combatants (see Table 3-1), which consist, in roughly decreasing order of size, of cruisers, destroyers, frigates, and littoral combat ships. The Navy also includes 10 amphibious ready groups (ARGs)—sets of three amphibious ships that transport Marine Corps ground and air units when they are deployed. Finally, the Navy maintains a fleet of submarines, including more than 50 attack submarines, which are responsible for attacking enemy surface ships and submarines, and 14 ballistic missile submarines, which are responsible for providing about two-thirds of the United States’ nuclear deterrent (as measured by the number of nuclear weapons they carry).

The Marine Corps is a hybrid service, with units that engage in combat on the ground and in the air. The Marine Corps organizes its forces into task forces, each with a command, ground combat, air combat, and support element. The largest such task force, a Marine expeditionary force (MEF), includes a ground combat division, an air wing, and a support group. The active component of the Marine Corps has three MEFs, including a total of three divisions, three air wings, and three logistics groups. The Marine Corps Reserve contains one division, one air wing, and one support group, although they are not organized into a fourth

1. U.S. Marine Corps, “History & Heritage—Our Purpose” (2015), www.marines.com/history-heritage/our-purpose.

2. At present, because of the planned gap between the retirement of one carrier and the commissioning of another, the Navy has only 10 carriers. For a detailed discussion of the Navy’s shipbuilding plans, see Congressional Budget Office, *An Analysis of the Navy’s Fiscal Year 2016 Shipbuilding Plan* (October 2015), www.cbo.gov/publication/50926. In addition, although the Navy’s plans call for maintaining 11 carrier strike groups, the service fields only 10 carrier air wings because the air wings rotate among carriers, and at any given time at least one carrier is undergoing an extended overhaul (and thus, does not need an air wing).

Table 3-1.

Number of Major Combat Units in the Navy and Marine Corps, 2017 and 2021

	2017	2021
Aircraft Carriers	11	11
Carrier Air Wings	10	10
Surface Combatants	104	125
Attack Submarines	51	51
Amphibious Ships	33	33
Marine Corps Infantry Battalions		
Active component	24	24
Reserve component	8	8

Source: Congressional Budget Office, using data from the Department of Defense's 2017 budget request.

Marine expeditionary force. The MEFs, divisions, air wings, and logistics groups are not standardized units but instead vary in size and composition. For that reason, the Congressional Budget Office has based its analysis of the force structure of the Marine Corps on smaller, more standardized units: Marine infantry battalions and aircraft squadrons.

Like the other services, the Navy and Marine Corps also contain large numbers of support or administrative units. The vast majority of the Navy's support units exist to support combat operations by ships and their aircraft, and the vast majority of the Marine Corps' support units exist to support combat operations by MEFs. Nearly all of the administrative units in the Department of the Navy are responsible for creating and maintaining the Navy's and Marine Corps' combat and support units.³

The Department of the Navy's forces are distinctive not only for their number and variety of units but also for the way in which different types of forces routinely work closely together. The Army and Air Force each essentially

3. As noted in Box 1-1 on page 10, "support" can have a wide variety of meanings in military contexts. In this report, "support units" are units that would generally be used to provide support to major combat units. For example, although Marine Corps combat troops could be called on to defend a base being built by Navy engineers (as happened to some extent on the Pacific island of Guadalcanal during World War II)—and thus the combat troops could be said to be supporting the engineers—in general, Navy engineers are considered support units.

focus on a single type of military power (ground combat or air combat), but the Navy and Marine Corps routinely integrate ships with aircraft (as in carrier strike groups), ships with ground combat units (as in amphibious ready groups), and aircraft with ground combat units (as in Marine expeditionary forces). Although all U.S. forces are expected to be able to operate jointly with other services, the routine and habitual integration of different types of military power within DoN goes beyond typical joint operations. For example, the Marine Corps has fewer artillery units to support its ground combat units than the Army does, in part because the Corps prefers to provide additional firepower (fire support) for its combat units by using its attack aircraft—aircraft that may well be based on Navy ships. In contrast, the Army has traditionally structured itself on the assumption that it must have substantial artillery capability in case Air Force aircraft are not available to provide fire support.

Besides conventional warships, MEFs, and forces organized in support of those units, the Navy and Marine Corps contain a number of smaller organizations that provide some highly specialized military capabilities. Prime examples include the Navy's fleet of ballistic missile submarines; its fleet of maritime patrol aircraft, which patrol the oceans from land bases; special-operations forces, such as the Navy's Sea, Air, and Land forces (known as SEALs); and construction battalions (known as Seabees). The Department of the Navy is also responsible for the U.S. sealift fleet, cargo ships that are used to transport equipment to overseas operations. Those ships, however, are largely operated by civilians employed by Military Sealift Command, and their operations are funded through revolving funds that are intended to let other organizations in the Department of Defense "pay" for their sealift needs using accounting credits internal to DoD.⁴

Distribution of Navy and Marine Corps Personnel

The Department of the Navy has roughly 600,000 military personnel, making it less than two-thirds the size of the Army. According to the department's plans for the 2017–2021 period, almost the same number of personnel will be in units devoted to overhead functions as in combat units; the smallest share will be in units that support

4. Many of the Navy's fleet replenishment ships, which provide fuel and other supplies to ships on deployments, are also operated by civilians. However, in this analysis, CBO treats those replenishment ships as part of the indirect support for combat ships.

Table 3-2.

Average Distribution of the Department of the Navy's Military Personnel, 2017 to 2021

Number of Personnel

	Active Component	Reserve Component	Total
Combat Units	210,000	34,000	244,000
Support Units	93,000	25,000	118,000
Overhead ^a	202,000	38,000	240,000
Total	505,000	97,000	602,000

Source: Congressional Budget Office, using data from the Department of Defense's 2017 budget request.

Numbers may not add up to totals because of rounding.

a. "Overhead" refers to administrative units as well as to personnel not assigned to any unit.

combat units. (See Table 3-2; because of how closely interwoven the Navy and Marine Corps are, that table shows totals for DoN as a whole rather than attempting to artificially separate the two services.)

Compared with the Army and the Air Force, DoN's forces include a relatively small number of reserve-component units, and those units are not tightly integrated into the operations of their respective active-component units. Instead, they serve largely as an additional pool of units that can be tapped in special circumstances.

In this report, the number of direct personnel that CBO estimates for a given type of ship generally reflects the average number of Navy personnel that would be required to man such a ship for one year, not the number of billets on that type of ship. Although an individual ship being deployed has a fairly specific number of billets on board, the average number of personnel that the Navy needs to man a ship is influenced by several other factors. For example, ships are not deployed continuously and often have a reduced crew while in port or in dry dock for maintenance. In those instances, ships may require fewer personnel than they have billets. Conversely, some types of Navy ships are operated using a dual-crewing system, with two sets of crews for the same ship, and thus require more personnel than a single crew's worth of billets.

Command Levels and Units

Navy ships are deployed either alone or in groups organized by task. The most common groups are carrier strike

groups and amphibious ready groups, the two types of units that form the central organizational structures for the Navy.⁵ CSGs are built around a single aircraft carrier and its air wing and generally include five or six surface combatants and an attack submarine. Broadly speaking, the other ships in the group are intended to protect the aircraft carrier from attack, with the air wing providing the group's offensive power (although those other ships also have offensive weapons, and the air wing also has defensive capabilities). ARGs consist of three amphibious ships to carry personnel, equipment, and the amphibious craft used to land forces on shore. The ships in an ARG consist of one large-deck amphibious ship (which also holds helicopters and aircraft) and two dock ships.

Rather than being deployed at all times, Navy ships progress through an operating cycle of deploying and returning to their home ports, undergoing maintenance, training new crews, and then deploying again. As a result, only a fraction of ships are actually deployed at any one time—typically, about 30 percent to 40 percent (depending on the type of ship, home port, and deployment location), although, when necessary, the Navy can increase that number in relatively short order. The Navy generally considers the number of ships deployed—its "forward presence"—to be a more meaningful measure of its contribution to national defense than the total number of ships in its fleet.⁶

Marine Corps ground units are organized in largely the same recursive pattern as Army units, with largely the same command levels (described in Box 2-1 on page 19). The main differences are that the Marine Corps prefers the term "regiment" to "brigade," lacks corps- and theater-level commands, and organizes its forces for combat in a different manner. Instead of grouping regiments into organizations similar to Army brigade combat teams and supporting them with units (such as air-support and logistics units) from higher command levels, the Marine Corps' practice when deploying for combat operations is to assemble task forces with ground combat forces, air combat forces, and logistics units as

5. In addition, the Navy and Marine Corps have occasionally employed expeditionary strike groups, which are essentially ARGs with some additional surface combatants and an attack submarine included.

6. For a more thorough discussion of the Navy's forward presence, see Congressional Budget Office, *Preserving the Navy's Forward Presence With a Smaller Fleet* (March 2015), www.cbo.gov/publication/49989.

appropriate for the specific operation, as well as a headquarters element for the whole task force.

The major types of Marine Corps organizations are differentiated by the size of their ground combat component: A Marine expeditionary unit (MEU) is based on an infantry battalion and has about 2,200 personnel, a Marine expeditionary brigade (MEB) is based on an infantry regiment and has about 12,000 personnel, and a Marine expeditionary force is based on an infantry division and has about 50,000 personnel. Those infantry components are supplemented with other ground combat elements; for example, a MEU is not simply an infantry battalion but typically includes a platoon of tanks. The sizes of the air combat and logistics elements are scaled to the sizes of the ground combat component and the mission.

Both the Army and the Marine Corps have units that are organized permanently and units that are organized specifically for deployments, but the latter are much more common in the Marine Corps. The only Marine task forces that are permanently organized are MEFs; unless they are deployed, MEUs and MEBs are simply small headquarters elements with no other forces assigned to them. That practice can lead to some ambiguity: In different contexts, the term MEU can refer to a headquarters with no other units attached, to a specific task force assembled for a specific deployment, or to the general idea of a task force based around an infantry battalion—the sense in which the term is used in this report. Likewise, the fact that MEUs and MEBs are largely created on an ad hoc basis using units drawn from MEFs leads to some confusion about the total number of Marine Corps units.

Because of such differences in organization, direct comparisons between Army and Marine Corps units are difficult. Whereas Army units typically receive much of their support from higher echelons (division-, corps-, and theater-level assets), Marine Corps units are constructed as integrated task forces that include all of their essential support elements. As a result, a Marine task force is much larger than a comparably sized Army unit would be. In addition, the Army primarily employs brigade combat teams, whereas the Marine Corps more commonly uses MEFs and MEUs—the MEB, which is roughly equivalent in size to a brigade combat team, is a largely theoretical construct. If the two services used comparably sized units and if both treated supporting units as integral to

their combat units, Army and Marine Corps units would be roughly similar in size and capability.⁷

Like the other military services, the Navy and Marine Corps differentiate between the total number of fixed-wing aircraft they possess and the number of official “slots” for those aircraft in their force structure. For example, a squadron of 12 aircraft is intended to be able to operate that many aircraft at all times (in other words, it has 12 slots, called the primary aircraft authorization). But it may have more aircraft assigned to it (called the primary mission aircraft inventory) so the squadron can continue to operate at full strength even if some of those aircraft require extended maintenance or are otherwise unavailable. Similarly, the services have many aircraft that are not assigned to combat units—some are at maintenance depots, some are assigned to training squadrons, and some may be in storage to serve as replacements if aircraft are lost in the future. For those reasons, a service’s total aircraft inventory is greater than its primary aircraft authorization levels. (For instance, the United States purchased 160 EA-18G electronic attack aircraft but maintains about 95 slots for EA-18Gs in the force structure.) In this report, all aircraft numbers represent primary aircraft authorizations.

Strengths and Limitations of Navy and Marine Corps Forces

The many different types of units that are part of the Department of the Navy have their own strengths and weaknesses (as described in the sections below about major elements of the force structure). But as a whole, those units constitute a highly capable force. The Navy’s surface combatants, for example, are widely considered to be exceptionally powerful units—generally larger, with bigger and more capable loads of weapons, and with more sophisticated sensors and electronics than the surface combatants of any other navy. Those ships often escort the Navy’s aircraft carriers, which are also larger, with a greater complement of aircraft, than those of any

7. Many other differences between the two services’ units would remain, however. For instance, the Army has no fixed-wing combat aircraft, whereas the Marine Corps has a large inventory of such aircraft. (The Army is prohibited from having fixed-wing combat aircraft by interservice agreements drawn up shortly after the Air Force was created from the Army Air Corps in the 1940s. However, the Army uses fixed-wing aircraft for purposes other than combat, such as reconnaissance and transport.)

other navy.⁸ The vast majority of other navies in the world resemble the U.S. Coast Guard more than they do the U.S. Navy, in that they focus on patrolling their country's coastlines rather than on projecting power overseas. With the probable exception of China's navy in the western Pacific Ocean, no other nation's navy appears intended to challenge U.S. naval supremacy. Perhaps as a result, the United States has not faced any significant naval combat since World War II (although the Soviet navy was prepared to engage U.S. and NATO naval forces during the Cold War).

For its part, the Marine Corps—though smaller than the Army—is considered one of the most capable ground combat organizations in the world. Similarly, DoN's fleet of aircraft—though smaller than the Air Force—is thought to be one of the world's most capable air combat organizations. Both of those forces have been used extensively in U.S. combat operations since World War II.

Because the Department of the Navy includes what are effectively among the world's largest and most powerful air forces and armies, the department's naval operations have a combined-arms character. Most DoN missions or operations include contributions from the department's ships, aircraft, and Marine Corps ground forces. Moreover, the United States has faced no serious naval threats since the end of the Cold War in the early 1990s, so in major conflicts since then, Navy and Marine Corps units have been used almost exclusively to influence ground operations or events ashore. Aircraft and Marine ground units are often DoN's most powerful tools for influencing events on land, which highlights the flexibility of the department's capabilities.

In the past, the United States has generally had a lower threshold for using air and naval forces in combat than for using ground forces. Naval forces can be stationed in international waters—and thus do not require cooperation from other countries—but are still capable of launching air strikes or cruise missile strikes against potential targets.⁹ In addition, they can respond rapidly, provide a relatively visible threat, and are fairly well protected from any reprisals (both by distance from shore and by their own defensive weapons). For those reasons,

8. The difference in size and capability between U.S. and other aircraft carriers is so great that most other nations' aircraft carriers are, in fact, more comparable to U.S. amphibious assault ships (which the Navy does not call aircraft carriers).

naval forces have often been the United States' preferred first option in crisis situations or in smaller interventions. In such situations, the United States has sometimes also employed amphibious ready groups, whose ability to land ground combat units on shore can heighten the perceived threat of a U.S. invasion. (However, the relatively small size of the ground combat forces included in an ARG—one combat battalion, with air and logistics support—makes their use as a threat credible only against fairly weak opponents.)¹⁰

Using naval forces (or the Air Force) to conduct air and cruise missile strikes on opposing states, without also committing ground combat forces, has had mixed results in achieving the United States' goals. In some cases—such as operations against Libya in the 1980s and Serbia in the 1990s—air and cruise missile strikes may have been enough to achieve U.S. aims. But in many other cases—including the U.S. bombing of North Vietnam during the 1960s and 1970s and U.S. cruise missile attacks against Afghanistan and Sudan in 1998 (Operation Infinite Reach)—aerial campaigns without the use of ground forces did not prove effective at accomplishing U.S. goals. (For a discussion of those and other past military operations, see Appendix C.)

By comparison, the United States has generally been successful in modern times in using amphibious forces to invade opposing countries. Only small and less capable states are vulnerable to an entirely amphibious invasion, however; in recent decades, the United States has taken part in few operationally significant amphibious assaults against major opponents.¹¹ In major conflicts with such

9. Cruise missiles are essentially small, unmanned, single-use aircraft that have wings, carry a warhead, and fly at the same altitudes as manned aircraft (as opposed to ballistic missiles, which are guided rockets that loft their warheads high in the atmosphere or above the atmosphere).

10. As an alternative, during the planned invasion of Haiti in the 1990s (referred to as Operation Uphold Democracy), the United States deployed an Army division aboard two aircraft carriers. That force, much larger than an ARG, created a very credible invasion threat that may have contributed to the Haitian government's acceptance of U.S. demands.

11. Before the Marine Corps began using helicopters as part of its amphibious force, only coastal areas were vulnerable to U.S. amphibious invasions. That is no longer the case—for example, the Marines participated in the invasion of land-locked Afghanistan in 2002—although some areas located far inland remain unreachable by U.S. amphibious forces.

opponents (including the 1991 and 2003 wars with Iraq), the Marine Corps was deployed in essentially the same manner as the Army—as an additional ground force—rather than conducting an amphibious assault. The Marine Corps' amphibious capability has been used most in some of the Corps' least demanding operations, including peacetime missions and operations against opponents such as Grenada or Somalia, which were not capable of presenting concerted resistance.

DoD believes that the most likely future scenarios for U.S. naval combat involve operations conducted close to an enemy landmass. Such “littoral” operations pose special challenges for naval forces: They allow an enemy's land-based forces to affect naval operations (for example, by attacking ships with land-based aircraft or missiles), while making it harder for naval forces to respond (for instance, by limiting their ability to maneuver, making it more difficult for them to find and destroy targets, and exposing them to mines such as those that damaged the USS *Princeton* and USS *Tripoli* during the 1991 war with Iraq). A potential conflict between the United States and China over the status of Taiwan, for example, would most likely involve China using land-based aircraft, cruise missiles, and ballistic missiles to try to keep the Navy out of the immediate area of operations. And a potential conflict in the Strait of Hormuz would most likely see Iran using submarines and land-based cruise missiles to try to deny Navy and commercial ships safe passage through the narrow waters of the strait (see Appendix C).

The lack of significant naval threats for the past two decades and the fact that, in major conflicts, Navy and Marine Corps units have usually been used to affect operations on land have led analysts to differing conclusions. Some argue that if the United States had invested fewer resources in naval forces and more in ground and air forces, it would have had more effective combat power at its disposal in all of its major combat operations since World War II. Other analysts, however, assert that the United States has not faced any major naval competitors precisely because the U.S. Navy's power has deterred other nations from having naval ambitions (because building a fleet capable of competing with the U.S. Navy would be prohibitively expensive). Still others point out that the United States, unlike its adversaries, has been able to enjoy the benefits of uncontested control of the sea lanes, such as the ability to use cargo ships to

transport ground forces to distant theaters of operations. Those benefits from deterrence and control of the sea lanes may be greatest when the U.S. Navy is most dominant, meaning that some of the advantages of naval dominance may not be readily apparent, despite their importance. (Many proponents argue that the deterrent effect of U.S. naval power provides a significant global public good by suppressing naval competition between other countries and ensuring freedom of navigation for civilian shipping.)

In addition to their roles during conflicts, naval forces perform a variety of peacetime missions. For example, they are routinely used to evacuate noncombatants from conflict zones, to provide humanitarian and disaster relief, and to conduct antipiracy patrols. Some advocates of naval forces also suggest that the Navy, by being physically present in distant locations around the world, provides a form of visible U.S. presence that is more effective at reassuring friends and allies about U.S. security commitments—and at deterring U.S. opponents—than are Army and Air Force units, which are often farther away. The vast majority of the Navy's operations today are routine deployments of ships around the globe to provide that presence.

What This Chapter Covers

The rest of this chapter presents CBO's analysis of the following major elements of the Navy's and Marine Corps' force structure (listed here with the percentage of the Department of the Navy's O&S costs that they account for):

- Aircraft carriers (21 percent); see page 52.
- Surface combatants (14 percent); see page 56.
- Attack submarines (7 percent); see page 59.
- Amphibious ships (9 percent); see page 61.
- Marine Corps infantry battalions (33 percent); see page 65.
- Other units and activities of the department (16 percent), such as ballistic missile submarines, construction engineers, and special-operations forces; see page 68.

This chapter also examines four topics of special concern to the Department of the Navy:

- The integration of the Navy and Marine Corps; see page 70.
- The ability to conduct forcible-entry operations (which involve gaining access to enemy territory that cannot be reached from adjacent land areas); see page 72.
- The types of aircraft used by the Navy; see page 74.
- The types of aircraft used by the Marine Corps; see page 77.

Major Element of the Force Structure

Aircraft Carriers

	Total	Direct	Indirect	Overhead
Aircraft Carrier				
Military Personnel per Unit	6,590	3,200	760	2,620
Annual Cost per Unit (Millions of 2017 dollars)	1,180	470	180	530
Carrier Air Wing				
Military Personnel per Unit	4,860	1,630	1,300	1,930
Annual Cost per Unit (Millions of 2017 dollars)	910	330	200	390

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

Aircraft carriers serve as platforms for flight operations by their air wings and also form the nucleus of carrier strike groups, or CSGs. (See Figure 3-1 on page 54 for the size and organization of a CSG.) All of the Navy’s current and planned aircraft carriers are nuclear powered, meaning that they can operate for long periods without needing to be refueled. In addition, all of them are large enough and have the necessary design features to allow sustained air operations by fixed-wing aircraft that are not capable of performing short takeoffs and vertical landings. (Those design features include catapults to launch aircraft, arresting wires to stop planes when they land, and angled decks.)¹² On its own, an aircraft carrier has a limited ability to defend itself from attacks by missiles, aircraft, submarines, or other ships. Its air wing and the other ships in its CSG are responsible for helping to defend the carrier.

The majority of the aircraft in a carrier air wing are F/A-18 multirole fighters, which are capable of defending against aerial threats as well as attacking targets at sea or on land.¹³ Those fighters are comparable in most respects

to the Air Force’s tactical aircraft and can carry most of the advanced munitions that Air Force strike aircraft do. The rest of the aircraft in a carrier air wing largely support the operations of the carrier and the F/A-18s.

Current and Planned Structure. The Navy will field 11 aircraft carriers and 10 carrier air wings in 2017.¹⁴ In its 2017 budget request, it indicated no plans to change the number of carriers through 2021, although it proposed eliminating one carrier air wing.¹⁵ Each air wing consists of eight squadrons of fixed-wing aircraft and helicopters. Together, the Navy’s aircraft carriers and associated air wings account for about 21 percent of the Department of the Navy’s total operation and support funding.

Purpose and Limitations. The Navy’s carrier force gives the United States the ability to strike a wide variety of targets across the world by air, particularly in places where the U.S. military does not have its own air bases on land or access to other countries’ air bases. The range of Navy fighter aircraft (and the ability to use aerial refueling)

12. The majority of the world’s aircraft carriers do not have those features and more closely resemble the Navy’s LHA amphibious assault ships. They are smaller, not nuclear powered, and do not have catapults, arresting wires, or angled decks, so they are only capable of operating a smaller air wing that consists of helicopters and specialized short-takeoff, vertical-landing aircraft.

13. The Navy is currently purchasing the C model of the F-35 Joint Strike Fighter to replace the older C and D models of the F/A-18.

14. When this report was published, the Navy had 10 active carriers because of a gap between the retirement of the USS *Enterprise* and the commissioning of the USS *Gerald R. Ford*. For a detailed discussion of the Navy’s shipbuilding plans, see Congressional Budget Office, *An Analysis of the Navy’s Fiscal Year 2016 Shipbuilding Plan* (October 2015), www.cbo.gov/publication/50926.

15. The Navy plans to keep the aircraft associated with that wing by distributing them to other air wings.

means that carrier air wings can strike targets relatively far inland, not just along coasts. In addition, the mobility of aircraft carriers allows the United States to reposition them to assist in almost any likely combat scenario. Experience has also shown that carrier-based aircraft are among the most powerful antiship weapons and that surface combatants exposed to attack from aircraft are extremely vulnerable (although the United States has not had many occasions to use that capability since World War II).

The main limitation of the carrier force is that carrier aviation is a relatively expensive way to employ tactical aircraft in operations in which air bases on land are available to the United States. The U.S. military has invested heavily in naval aircraft and has used them in every major conflict since World War II (at times, perhaps, because the assets existed rather than because they were the only assets that could perform a particular mission). In many of those conflicts, however, the unique value of aircraft carriers—to provide bases in otherwise inaccessible locations—was not fully demonstrated because the United States had access to air bases on land for at least part of the conflict.¹⁶

A possible further drawback of aircraft carriers is that during combat operations, they could face a number of threats that might make them vulnerable, despite the defensive capabilities of the other ships in a strike group. Navy ships have not faced sustained attacks since World War II, however, so it is difficult to assess how vulnerable aircraft carriers would be in a conflict in which they came under heavy attack from aircraft, cruise missiles, ballistic missiles, or submarines. Analysts have long debated how well aircraft carriers could survive attack in a contested naval environment (such as was possible in a conflict with the Soviet Union or might be possible in a future conflict with China).

16. In some instances, even if the United States has access to air bases on land, the bases do not have enough capacity to support an entire U.S. air operation. In such cases, having carrier aviation allows the United States to station more tactical aircraft in a theater of operations than it would otherwise be able to do. (That advantage tends to diminish over the course of a long conflict, however, because Air Force engineers can substantially improve the size and capability of friendly nations' air bases.) Aircraft carriers can also provide the United States with flexibility in cases in which regional governments do not allow U.S. forces to freely use local air bases or travel through local airspace.

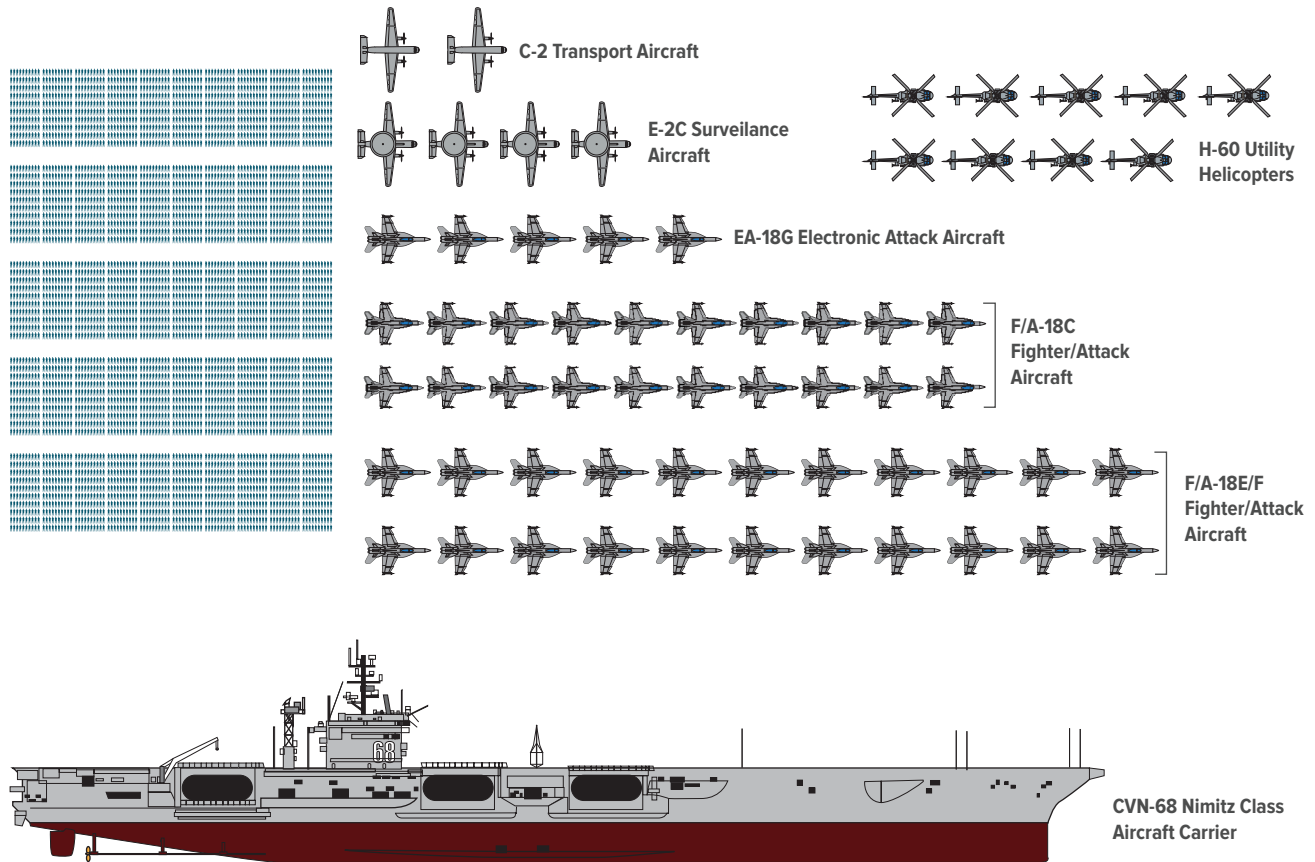
Although no adversary has successfully attacked a U.S. carrier since 1945, the importance of aircraft carriers for the United States' ability to project power has created strong incentives for hostile states to develop weapons and tactics to counter those ships and their aircraft. For example, some states are developing high-speed antiship cruise missiles and antiship ballistic missiles in an effort to penetrate the air defenses of carrier strike groups. In turn, the emergence of those more sophisticated weapons has led the Navy to develop responses, including improvements in air and missile defenses.

Past and Planned Use. For more than 70 years, the United States has used carrier-based aircraft in all of its major combat operations as well as in a number of smaller operations (see Appendix C). In many cases, those aircraft have been the most rapid and flexible form of military response available to the United States. Aircraft carriers have also been employed, though to a much more limited degree, for some nontraditional missions, such as disaster response. In addition, plans for a U.S. invasion of Haiti in the mid-1990s (called Operation Uphold Democracy) envisioned using two aircraft carriers as bases for an air assault by an Army division, with the division's helicopters taking the place of the carriers' normal air wings. (The invasion was never carried out because a diplomatic solution to the crisis was found.) The U.S. military seems likely to continue to use aircraft carriers in future conflicts, unless a potential adversary proves capable of presenting an unacceptably dangerous threat to carrier strike groups (as some analysts believe China might in a future conflict in the South China Sea).

The Navy's goals for the size of the carrier fleet are based on its analysis of wartime scenarios as well as on its goals for having ships deployed overseas (providing what is commonly called forward presence). In major U.S. military operations since the end of the Cold War—such as the conflicts in Kuwait in 1991, in Afghanistan in 2001, and in Iraq in 2003—the Navy eventually provided five to seven aircraft carriers. Maintaining a fleet of 11 carriers would usually allow 5 of them to be available within 30 days for a crisis or conflict (the rest would be undergoing scheduled maintenance or taking part in training exercises and would be unready for combat). Within 90 days, the Navy would generally have seven carriers available. A larger carrier force would be able to provide more ships for a conflict, and a smaller force fewer.

Figure 3-1.

Ships, Aircraft, and Personnel in a Navy Carrier Strike Group



Continued

During peacetime, the carrier fleet conducts routine patrols around the world, providing forward presence to reassure the United States’ friends and allies and deter potential aggressors. Given the Navy’s normal operating cycles for ships and crews, the current force of 11 carriers—one of which is based in Japan—can provide the equivalent of two carriers deployed year-round and a third carrier deployed for eight months of the year. (At any given time, the other carriers are transiting to or from their deployment areas, engaging in training activities, undergoing routine maintenance, or being overhauled.)

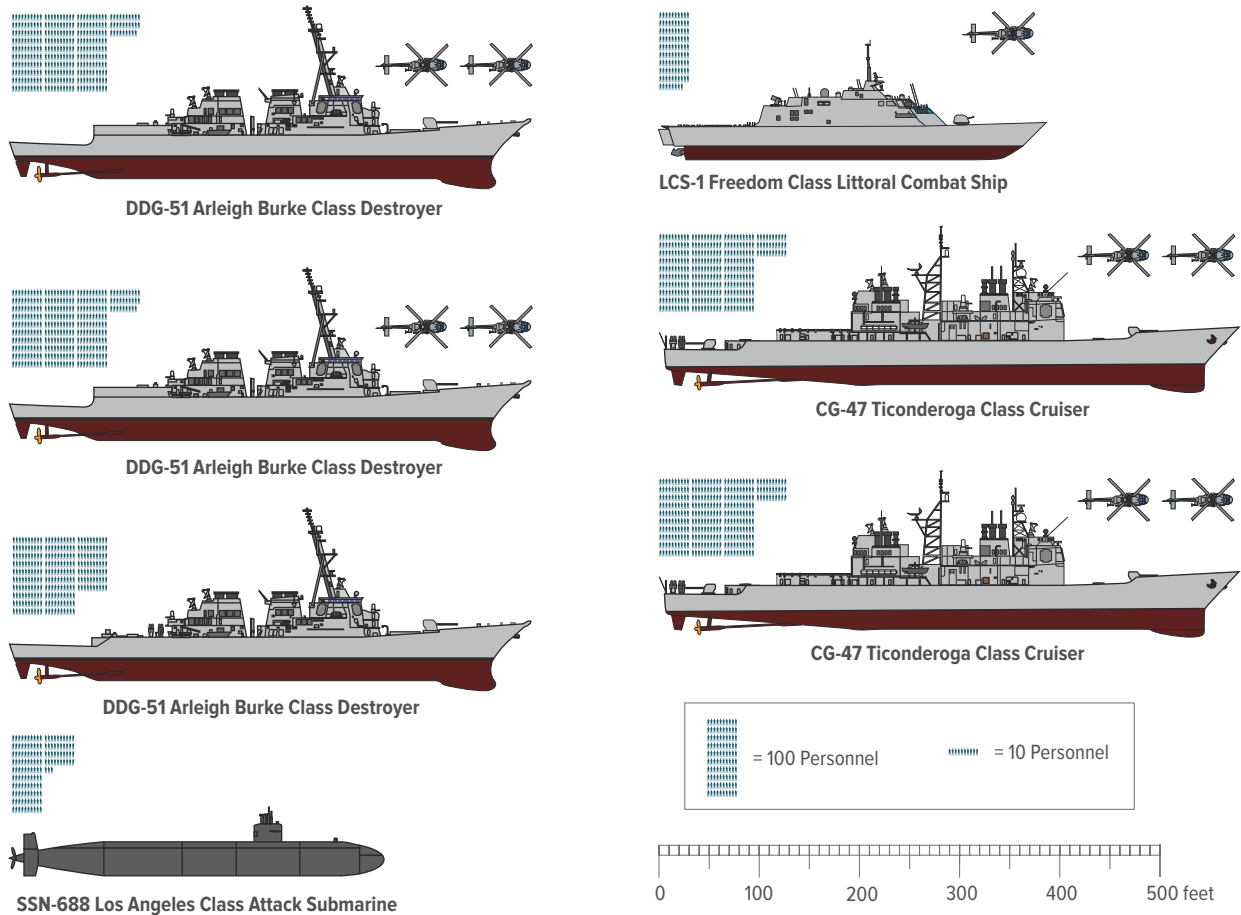
Having more carriers, longer deployments, or more carriers based overseas would increase the fleet’s capability to provide forward presence, whereas having fewer carriers or shorter deployments, or withdrawing the carrier based in Japan, would decrease that capability.¹⁷

17. For a more thorough discussion of the Navy’s forward presence, including deployment cycles and approaches to increase forward presence, see Congressional Budget Office, *Preserving the Navy’s Forward Presence With a Smaller Fleet* (March 2015), www.cbo.gov/publication/49989.

Figure 3-1.

Continued

Ships, Aircraft, and Personnel in a Navy Carrier Strike Group



Source: Congressional Budget Office, using data from the Department of Defense.

The number of personnel shown here for the various ships reflects the Navy's official crew size (number of billets) for each type of ship rather than (as in the entries for those ships) the average number of personnel that would be required to man such a ship for one year.

Major Element of the Force Structure

Surface Combatants

	Total	Direct	Indirect	Overhead
Arleigh Burke Class Destroyer (DDG-51)				
Military Personnel per Unit	720	340	100	290
Annual Cost per Unit (Millions of 2017 dollars)	140	60	20	60
Ticonderoga Class Cruiser (CG-47)				
Military Personnel per Unit	550	250	90	220
Annual Cost per Unit (Millions of 2017 dollars)	110	40	20	40
Littoral Combat Ship				
Military Personnel per Unit	430	190	70	170
Annual Cost per Unit (Millions of 2017 dollars)	100	40	20	30
Zumwalt Class Destroyer (DDG-1000)				
Military Personnel per Unit	500	220	80	200
Annual Cost per Unit (Millions of 2017 dollars)	100	40	20	40

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

The Navy divides its fleet of surface combat ships into large surface combatants (destroyers and cruisers) and small surface combatants (littoral combat ships and FFG-7 frigates, a type of ship the Navy retired in 2015). The larger combatants are powerful ships equipped with the Vertical Launch System (VLS), which allows them to use several different kinds of missiles to attack targets in the air, at sea, or on land. The smaller combatants do not have the VLS but instead carry a variety of smaller and more specialized weapons intended mainly for defensive purposes, particularly antisubmarine warfare. Most of the Navy’s surface combatants carry one or two SH-60 Seahawk helicopters to assist in various missions.

Since World War II, the Navy’s surface combatants have evolved from being vessels distinguished primarily by the size of their main guns—which in turn largely determined the size of the ships—to being versatile platforms for several weapon systems. Since the introduction of the VLS in the early 1980s, the Navy’s large surface combatants have been differentiated mainly by their sensors and

intended combat specialties rather than by their size or type of weapons. Ships equipped with the VLS can carry an interchangeable set of standard munitions, including Tomahawk cruise missiles, ASROC antisubmarine weapons, and Standard air-defense missiles. (Such ships can also carry Harpoon antiship missiles, which use a launch system other than the VLS.) In addition, the Navy has a limited number of Standard missiles that can intercept short- and medium-range ballistic missiles, although that number is expected to grow. Similarly, the Navy’s small surface combatants have become versatile ships primarily intended to defend larger ships against attack by submarines and small boats and to replace the Navy’s mine countermeasures ships. All of the Navy’s surface combatants have enough defensive capability that they can operate independently during normal peacetime deployments.

Current and Planned Structure. In 2017, the Navy will field 104 surface combat ships of various sizes, including DDG-51 and DDG-1000 destroyers, CG-47 cruisers,

and littoral combat ships (LCSs). That total number is set to increase to 125 by 2021 as new DDG-51s, DDG-1000s, and LCSs are added to the fleet.¹⁸ Together, surface combatants account for about 14 percent of the Department of the Navy's total operation and support funding.

Purpose and Limitations. A large share of the Navy's surface combatants are used in carrier strike groups to protect aircraft carriers. Although numbers vary at times, a carrier strike group generally includes five or six surface combatants, in addition to the carrier and an attack submarine. Surface combatants could also be used to escort and defend amphibious ready groups in some scenarios, but it is not currently normal peacetime practice for the Navy to deploy surface combatants with those groups.

In addition, surface combatants are frequently deployed on their own or in small groups (called surface action groups) either to defend an area against ballistic missiles or to allow the Navy's limited number of ships to provide a greater amount of forward presence in places of interest to the United States. Missile defense missions and forward presence missions are similar in many respects, though they differ in some ways. In both cases, the essence of the deployment is simply to be available in some area. However, the Navy's ability to carry out missile defense missions depends on the limited number of large surface combatants that have ballistic missile defense capability, and the locations of those missions are determined by the possible flight paths that missiles could travel between an adversary and its potential targets.

The main limitation of surface combatants is that they have less capability than aircraft carriers or amphibious ships to affect ground combat operations, which have dominated the major conflicts in which the United States has engaged for the past 70 years. Although large surface combatants can launch Tomahawk cruise missiles, the Navy has a significant capability to fire cruise missiles

from other vessels (such as attack and guided missile submarines), and most U.S. combat operations rely on tactical aircraft for the vast majority of strikes on ground targets.¹⁹ Surface combatants also have guns that can provide firepower, but those guns have relatively short ranges, which severely limits their ability to affect combat operations on land. The DDG-1000 class of destroyers that the Navy is commissioning will have an advanced gun system with a longer range than other naval guns in the fleet today, but in many scenarios that range will still not be long enough to make a significant contribution to ground combat. (In addition, the Navy plans to buy only three DDG-1000 destroyers, so the availability of those longer-range naval guns will be quite limited.)

In general, surface ships face a number of potential threats in naval combat operations that might make them vulnerable. However, because the United States has engaged in very little naval combat since World War II, it is difficult to gauge how vulnerable the Navy's surface ships would be if they came under heavy attack from aircraft, cruise missiles, ballistic missiles, or submarines. Some events—such as the war between the United Kingdom and Argentina over the Falkland Islands in 1982 and the attack on the USS *Stark* by a missile launched from an Iraqi jet in 1987—suggest that surface ships may be extremely vulnerable to modern weaponry. Moreover, during Operation Desert Shield in the early 1990s, two U.S. surface combatants hit Iraqi mines, which suggests that older naval mines can be effective against Navy ships. Similarly, in 2000 a boat filled with explosives attacked the USS *Cole* in a port in Yemen, indicating that small boats may be capable of inflicting great damage on surface combatants operating close to shore (for a discussion of those and other past military operations, see Appendix C). However, the Navy has taken a number of steps to respond to those potential threats, and it is difficult to judge how successfully U.S. surface combatants might fare in similar situations in the future.

Past and Planned Use. In practice, the most common contributions that surface combatants have made to U.S. combat operations in recent decades have been as platforms for launching Tomahawk cruise missiles to

18. For a detailed discussion of the Navy's shipbuilding plans, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan* (October 2015), www.cbo.gov/publication/50926. In its 2016 budget request, the Navy proposed removing 11 CG-47 cruisers from the fleet, but in the National Defense Authorization Act for Fiscal Year 2016, lawmakers prohibited the Navy from eliminating those ships. The Navy did not propose removing any CG-47 cruisers from the fleet in its 2017 budget request.

19. Cruise missiles are most frequently used at the beginning of a conflict, when the United States is typically trying to destroy an enemy's air defenses. Cruise missiles are considered a safer option than aircraft for strike missions when enemy air defenses are still capable of threatening the lives of U.S. pilots.

strike targets on land and as protectors of aircraft carriers and amphibious ships. Those roles reflect the nature of recent conflicts: Iraq and Afghanistan had no significant naval forces to engage. In possible future conflicts, however, the ability of U.S. cruisers and destroyers to provide missile defense and air defense could be significant. For example, scenarios involving possible future conflicts between the United States and China over the status of Taiwan would probably require the Navy's large surface combatants to defend Taiwan from attack by ballistic missiles and to defend U.S. carriers from attack by aircraft, ballistic missiles, and cruise missiles. Similarly, scenarios involving attempts by Iran to restrict shipping through the Strait of Hormuz would probably require that large surface combatants defend against aircraft and missiles and that surface combatants of all sizes defend against submarines and small boats (see Appendix C).

Analyses of such wartime scenarios have led the Navy to set a goal of having 88 large surface combatants. Although a significant portion of the Navy's cruisers and destroyers are dedicated to protecting aircraft carriers, they also carry out a variety of independent operations and other missions, such as providing regional ballistic missile defense in Europe and Northeast Asia. Major reductions in the force of large surface combatants (without similar reductions in the force of aircraft carriers) might imperil the Navy's ability to provide escorts to

carriers, but small or moderate changes to the number of large surface combatants would not, although they might affect the Navy's ability to conduct other missions or to provide forward presence in peacetime.

With a planned force of 88 large surface combatants—including 9 based in Japan and 4 based in Spain—the Navy could have approximately 28 of those ships operating in overseas areas at any one time, given its normal operating cycle. Buying more ships, conducting longer deployments, or basing more ships overseas would increase that number, and the reverse would decrease it.²⁰

The Navy's plans for small surface combatants call for having a force of 52 by 2028. With the retirement of FFG-7 frigates, that force will consist entirely of littoral combat ships—including, in the future, a new class of improved LCSs that the Navy plans to designate as frigates. LCSs (and the future frigates) use a scheme of rotating crews that would allow the Navy to keep 26 of those 52 small surface combatants forward deployed at any given time.

20. For a more thorough discussion of the Navy's forward presence and the factors that affect it, see Congressional Budget Office, *Preserving the Navy's Forward Presence With a Smaller Fleet* (March 2015), www.cbo.gov/publication/49989.

Major Element of the Force Structure

Attack Submarines

	Total	Direct	Indirect	Overhead
Military Personnel per Unit	390	190	50	150
Annual Cost per Unit (Millions of 2017 dollars)	140	70	40	30

Because of data limitations, the Congressional Budget Office could not estimate costs for different classes of attack submarines using the framework of this analysis.

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

The Navy’s attack submarines are large vessels powered by nuclear reactors, which allow them to operate underwater for long periods with no practical limits on their range. They are armed with a variety of weapons, such as torpedoes for destroying surface ships and other submarines and Tomahawk cruise missiles for striking targets on land. In addition, some U.S. attack submarines have been fitted with specialized equipment allowing them to deliver teams of special forces ashore. (Attack submarines are not capable of performing some naval missions, such as engaging aerial targets or providing missile defense.)

Current and Planned Structure. The Navy will field 51 attack submarines (which consist of Los Angeles, Seawolf, and Virginia class submarines) in 2017. That number is expected to rise to 52 the following year but return to 51 by 2020. Attack submarines account for about 7 percent of the Department of the Navy’s total operation and support funding. (The Navy operates other types of submarines, such as ballistic missile and guided missile submarines. Those types are discussed in an entry, “Other Department of the Navy Units and Activities,” on page 68.)

Purpose and Limitations. The Navy’s fleet of attack submarines evolved largely to ensure the United States’ ability to use sea lanes around the world freely for military and civilian shipping during conflicts. For years, that fleet’s main adversary was the Cold War–era Soviet navy, which built large numbers of submarines in an effort to prevent the United States from transporting military forces to Europe by ship in the event of a conflict there. Another major mission for the Navy’s attack submarines was to hunt for and destroy Soviet ballistic missile submarines (those carrying strategic nuclear warheads),

including submarines operating beneath the Arctic ice pack.

In contrast to the Navy’s nuclear-powered submarines, many of the United States’ potential adversaries have diesel electric submarines. Those submarines use diesel engines to charge batteries, which can then power the submarines for relatively short periods while submerged. Diesel electric submarines are often considered best suited to coastal defense, for two reasons. First, the need to carry diesel fuel limits their range, and second, the need for an air supply (generally obtained either by surfacing or by raising an air-intake snorkel periodically) limits their ability to stay underwater. Diesel electric submarines can be more tactically effective than nuclear submarines, because battery power is quieter underwater than a nuclear reactor. That quietness gives diesel electric submarines an advantage in detecting, or avoiding detection by, enemy warships and submarines.

The Navy is generally very secretive about its submarine operations. Nevertheless, it has asserted that the stealthy nature of attack submarines makes them excellent intelligence-gathering assets, capable of observing foreign nations while undetected. A lack of unclassified information, however, makes it difficult to assess the value of that mission or the number of submarines that it requires. At the same time, the stealthy nature of attack submarines means that they are not useful for providing visible forward presence overseas, except when conducting port visits in other countries.

The main limitation of the attack submarine force is that it has relatively little ability to directly affect ground combat operations, which have dominated the United States’

military conflicts since World War II. Although attack submarines can launch Tomahawk cruise missiles, the Navy has an enormous capability to fire cruise missiles from other vessels, such as surface combatants and guided missile submarines. Moreover, most U.S. combat operations rely on tactical aircraft for the vast majority of strikes on ground targets.²¹ Attack submarines can sometimes be used to deploy special forces covertly, but that capability is often more useful in peacetime than during major combat operations, when the United States has numerous methods for inserting special forces into a theater (including by fixed-wing aircraft or helicopters).

There is little reason to believe that the Navy's attack submarine fleet is particularly vulnerable to any type of threat in the current military environment. By their nature, submarines are the most difficult types of naval vessels to detect and destroy, and the greatest potential threat to any submarine is generally another submarine. Some analysts have questioned how U.S. attack submarines might perform against advanced diesel electric submarines in shallow waters, such as those of the Persian Gulf, where diesel electric submarines have some tactical advantages. But the United States has various options for attacking and defeating such submarines, including land-based patrol aircraft, ship-based helicopters, and surface combatants.

Past and Planned Use. In recent decades, the most common roles that attack submarines have played in U.S. combat operations have been as platforms for launching Tomahawk cruise missiles at ground targets, for conducting surveillance, or for collecting intelligence. However, those roles reflect the fact that Iraq and Afghanistan had no significant naval forces to engage. In conflicts that the United States might face in the future, the ability of attack submarines to intercept an enemy's naval forces and commercial shipping close to the enemy's coastline could be important in the conduct of the conflict. For instance, scenarios involving conflicts between the United

States and China over the status of Taiwan could easily hinge on the possibility of a Chinese amphibious invasion of Taiwan, in which case the ability of U.S. attack submarines to destroy Chinese vessels would be critical. (For a discussion of DoD's planning scenarios for those and other areas, see Appendix C.) Similarly, scenarios involving attempts by Iran to restrict shipping through the Strait of Hormuz might require U.S. attack submarines to destroy Iranian submarines (which would most likely be an important part of Iran's strategy to deny the United States access to the Persian Gulf).

On the basis of such wartime scenarios, the Navy's stated goal for the size of the attack submarine force has remained at 48 for the past decade. The Navy's analysis is based on classified information, however, so it is not clear what effects increasing or decreasing the size of that force would have on the Navy's ability to achieve its wartime objectives.²²

In peacetime, attack submarines' main missions are conducting surveillance, gathering intelligence, and supporting carrier strike groups. The Navy aims to have at least 10 attack submarines deployed overseas at any given time for various peacetime operations, which may also include supporting the activities of special-operations forces. The Navy currently bases three of its attack submarines in Guam, although that number will soon rise to four. The standard operating cycle for attack submarines—one 6-month deployment during a 24-month period—means that a submarine based in the continental United States is deployed overseas for an average of about 3 months per year (6 months over two years), whereas a submarine based in Guam is deployed overseas for about twice that amount of time. The Navy could keep more attack submarines overseas at any given time if it had a larger force, deployed submarines for longer periods, or stationed more of them at overseas bases. Conversely, a smaller force, shorter deployments, or fewer submarines based outside the United States would reduce the number of attack submarines operating overseas at any one time.

21. Cruise missiles are most frequently used at the beginning of a conflict, when the United States is typically trying to destroy an enemy's air defenses. Cruise missiles are considered a safer option than aircraft for strike missions when enemy air defenses are still capable of threatening the lives of U.S. pilots.

22. For a detailed discussion of the Navy's shipbuilding plans, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan* (October 2015), www.cbo.gov/publication/50926.

Major Element of the Force Structure

Amphibious Ships

	Total	Direct	Indirect	Overhead
Military Personnel per Unit	1,450	710	170	580
Annual Cost per Unit (Millions of 2017 dollars)	270	110	40	120

Because of data limitations, the Congressional Budget Office could not estimate costs for different classes of amphibious ships using the framework of this analysis. The costs shown here are average costs for ships only (they do not include the costs of the Marine units that would deploy on the ships).

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

As their name implies, amphibious ships are designed to conduct operations that involve moving from sea to land—specifically, delivering forces into hostile territory from friendly ships. The Navy’s amphibious ships generally operate in amphibious ready groups (ARGs), each of which is composed of three ships (see Figure 3-2):

- One large-deck amphibious assault ship (an LHA or LHD class ship), which is capable of carrying helicopters, tilt-rotor aircraft, and specialized fixed-wing aircraft that can perform short takeoffs and vertical landings. Those ships also have well decks that allow them to launch and recover Navy landing craft and Marine Corps amphibious assault vehicles.
- Two dock ships (one LPD and one LSD class ship), which have large cargo holds and the ability to launch and recover Navy and Marine Corps landing craft and amphibious assault vehicles.²³

An amphibious ready group is designed to carry a single Marine expeditionary unit (MEU), which consists of an infantry battalion plus air and logistical support units, with a total of about 2,200 personnel and 30 aircraft, both rotary-wing (helicopters and tilt-rotors) and fixed-wing aircraft.²⁴ Amphibious ships have no meaningful offensive capability of their own, but they have the

capability to defend themselves against aerial and naval threats.

Current and Planned Structure. The Navy plans to field 33 amphibious ships during the 2017–2021 period—enough for 10 complete amphibious ready groups now and 11 complete groups once an 11th large-deck amphibious assault ship is delivered in 2024. (Those figures do not include 2 command ships that are considered part of the amphibious fleet in the Department of Defense’s Future Years Defense Program.) Amphibious ships account for about 9 percent of the Department of the Navy’s total operation and support funding.

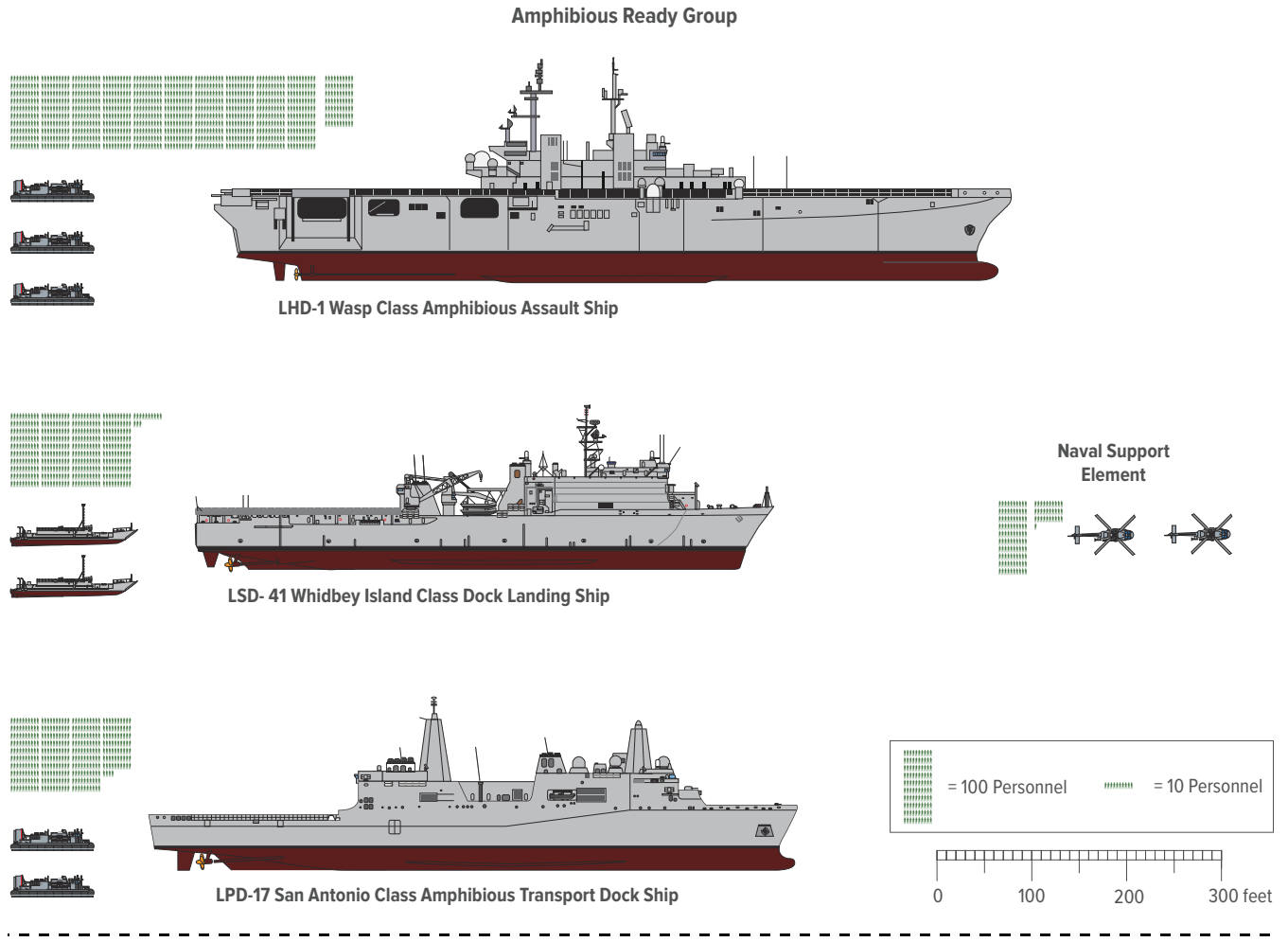
The Navy’s three main types of amphibious ships vary greatly in size and capability. However, data from DoD do not distinguish between the different types, so for this analysis, CBO reports average values for personnel and costs for amphibious ships, even though none of the different types of ships exactly match those average values. Nevertheless, because the Navy generally buys amphibious ships in fairly constant ratios of the different types of ships, large changes in the number of amphibious ships in the fleet will result in the same approximate average cost

23. The two classes of dock ships largely serve the same function, but they differ somewhat in their ability to carry equipment and personnel. LPD class ships, which are larger than LSD class ships, can carry helicopters or V-22 tilt-rotor aircraft as well as landing craft. For more information about the differences between types of amphibious ships, see U.S. Navy, “America’s Navy: The Amphibs” (accessed March 22, 2016), www.navy.mil/navydata/ships/amphibs/amphib.asp.

24. Marine expeditionary units are discussed in more detail in the entry “Marine Corps Infantry Battalions,” on page 65. Although the ships that make up an amphibious ready group carry a MEU when they are deployed at sea, it is not correct to infer that there is one MEU per ARG. MEUs are not assigned to ARGs when they are not deployed, and the Marine Corps maintains 7 MEU headquarters, although the Navy can field 10 ARGs. Rather than being a fixed set of units, MEUs are task-organized units that are primarily composed of units drawn from other Marine Corps commands.

Figure 3-2.

Ships, Aircraft, Equipment, and Personnel in a Navy Amphibious Ready Group and a Marine Expeditionary Unit



Continued

and personnel requirement for an amphibious ship as CBO has estimated.

Purpose and Limitations. Unlike past amphibious operations, which relied entirely on waterborne landing craft, modern operations generally involve delivering personnel and equipment to a target area by air as well as by water. For smaller operations that do not require transporting heavy equipment, ARGs can conduct the entire delivery operation with the MEU's aircraft, giving modern amphibious operations much greater range and flexibility than past operations.

ARGs (and their associated MEUs) are also capable of performing a wide variety of missions in peacetime. They

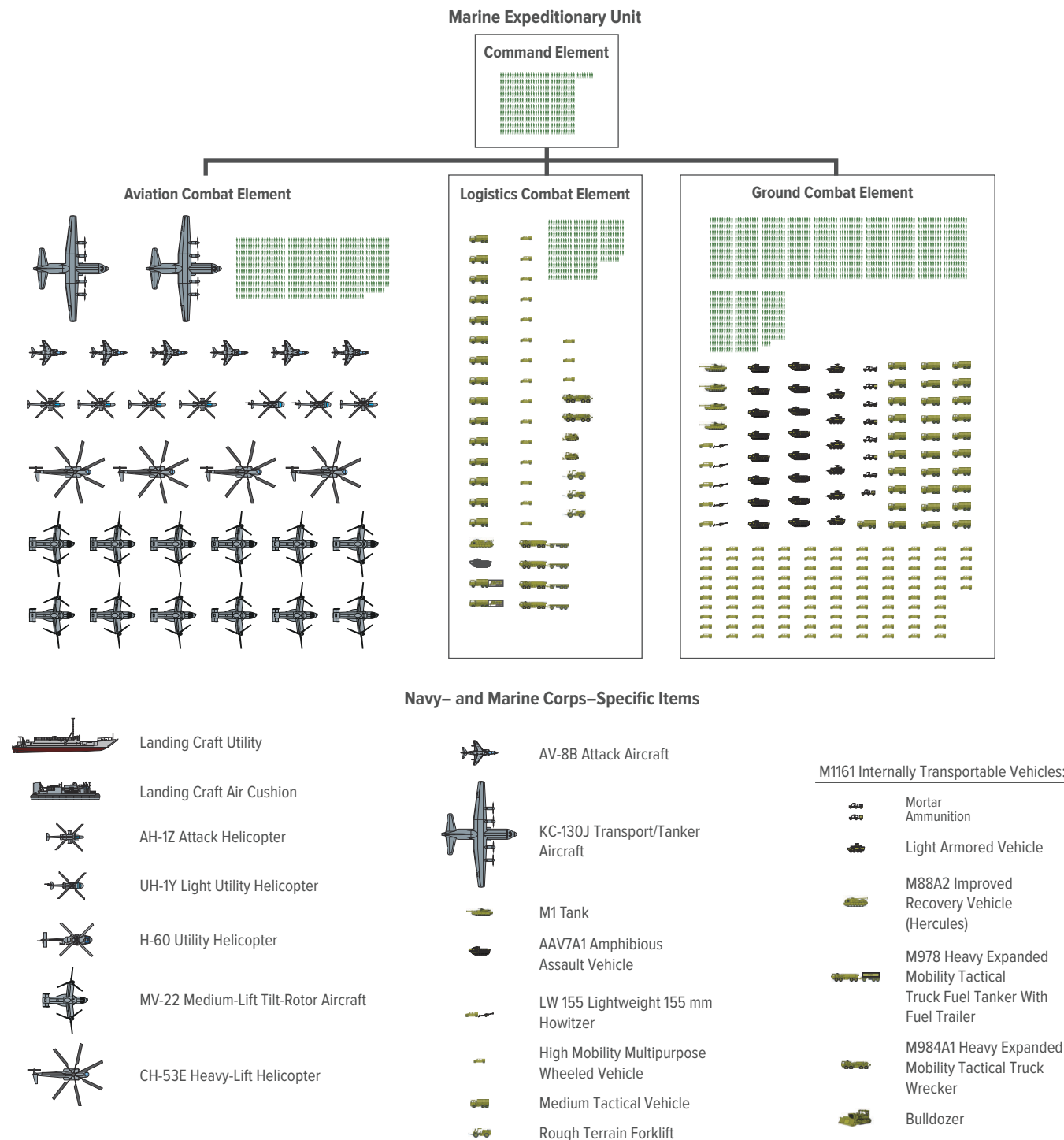
can be used to evacuate embassy personnel and other noncombatants from a conflict zone, and they are considered extremely useful for humanitarian assistance, disaster response, antipiracy missions, and other types of operations that do not involve major conflicts.

The main limitation of the amphibious force is that a single MEU is not large enough to significantly affect most major combat operations. Although several ARGs could be combined to land a larger force, the conditions under which such a major amphibious operation would be necessary are relatively rare. Experience indicates that opposed amphibious assaults are extremely dangerous, so military planners strongly prefer to conduct them only when no better options exist. Other than landing Marine

Figure 3-2.

Continued

Ships, Aircraft, Equipment, and Personnel in a Navy Amphibious Ready Group and a Marine Expeditionary Unit



Source: Congressional Budget Office, using data from the Department of Defense.

The number of personnel shown here for the various ships reflects the Navy's official crew size (number of billets) for each type of ship rather than (as in the entries for those ships) the average number of personnel that would be required to man such a ship for one year.

Corps forces, ARGs are capable of offering only minor air support in a conflict. ARGs carry far fewer aircraft than an aircraft carrier does, and their aircraft have much shorter ranges and smaller payloads. (Moreover, as noted above, even carrier-based aircraft tend to play a more limited role in major conflicts than land-based aircraft do.)

Past and Planned Use. The United States has frequently used amphibious ships to deploy Marine Corps forces for small-scale operations, and it seems likely to continue to do so in the future. The United States has also deployed amphibious ships for major combat operations, but it has not conducted any large-scale amphibious assaults since the 1950 Inchon landings during the Korean War. Amphibious ships played a fairly minor role in the 1991 and 2003 wars with Iraq.²⁵ However, during operations against the Taliban in 2002, a small Marine Corps force assaulted Kandahar, Afghanistan, from an amphibious ready group more than 400 miles away in the Indian Ocean. That assault showed the ability of modern amphibious forces to deploy entirely by air over a long range. (For a discussion of those and other past military operations, see Appendix C.)

For some time, the Navy and Marine Corps have maintained a goal of having enough amphibious ships to deploy the assault echelons of two Marine expeditionary brigades (MEBs) in an amphibious assault. That goal is somewhat nebulous because MEBs are not standardized units, but transporting two of them would probably require about 15 amphibious ships. Ensuring that 15 amphibious ships were at sea when needed would in turn require 30 amphibious ships to be operationally available at a given time, out of the Navy's stated inventory goal of 34 ships.

The main challenge of such an amphibious assault would be to assemble enough ships at sea at the same time and

place—a challenge that would depend primarily on the Navy's ability to rotate and schedule ships efficiently. (Deploying all of the Navy's ships simultaneously is impossible because, at any one time, much of the fleet is at its home port undergoing maintenance, being used for training, or in transit to or from its area of operations.) The Navy and Marine Corps would prefer to have a total fleet of 38 amphibious ships. However, that goal appears unlikely to be met at any time in the foreseeable future because the Navy's acquisition plans do not envision constructing that many amphibious ships.²⁶

The Marine Corps has not conducted a MEB-size amphibious assault in many decades, and few of DoD's planning scenarios combine all of the factors necessary to make a MEB-size or larger amphibious assault a desirable option. That subject is discussed in more detail later in this chapter, in the special-topic entry on forcible-entry operations.

Like other surface ships, amphibious ships are used extensively during peacetime for routine patrols to provide forward presence. Their notional operating cycle—one 7-month deployment every 36 months—means that with the current fleet of 33 amphibious ships (4 of which are based in Japan), the Navy can have the equivalent of 8 amphibious ships providing overseas presence year-round and a 9th ship for about 4 months of the year. Acquiring more amphibious ships, lengthening deployments, or basing more amphibious ships overseas would increase the fleet's capacity to provide forward presence, whereas having fewer ships, shortening deployments, or withdrawing ships based in Japan would decrease that capacity. In recent years, high demand for operating amphibious ships overseas has led the Navy to extend deployments for most amphibious ships well beyond the 7 months of their official operating cycle (which is itself an increase from 6 months a decade ago).

25. In 1991, Marine Corps forces onboard amphibious ships were credited with playing a diversionary role, possibly forcing the Iraqi military to defend the coastline with forces that would otherwise have been committed to defending Kuwait's land borders.

26. For a detailed discussion of the Navy's shipbuilding plans, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan* (October 2015), www.cbo.gov/publication/50926.

Major Element of the Force Structure

Marine Corps Infantry Battalions

	Total	Direct	Indirect	Overhead
Active-Component Marine Infantry Battalion				
Military Personnel per Unit	5,780	1,490	1,990	2,300
Annual Cost per Unit (Millions of 2017 dollars)	740	140	140	470
Reserve-Component Marine Infantry Battalion				
Military Personnel per Unit	4,370	2,070	560	1,740
Annual Cost per Unit (Millions of 2017 dollars)	470	70	50	350
Marine Aircraft Complement				
Military Personnel per Unit	2,750	760	890	1,090
Annual Cost per Unit (Millions of 2017 dollars)	520	160	140	220

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

The Marine Corps’ infantry battalions, unlike the Army’s brigade combat teams (BCTs), are “pure” light-infantry organizations that are not intended to operate independently. Instead, they are assembled into task forces—tailored to the needs of a specific operation—with other ground combat forces, air-support and logistics units, and a headquarters element for the whole task force. A Marine expeditionary unit (MEU) is a task force based on an infantry battalion (see Figure 3-2 on page 62), and a Marine expeditionary brigade (MEB) is a task force based on a regiment (typically with three battalions). The largest organization in the Marine Corps is based on an infantry division (which usually consists of three regiments) and is referred to as a Marine expeditionary force (MEF).

The Marine Corps maintains three MEFs as standing peacetime organizations, but it assembles MEUs and MEBs only as needed for actual operations.²⁷ The Marine Corps also tailors its MEFs for some deployments. For example, when I Marine Expeditionary Force deployed to

Kuwait in 1991 and to Iraq in 2003, it did not include exactly the same set of units that it normally includes when stationed at Camp Pendleton in California.

Although Marine task forces other than MEFs are not standardized units, the Congressional Budget Office’s modeling approach of allocating support units to major combat units produces an estimated size and cost for a Marine infantry battalion that approximates an “average” for Marine Corps ground combat and air combat forces and their associated support units. Under that approach, if a notional Marine Corps task force consisted of three battalions (three MEUs or a single MEB), it would have three times the number of personnel, and three times the cost, of the average battalion-size force discussed here.²⁸

In CBO’s analysis, a fully supported Marine infantry battalion is assigned a proportional share of the following:

- Each Marine division’s assets, which include field artillery regiments, tank battalions, light armored vehicle battalions, and amphibious assault battalions;

27. The Marine Corps maintains several headquarters for the smaller organizations, but those headquarters do not have units attached to them when they are not taking part in operations.

28. In practice, smaller Marine Corps task forces tend to be assembled for less demanding tasks and include fewer support personnel.

- Each Marine aircraft wing's squadrons of aircraft, which consist of utility helicopters, attack helicopters, heavy-lift helicopters, tilt-rotor aircraft, and short-takeoff, vertical-landing attack aircraft; and
- Each Marine logistics group's assets, which provide logistical support to Marine Corps forces.

Although Marine Corps doctrine treats ground and air assets as inseparable parts of task forces, CBO separated the aircraft and air crew of each infantry battalion's support units into a separate category (referred to here as an aircraft complement) to more clearly display their costs.²⁹ However, for reasons discussed below in the special-topic entries on Navy and Marine Corps integration (page 70) and naval shipborne aviation (page 74), CBO did not include the Marine Corps' F/A-18 fixed-wing aircraft in the aircraft complements. Similarly, not all of the personnel that CBO displays as associated with Marine units are marines—some are Navy personnel assigned to Marine Corps units.

Current and Planned Structure. The Marine Corps intends to field 24 infantry battalions in the active component and 8 infantry battalions in the Marine Corps Reserve in 2017, with no plans to change either number through 2021. Those battalions and their aircraft complements account for virtually all of the Marine Corps' operation and support funding but about one-third of the Department of the Navy's operation and support funding.

Purpose and Limitations. A fully supported MEU, MEB, or MEF is roughly the same size as an equivalent Army ground combat formation but has a different mix of combat and support units. At the highest level, the differences are mostly attributable to the Marine Corps' integration of fixed-wing aircraft into its forces. The Army does not have its own fixed-wing attack aircraft and relies more heavily on its field artillery units for fire support, whereas the Marine Corps maintains a large complement of fixed-wing attack aircraft but only a modest amount of field artillery. Another difference is that Marine Corps units generally include more direct combat

units—with a relatively large amount of infantry in each battalion and a variety of armored vehicles, such as tanks and personnel carriers—as well as robust support from rotary-wing aircraft. At the same time, Marine Corps units have a more limited variety of supporting units, such as air-defense capability, and a more limited logistics structure (in part because the Army is responsible for theater-level logistics functions).

Such structural differences may not be as operationally significant as they appear, however, because U.S. forces always operate as joint (multiservice) forces. Army BCTs, for example, receive substantial air support from the Air Force's fixed-wing aircraft, and they are not necessarily deficient compared with Marine Corps regiments merely because that fixed-wing air support is not part of a BCT.

The main limitation of Marine Corps battalions is that, being primarily a light-infantry force with a limited armored component, they are not well suited for combat against heavily armored opponents in unfavorable terrain. However, that limitation may be less significant in practice than it is for the Army's infantry BCTs, because Marine Corps forces have access to some armored vehicles (each Marine division includes a tank battalion, for example) and also have access to a wider array of air-support assets (in the form of Marine Corps fixed-wing aircraft) that are organic to (included in) the force.

One criticism sometimes leveled at Marine Corps battalions is that when they are not performing amphibious assault missions, they essentially form a second Army, which is duplicative and wasteful for the United States. The U.S. military's practice of maintaining two separate armed services to provide ground combat forces is unusual compared with what most other nations do. However, the Marine Corps has a long record of combat on land in operations unconnected to its amphibious assault mission, and DoD often employs Marine Corps ground forces as if they are essentially interchangeable with Army ground forces. Moreover, Marine Corps and Army units routinely operate together as part of joint forces. In theory, the United States might gain some benefits from consolidating ground combat forces in a single military service. But in practice, it is difficult to identify any substantial inefficiencies at the Department of Defense that result from maintaining large Marine Corps ground combat units.

29. In CBO's analysis of the Marine Corps' forces, the direct costs and personnel of an infantry battalion or aircraft complement represent those of the ground combat or air combat elements, whereas the indirect costs and personnel represent those of the command and logistics elements.

Some observers argue that the two ground services have a complementary relationship rather than a duplicative one. In that view, the Marine Corps' strengths in being able to deploy forces from the sea and in integrating fixed-wing aircraft with ground units complement the Army's strengths in conducting large-scale combat operations (involving infantry, armored units, and other types of forces) and in coordinating combat logistics.

Past and Planned Use. Marine Corps ground forces have taken part in all of the United States' major combat operations in recent history—including Operation Desert Storm (to remove Iraqi forces from Kuwait in 1991), Operation Iraqi Freedom (the invasion of Iraq in 2003), and Operation Enduring Freedom (the invasion of Afghanistan in 2001)—as well as in numerous smaller operations. In Operations Desert Storm and Iraqi Freedom, DoD successfully used Marine Corps forces against an Iraqi army that had large numbers of armored vehicles in desert terrain (which is generally considered highly advantageous to armored forces).³⁰ In addition, Marine Corps ground forces were heavily involved in subsequent counterinsurgency operations in Iraq and Afghanistan. (For a discussion of those and other past military operations, see Appendix C.)

In the 1990s, DoD's post–Cold War planning focused on being able to fight two major wars simultaneously (or

nearly simultaneously). Each war was generally assumed to require four Marine regiments (of three battalions each). Subsequent planning has not been as rigid but envisions needing similar numbers of Marine Corps units for major conflicts, which means that the eight regiments in the Marine Corps' active component and three in the Marine Corps Reserve would be enough for two major conflicts. However, if the future security environment is dominated by scenarios that place more emphasis on naval and air forces—such as potential operations around Taiwan, the South China Sea, or the Strait of Hormuz—the need for ground forces may decline (see Appendix C).

In principle, the need for Marine Corps infantry battalions is affected by the number of three-ship amphibious ready groups (ARGs) that the Navy maintains. However, the Marine Corps is significantly larger than necessary to satisfy the demand for MEUs on ARGs. With 2 or 3 ARGs typically at sea at any time (each with a MEU), the Marine Corps would have to use only 6 to 9 of its 24 active-component infantry battalions to meet that need (given the common ratio of 2 nondeployed units needed to sustain 1 deployed unit). Very large reductions in the size of the Marine Corps, without a similar reduction in the size of the amphibious force, might imperil the Marine Corps' ability to provide MEUs for ARGs, but small or moderate changes to the size of the Marine Corps would not—assuming that the Marine Corps was not under heavy pressure from other commitments. At times when the service has had other major commitments, such as providing ground forces during the occupation of Iraq, keeping a large enough pool of forces to provide MEUs for ARGs was demanding, requiring DoD to set priorities for its limited number of assets.

30. In Operation Desert Storm, Army heavy forces were primarily responsible for attacking and destroying Iraqi Republican Guard divisions (Iraq's most capable armored units), while Marine Corps ground forces were responsible for liberating Kuwait. In Operation Iraqi Freedom, when Iraqi forces were less well equipped and capable, Army and Marine Corps ground forces each had their own attack paths.

Major Element of the Force Structure

Other Department of the Navy Units and Activities

	Total	Direct	Indirect	Overhead
Ballistic and Guided Missile Submarines				
Military Personnel per Unit	660	320	80	260
Annual Cost per Unit (Millions of 2017 dollars)	170	70	40	50
P-3 and P-8 Maritime Patrol Aircraft Squadrons^a				
Military Personnel per Unit	1,890	630	500	750
Annual Cost per Unit (Millions of 2017 dollars)	330	110	70	150
Seabee Construction Engineers				
Total Military Personnel	14,200	8,550	0 ^b	5,650
Total Annual Cost (Millions of 2017 dollars)	1,860	720	0 ^b	1,150
Navy Special-Operations Forces				
Total Military Personnel	16,440	9,900	0 ^b	6,550
Total Annual Cost (Millions of 2017 dollars)	2,370	1,050	0 ^b	1,330
Marine Corps Special-Operations Forces				
Total Military Personnel	3,530	2,130	0 ^b	1,410
Total Annual Cost (Millions of 2017 dollars)	490	210	0 ^b	280
Rest of the Navy				
Total Military Personnel	37,990	22,860	0 ^b	15,120
Total Annual Cost (Millions of 2017 dollars)	6,550	3,490	0 ^b	3,060
Rest of the Marine Corps				
Total Military Personnel	770	460	0 ^b	310
Total Annual Cost (Millions of 2017 dollars)	230	160	0 ^b	60

“Direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The numbers shown here are rounded to the nearest 10 personnel or \$10 million; more detailed information is presented in Appendixes A and B.

a. Notional squadrons of 12 aircraft (actual squadrons vary in size).

b. In the analytic framework used for this report, other units and activities are generally considered to not have any units supporting them and thus to not have any indirect personnel or costs.

Although the vast majority of the Navy's and Marine Corps' units are connected with ships and Marine expeditionary forces (MEFs), the Department of the Navy includes a number of other units that are not directly related to ships and MEFs. Together, those units account for 16 percent of the department's operation and support.

The Navy's 14 **ballistic missile submarines** (all from the Ohio class) are similar to other naval vessels in most respects. However, they carry nuclear weapons and are the Navy's contribution to the U.S. nuclear deterrent, so their number is normally determined by national nuclear policy and by the outcomes of arms control negotiations rather than by the considerations that affect other U.S. military units.³¹ In its budget documents, the Navy combines ballistic missile submarines and **guided missile submarines**, which are 4 former ballistic missile submarines that have been converted to launch Tomahawk cruise missiles and to support special operations. Those guided missile submarines are less subject to arms control considerations than the ballistic missile submarines are.

The Navy's fleet of approximately 90 **maritime patrol aircraft** consists of land-based, long-range aircraft equipped with a variety of sensors and weapons. They are capable of monitoring large areas of the ocean, improving the Navy's ability to find and track other nations' ships and submarines. They are also capable of conducting limited attacks on ships and submarines. The older P-3 model patrol aircraft are currently being replaced by

newer P-8 model aircraft. The Navy is also in the process of fielding an unmanned long-range patrol aircraft, the MQ-4 Triton, which is based on the airframe of the Air Force's RQ-4 Global Hawk (discussed in Chapter 4).

The Navy's **construction engineers**, referred to as Seabees, provide a variety of engineering services to the Navy. They have the ability to build or improve bases in theaters where the infrastructure and basing options are poor. In that role, Seabees have contributed greatly to the success of past U.S. military operations in distant theaters. Because the United States has often intervened in countries with poor infrastructure—and because deploying U.S. forces can place great strain on the ports and air bases that receive them—the capability to improve that infrastructure has typically been highly valuable, although less recognized than some of the service's other capabilities. Unlike most of the Navy's forces, a relatively large percentage of Seabees are in the Naval Reserve.

The Navy and Marine Corps also maintain **special-operations forces**, which are trained, equipped, and overseen by the Department of Defense's Special Operations Command (SOCOM). They focus on such missions as unconventional warfare, special reconnaissance, counterterrorism, or the training of foreign militaries. The forces overseen by SOCOM are discussed in more detail in Chapter 5, which deals with defensewide activities.

By the Congressional Budget Office's estimate, about 38,000 military personnel and \$6.5 billion a year are devoted to **units and activities of the Department of the Navy other than those described in this chapter**. They consist of a variety of smaller organizations providing specialized capabilities; examples include the Navy's and Marine Corps' contributions to various joint commands and defensewide organizations, as well as some miscellaneous command-and-control functions.

31. Arms control agreements can affect not only the number of ballistic missile submarines in the fleet but also the number of Trident missiles that each submarine carries and the number of warheads on each Trident missile. Ballistic missile submarines are generally considered to be the best available element of U.S. nuclear forces for ensuring that the nation maintains a "second-strike" nuclear capability—that is, it would be extremely difficult for an enemy to destroy ballistic missile submarines that were at sea, so those submarines would most likely be available to retaliate against any nuclear attack.

Special Topic

Integration of the Navy and Marine Corps

Amphibious operations offer perhaps the most iconic image of the close relationship between the Navy and the Marine Corps, with Navy ships carrying Marine Corps units into battle. However, the two “sea services” are integrated on a much deeper level than that in their day-to-day operations.

This report follows conventional usage in talking about Navy ships and Marine Corps combat units, but in reality, many Navy ships have Marine Corps personnel onboard as part of their crew (although that practice is becoming less widespread than it used to be).³² In some cases, larger Marine Corps units—such as entire squadrons of aircraft within carrier air wings—provide a significant share of a ship’s combat power. Similarly, Marine Corps units include some Navy personnel; for example, all medical personnel assigned to Marine Corps units are members of the Navy. Thus, nearly all large Navy and Marine Corps units are actually a mix of personnel from both services.

For the purposes of this analysis, the extent to which the support and administrative structures of the Navy and Marine Corps are intertwined makes it impossible to determine which of the costs and personnel dedicated to sustaining the Department of the Navy’s (DoN’s) combat units should be allocated to the Navy and which to the Marine Corps. Such intertwining is pervasive. For example, the U.S. Naval Academy produces officers for both the Navy and Marine Corps, and the training establishments for weapon systems that both services operate, such as F/A-18 aircraft, are largely integrated as a single establishment within DoN. For those reasons, this analysis focuses on the department rather than on each of its services individually.

32. Historically, shipboard detachments of marines were used for several purposes, such as deterring potential mutineers; allowing ships to make small landings; repelling or initiating boarding actions; and, during the Cold War, guarding nuclear weapons. Providing shipboard detachments was the primary function of the Marine Corps during the 18th and 19th centuries, but that function declined in importance during the 20th century. Today, the use of shipboard detachments is greatly reduced, in part because of the need for marines in the ground combat operations in Iraq and Afghanistan.

Functions that are performed by civilians are performed by DoN civilians—there are no Navy or Marine Corps civilians (although DoN personnel can be assigned to Navy or Marine Corps organizations). DoN organizations staffed by DoN civilians are responsible for many administrative duties that support both services, such as management of the Navy’s and Marine Corps’ budgets. For weapon systems used by both services, DoN generally integrates functions such as procurement and depot maintenance.³³

The strong interrelationship between the Navy and the Marine Corps is based on tradition: The need to provide soldiers onboard ships was the original reason for the existence of a Marine Corps. That tight interweaving is usually described as having a variety of positive effects. The most prominent effect is that it helps to produce a common culture in the two sea services that promotes trust and cooperation. Such close integration is also seen as a natural extension of the expeditionary nature common to the two services—the routine, frequent peacetime deployments that both services are accustomed to conducting are distinct from the more limited peacetime deployments traditionally practiced by the Army and the Air Force. Another natural complement between the sea services is that the Navy’s greatest limitation as a combat force is its limited ability to project power ashore, and the Marine Corps provides that ability to the Navy. Similarly, the Navy provides the means to convey Marine units to operations.

The benefits of the Navy and Marine Corps’ integration are sometimes contrasted (by implication if not explicitly) with the historical relationship between the Army and the Air Force. Since 1947, when the Air Force was created by splitting off the Army Air Corps from the Army, the Air Force has made a great effort to differentiate itself from the Army as a separate and distinct service, with separate and distinct missions, culture, weapon systems, and war-fighting doctrine. At times, those separate cultures have

33. For example, all of DoN’s aircraft are purchased through the Aircraft Procurement, Navy, appropriation. Separating that appropriation into “blue” (Navy) and “green” (Marine Corps) funding—as some analysts do when trying to describe each service’s spending independently—requires detailed knowledge of specific programs, multiple assumptions, and significant analytic effort.

led the Air Force and the Army to disagree in important ways about military operations, particularly about the Air Force's provision of close air support to Army ground combat units.³⁴ Some observers (and Army personnel) have argued that the Air Force is reluctant to provide as

34. "Close air support" generally refers to attacks by combat aircraft on enemy forces that are in contact with U.S. ground forces (often conducted at the request of those ground forces)—as opposed to air attacks on fixed installations, enemy forces not in contact with U.S. ground forces, or other targets.

much close air support as Army ground combat units need, preferring to wage separate air campaigns largely disconnected from ground combat operations. However, other observers say that such differences are overstated and that the Air Force has always supported Army units during combat operations (regardless of their specific views about the nature of joint operations and the role of airpower at the time). Compared with those two services, the Navy and Marine Corps appear to coordinate operations more smoothly and be less inclined to try to conduct operations separately.

Special Topic

Forcible-Entry Capability

Forcible entry occurs when a military force gains access to enemy territory that cannot be reached from adjacent land areas. Three main types of forcible-entry operations exist, each performed by specialized forces:

- Airborne assault, in which troops parachute into an area from fixed-wing aircraft;
- Air assault, in which troops attack from helicopters; and
- Amphibious assault, in which troops are carried to shore on naval landing craft.

Unlike conventional ground operations, in which troops advance from friendly terrain into adjacent enemy terrain, forcible-entry operations focus on giving troops access to enemy territory that is behind the enemy's lines, far from friendly territory, on hostile islands, or otherwise not accessible to conventional ground forces.

History and Nature of Forcible-Entry Operations.

The value of forcible-entry capability was demonstrated in many dramatic ways in World War II. Amphibious assaults were central to the conduct of the war in the Pacific, where the United States fought Japan across a string of island chains and archipelagos and made plans to assault the island nation of Japan. In the European theater, the lack of any Allied-controlled territory on the mainland of Western Europe made amphibious assaults into North Africa, Sicily, mainland Italy, and the French province of Normandy crucial to the overall goal of invading and defeating Germany. Forcible-entry operations by air were not feasible in the Pacific because of the great distances between islands, but the European theater saw several major airborne assaults (in conjunction with amphibious assaults in Sicily and Normandy). During the Korean War, a major amphibious assault at Inchon demonstrated the power of forcible-entry operations to change the course of a conflict.

Helicopters were not developed enough during earlier wars to perform air-assault operations, but in the Vietnam War, the Army employed air-assault tactics frequently. Air assaults were generally used to rapidly bring large concentrations of Army forces into contact with Viet Cong and

North Vietnamese Army units, which often preferred to avoid direct confrontation with U.S. troops. Since then, the Army's air-assault forces have relied on helicopters for mobility in most conflicts in which those forces have been used. The Marine Corps' amphibious forces also include an air-assault component of helicopters and tilt-rotor aircraft. In an amphibious operation, the air assault would most likely be conducted in coordination with an assault by Marine forces in Navy landing craft.

The brigade combat teams (BCTs) of the Army's 82nd Airborne Division and the Air Force's fleet of large cargo aircraft are the main elements of the U.S. force structure necessary for airborne assaults. The BCTs of the Army's 101st Airborne Division and the Army's cargo and utility helicopters are the main elements necessary for air assaults. And the Marine Corps' ground forces, helicopters, and landing craft, along with the Navy's amphibious ships and landing craft, are the main elements of the force structure needed for amphibious assaults. In addition, U.S. special forces have conducted all three types of forcible-entry operations on many occasions—though on a much smaller scale—to gain access to hostile territory.

Under certain circumstances, the U.S. military has combined elements of its forcible-entry capability in other ways. For example, during the war in land-locked Afghanistan, Marine Corps forces conducted an air assault on the city of Kandahar from amphibious ships more than 600 miles away in the Indian Ocean. And when the United States prepared to invade Haiti in support of an ousted president in the mid-1990s, the military planned to conduct the invasion using Army air-assault forces (infantry and helicopters) transported on Navy aircraft carriers. More recently, the Department of Defense has explored the concept of "sea basing," in which Navy ships would serve as the rear area of a theater during a conflict—performing all logistics functions for a force on shore—and would be connected to ground forces in combat by a "bridge" of aircraft and landing craft.³⁵

35. See Congressional Budget Office, *Sea Basing and Alternatives for Deploying and Sustaining Ground Combat Forces* (July 2007), www.cbo.gov/publication/18801.

Advantages and Disadvantages of Forcible-Entry Operations. The major advantage of forcible-entry operations is that, under some circumstances, it is impossible to fight an adversary without them. Enemy-held islands, or other territories that do not have a land border with a friendly state, are inaccessible to conventional ground operations. In addition, forcible-entry capabilities can be important for gaining major combat advantages through surprise and mobility (as in the Inchon landing). Scenarios in which such capabilities could be useful in the future include possible operations in North Korea or the Strait of Hormuz (for a description of such scenarios, see Appendix C). On a smaller scale, the use of helicopters for air-assault operations has allowed U.S. forces to operate relatively freely in the mountainous landscape of Afghanistan, avoiding some of the limitations that the country's poor infrastructure and rugged terrain would otherwise impose.

One of the main drawbacks of forcible-entry operations is that, if conducted in the face of strong opposition, they can be extremely dangerous, and if unsuccessful, they have the potential to result in heavy losses. During World War I, the troops taking part in Britain's amphibious assault at Gallipoli were unable to penetrate inland, and they suffered enormous casualties from combat and illness before their beachhead was evacuated. In World War II, Britain's 1st Airborne Division suffered a casualty rate of about 80 percent during Operation Market Garden, an unsuccessful airborne assault intended to penetrate German lines as part of the Allies' invasion of Germany. And in 1980, an air assault intended to rescue Americans held hostage in Iran was aborted well before reaching its target after most of the helicopters committed to the mission were lost because of mechanical failure or accidents.

Even when forcible-entry operations succeed in taking the intended enemy territory, their difficulty can be so great as to outweigh the benefits. For instance, when U.S. forces invaded the Pacific island of Peleliu during World War II, they were unprepared for the intensity of Japanese resistance and suffered numerous casualties, far in excess of the island's strategic value.³⁶ Also during that war,

Allied forces that staged an amphibious assault at Anzio, Italy, were isolated in a small pocket near their beachhead for a long period, unable to break out, and were largely irrelevant to the battle for Italy.³⁷

To be feasible, forcible-entry operations require a number of preconditions to be met. Airborne- and air-assault operations require control of local airspace, and amphibious operations require control of local airspace and local waters. Surprise is necessary to reduce risk, and major operations must occur either close enough to friendly ground forces to allow them to link up or close enough to a port to allow follow-on forces to be deployed. (In some more limited operations, capturing an airfield may be sufficient to allow follow-on forces to be deployed.)

The majority of units and equipment associated with the United States' forcible-entry capability have the ability to perform other roles as well. Apart from some additional training and equipment, the Army's air-assault and airborne BCTs are almost identical to other Army light BCTs, and they are routinely used interchangeably with other light BCTs in conventional operations. Similarly, the Army's cargo and utility helicopters can be used for a wide variety of missions besides air assaults. And the Marine Corps' ground and air forces have been used extensively for combat in conventional operations. In most respects, the only significant additional units and equipment (and thus cost) involved in maintaining forcible-entry capabilities is the Navy's fleet of amphibious ships and specialized landing craft. (The Marine Corps' landing craft are not designed exclusively for amphibious assaults; they also serve as armored personnel carriers for Marine ground forces operating on shore, although they are less useful in that role than conventional personnel carriers.)

36. See Center for Military History, *Western Pacific, 15 June 1944–2 September 1945* (October 2003), www.history.army.mil/brochures/westpac/westpac.htm.

37. See Center for Military History, *Anzio, 22 January–24 May 1944* (January 2010), www.history.army.mil/brochures/anzio/72-19.htm.

Special Topic

Naval Shipborne Aviation

Naval shipborne aviation consists of the squadrons that make up carrier air wings and the shipboard helicopters on surface combatants. Carrier air wings are composite units with several types of aircraft; their per-unit costs and personnel were presented in an entry, “Aircraft Carriers,” on page 52. Likewise, the costs and personnel for shipboard helicopters on surface combatants were shown

in an entry, “Surface Combatants,” on page 56. In this section, the Congressional Budget Office breaks out the personnel and costs for those same Navy aircraft by the type of aircraft—rather than by the type of ship they are associated with—and describes the roles that each kind of aircraft plays.

	Total	Direct	Indirect	Overhead
F/A-18 Fighter/Attack Aircraft Squadron				
Military Personnel per Unit	780	260	210	310
Annual Cost per Unit (Millions of 2017 dollars)	160	60	40	60

All units presented under this topic are notional squadrons of 12 aircraft (actual squadrons vary in size).

In all of the tables under this topic, “direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. The numbers shown in these tables are rounded to the nearest 10 personnel or \$10 million.

F/A-18s are multirole fixed-wing aircraft capable of attacking other planes in the air or targets on the ground. Two varieties are currently in use: the older C/D model and the newer E/F model that is based on it. The F/A-18E/Fs are significantly larger and more capable than their predecessors, with a longer range, greater payload capacity, and improvements to their electronics and other systems. The fleet of F/A-18s is the mainstay of naval shipborne aviation, providing the vast majority of the

Navy’s ability to strike targets. (Most other naval aircraft are used for support purposes, as described below.) The Marine Corps also operates F/A-18s. Some are used aboard aircraft carriers as integral parts of a carrier air wing; others are used to support Marine Corps operations from air bases on land. The Navy and Marine Corps plan to field 542 F/A-18s in 2017; that inventory is scheduled to decline to 522 in 2021 as F-35 aircraft begin to replace older F/A-18s.

	Total	Direct	Indirect	Overhead
EA-18G Electronic Attack Aircraft Squadron				
Military Personnel per Unit	1,420	480	380	570
Annual Cost per Unit (Millions of 2017 dollars)	240	80	50	110

EA-18G aircraft are a variant of the F/A-18F, specialized for jamming an enemy’s transmissions (electronic warfare) and for attacking an enemy’s air defenses. (They have largely replaced the Navy’s older fleet of EA-6B aircraft, which performed the same roles.) In the 1990s, with the retirement of the Air Force’s fleet of EF-111s,

the Department of Defense decided to make the Navy responsible for providing all electronic warfare support to U.S. forces. Thus, EA-18Gs support operations not only by aircraft carriers and Marine Corps units but also by the Air Force. The Navy plans to field an average of 96 EA-18Gs over the 2017–2021 period.

	Total	Direct	Indirect	Overhead
F-35 Fighter Aircraft Squadron				
Military Personnel per Unit	260	90	70	100
Annual Cost per Unit (Millions of 2017 dollars)	150	80	50	20

Because F-35s are not yet in full operational service, their actual costs may differ from the planned costs included in the Department of Defense’s budget documents, on which these estimates are based.

The Department of the Navy is acquiring a new fighter aircraft, the F-35, also known as the Joint Strike Fighter. It is being produced in two variants for the department: The B version will offer short-takeoff, vertical-landing capability to the Marine Corps (that capability is discussed in more detail in the special-topic entry on Marine Corps aviation below), and the C version will be capable of taking off from and landing on aircraft carriers. The

F-35Cs will replace the Navy’s current F/A-18C/Ds, performing the same missions. Although they are expected to be superior to those F/A-18C/Ds in many ways, the largest improvement they will offer is providing the Navy with a low-observable (or “stealthy”) attack aircraft. The Navy and Marine Corps plan to field 97 F-35s by 2021, replacing older F/A-18s.

	Total	Direct	Indirect	Overhead
H-60 Helicopter Squadron				
Military Personnel per Unit	1,000	330	270	400
Annual Cost per Unit (Millions of 2017 dollars)	170	50	30	80

The Navy uses H-60 helicopters for a variety of purposes, such as moving passengers, supplies, and small loads of cargo. Their combat roles include antisubmarine warfare and anti-surface warfare. Helicopters are very well suited to antisubmarine warfare because they can move rapidly to several locations and deploy cheap, disposable, floating sonar sensors. (Determining the position of an enemy submarine requires triangulation, so relying on multiple sonars in the water is generally more effective than using a single shipboard sonar.) Navy surface combatants usually

have one or two SH-60 helicopters (antisubmarine variants of the H-60) onboard, and aircraft carriers have a squadron of up to eight helicopters. Although they have traditionally been specialized for antisubmarine warfare, some models of the H-60 can be equipped with anti-surface-ship weapons, such as Hellfire missiles. In that configuration, helicopters are useful for operations against small boats, such as antipiracy missions. The Navy plans to field 236 H-60 helicopters throughout the 2017–2021 period.

	Total	Direct	Indirect	Overhead
C-2 Transport Aircraft Squadron				
Military Personnel per Unit	1,140	380	300	450
Annual Cost per Unit (Millions of 2017 dollars)	190	60	40	90
E-2 Surveillance Aircraft Squadron				
Military Personnel per Unit	1,240	410	330	490
Annual Cost per Unit (Millions of 2017 dollars)	230	80	50	100

C-2s and E-2s are specialized aircraft that support the operations of aircraft carriers. C-2s are small transport planes used to bring supplies and personnel to and from an aircraft carrier while it is under way. E-2s are variants of the C-2 that are specialized to serve as platforms for airborne radar; such radar greatly improves the ability of a carrier strike group to detect and engage aerial and surface targets. In using radar to detect targets at long range,

ships (or other platforms on the surface) are intrinsically limited by the curvature of the Earth. (Radar, like visible light, has a horizon below which any target cannot be seen.) By flying high, aircraft can increase the range at which they can detect targets. For the same reason, the Air Force uses E-3 surveillance aircraft for its operations. The Navy plans to continue to field 25 C-2 and 45 E-2 aircraft through 2021.

Special Topic

Marine Corps Aviation

The Marine Corps’ aviation units are organized into squadrons that make up Marine aircraft wings. Those air wings are composite units with several types of aircraft. Their per-unit costs and personnel are presented in the entry about Marine Corps infantry battalions on page 65 as the aircraft complement to a battalion. In this section, the Congressional Budget Office breaks out the personnel

and costs for those same Marine Corps aircraft by type of aircraft and describes the roles that each type of aircraft performs. The discussion excludes the Marine Corps’ F/A-18 fighter/attack aircraft, which are discussed in the special-topic entry about naval shipborne aviation on page 74.

	Total	Direct	Indirect	Overhead
AV-8B Attack Aircraft Squadron				
Military Personnel per Unit	960	250	330	380
Annual Cost per Unit (Millions of 2017 dollars)	180	50	50	80

All units presented under this topic are notional squadrons of 12 aircraft (actual squadrons vary in size).

In all of the tables under this topic, “direct” personnel and costs are associated with a major combat unit, “indirect” personnel and costs are associated with units that support the major combat unit, and “overhead” personnel and costs are associated with the major combat unit’s share of administrative or overhead activities. The numbers shown in these tables are rounded to the nearest 10 personnel or \$10 million.

AV-8Bs are fixed-wing aircraft with short-takeoff, vertical-landing (STOVL) capability that are intended mainly to attack targets on the ground. Unlike conventional fixed-wing aircraft, they do not need long runways at an air base to take off or arrestor hooks on an aircraft carrier to land. Instead, they can perform a rolling takeoff from a short runway and can land vertically, like a helicopter. Those qualities allow AV-8Bs to be based in locations with limited infrastructure for aircraft or to be based on LHA- or LHD-type amphibious ships (which have much smaller flight decks than aircraft carriers and no catapults or arresting wires). However, those capabilities also necessitate a very specialized form of aircraft design, which requires design compromises that make STOVL aircraft less capable in certain respects—especially range and payload capacity—than other fixed-wing aircraft of similar size.

The Marine Corps intends to replace its current fleet of AV-8Bs with the F-35B variant of the Joint Strike Fighter, which will have a similar STOVL capability (and similar limitations compared with other versions of the F-35). The Marine Corps’ use of STOVL aircraft has long been the subject of criticism. One reason is that most Marine air operations are conducted from land bases that do not require STOVL capability. Another reason is that STOVL aircraft are costly to design, expensive to order in the relatively small quantities that the Marine Corps uses, and less capable in many ways than equivalent aircraft with conventional landing capabilities. The Marine Corps accepts those trade-offs to obtain fixed-wing air support that it can operate from amphibious ships or from small bases on shore. The Marine Corps plans to field 80 AV-8Bs in 2017; that inventory is scheduled to decline to 48 in 2021 as F-35 aircraft begin to replace AV-8Bs.

	Total	Direct	Indirect	Overhead
H-1 Utility and Attack Helicopter Squadron				
Military Personnel per Unit	860	220	300	340
Annual Cost per Unit (Millions of 2017 dollars)	130	30	30	70

The H-1 series of helicopters consists of two types: UH-1s, utility helicopters capable of transporting small loads of cargo and personnel, and AH-1s, attack helicopters that provide fire support to Marine Corps ground forces. (Despite their different roles, the AH-1 began its life as a modified UH-1, and the Marine Corps often combines the budgets for the two types of helicopters.) In addition to being generally useful for all kinds of

operations, variants of the H-1 are included in the Marine expeditionary units (MEUs) embarked on amphibious assault ships. (AH-1s, as attack helicopters, do not transport personnel or equipment but rather escort the transport aircraft and, if necessary, attack any hostile forces at the landing zone.) The Marine Corps plans to field an average of 232 H-1 helicopters during the 2017–2021 period.

	Total	Direct	Indirect	Overhead
V-22 Medium-Lift Aircraft Squadron				
Military Personnel per Unit	760	200	260	300
Annual Cost per Unit (Millions of 2017 dollars)	150	40	40	60

The Marine Corps recently replaced its CH-46 medium-lift helicopters with V-22 tilt-rotor aircraft. Like H-1 series helicopters, V-22s are included in the MEUs embarked on amphibious assault ships and are essential to the Marine Corps' ability to transport personnel and equipment to specific locations. They are larger aircraft than UH-1 helicopters, with much greater transport

capacity. The V-22 had a relatively long and difficult development cycle, but it is now operational and provides longer range and greater speed than the older CH-46 helicopters. In most air assault operations, the V-22 fleet would carry the majority of Marine Corps personnel. The Marine Corps plans to field about 240 V-22 tilt-rotor aircraft by 2021.

	Total	Direct	Indirect	Overhead
CH-53 Heavy-Lift Helicopter Squadron				
Military Personnel per Unit	960	250	330	380
Annual Cost per Unit (Millions of 2017 dollars)	190	60	60	80

The CH-53 heavy-lift helicopter is the final air component of the Marine Corps' amphibious assault capability. By far the largest and most powerful transport helicopter that the Marine Corps possesses, the CH-53 can carry pieces of equipment by air that are too big for any other aircraft in a MEU. The Marine Corps is planning to replace its older CH-53 helicopters with a new CH-53K

model, which would be capable of carrying even larger loads. The fleet of heavy-lift helicopters would transport the majority of equipment and supplies in most air assault operations. The Marine Corps plans to field 136 CH-53 helicopters throughout the 2017–2021 period.

	Total	Direct	Indirect	Overhead
KC-130 Transport/Tanker Aircraft Squadron				
Military Personnel per Unit	980	330	260	390
Annual Cost per Unit (Millions of 2017 dollars)	160	50	30	80

KC-130 tankers are modified C-130 transport aircraft that are capable of refueling the Marine Corps' fixed-wing aircraft and helicopters while they are in flight, greatly extending the operating range of those aircraft. KC-130s retain many of the characteristics of the base C-130 airframe and can be used as transport aircraft when not needed for aerial refueling. They can also support ground operations in some circumstances. For example, during the initial invasion of Afghanistan, Marine Corps forces conducted a long-range air assault on

Kandahar and received fuel for their ground vehicles and equipment from KC-130s. (In addition, the Marine Corps is acquiring weapons kits that can be used to turn KC-130s into armed attack aircraft, but that will be a secondary role not given to all KC-130s.) Unlike the majority of Navy and Marine Corps aircraft, KC-130s are too large to be based on aircraft carriers or amphibious ships; they must operate from air bases on land instead. The Marine Corps plans to field an average of 71 KC-130 tankers during the 2017–2021 period.