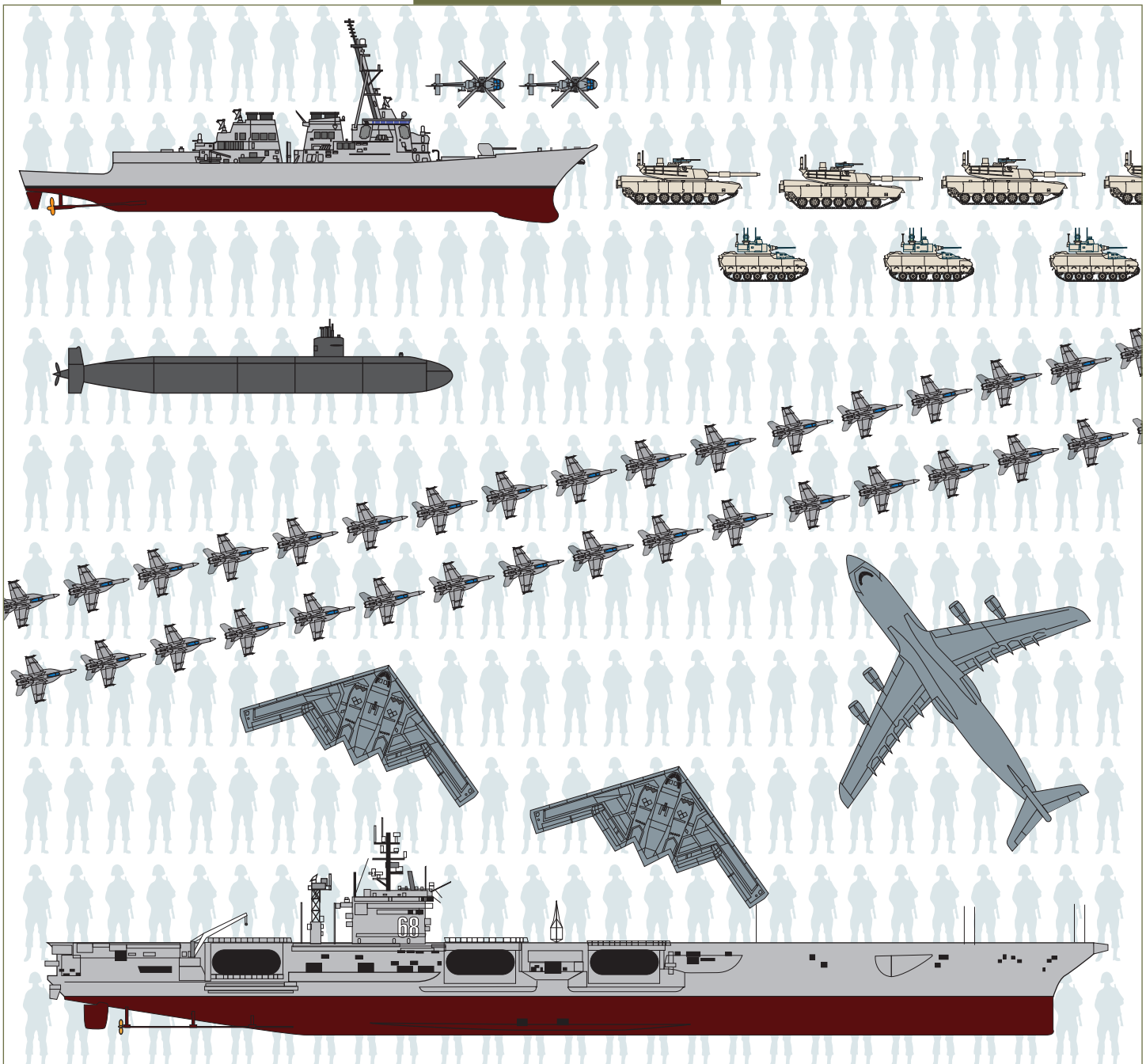


CBO

The U.S. Military's Force Structure: A Primer



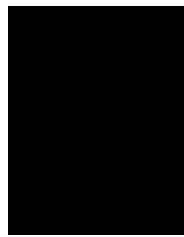
JULY 2016

Notes

Unless otherwise indicated, all years referred to in this study are federal fiscal years (which run from October 1 to September 30 and are designated by the calendar year in which they end). In addition, all costs apply to fiscal years and are expressed in fiscal year 2017 dollars of total obligational authority, and all growth rates are measured in real terms (with the adjustments for inflation made using the Congressional Budget Office's projection of the gross domestic product price index).

Numbers in the text and tables may not sum to totals because of rounding.

Supplemental information for this analysis is available on CBO's website (www.cbo.gov/publication/51535).



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Summary

In fiscal year 2015, the Department of Defense (DoD) spent a total of roughly \$390 billion on operation and support (O&S) of military units. The O&S budget covers the costs associated with the day-to-day running of units. Those costs include pay and benefits for military personnel, compensation for most civilian employees, health care costs for military and civilian personnel, and the daily expenses of operating a unit, such as equipment maintenance, training, support contractors, and so on. The O&S budget makes up about two-thirds of DoD's total "base" budget, which is the defense budget excluding additional funds provided specifically for wartime operations. (The rest of DoD's base budget is spent on acquiring weapon systems and constructing buildings and other infrastructure.)

The size and complexity of the U.S. armed forces can make it difficult to determine how the O&S budget is distributed among units. In this report, the Congressional Budget Office analyzes the structure and cost of the military from the perspective of major combat units, such as Army brigades, Navy aircraft carrier strike groups, Marine Corps task forces, and Air Force squadrons. CBO allocates most of the O&S budget and DoD's total number of military personnel among major combat units—and their associated support units and overhead activities—to provide a clearer picture of the size and cost of the major elements of the military's force structure. Such information can help policymakers evaluate proposals to change the structure or budget of the armed forces.

CBO's analysis indicates that major combat units by themselves account for roughly one-quarter of DoD's operation and support costs and contain about one-third of DoD's military personnel. Most of the rest of DoD's O&S costs and military personnel are associated either with units that support major combat units (which CBO considers part of the cost of maintaining fully supported major combat units) or with overhead activities necessary

for manning, equipping, and training combat and support units. In addition, the total operating costs associated with a major combat unit include a share of the costs of "defensewide" activities, such as the Defense Health Program, that provide various forms of administrative support to DoD as a whole.

As an example, by CBO's calculation, an armored brigade in the Army's active component has about 4,200 military personnel assigned to it. But that number rises to about 17,450 military personnel if it includes the units that support the armored brigade (by providing transportation and maintenance, for example) and the brigade's proportional share of overhead activities that support DoD and the Army (such as recruiting, basic training, and administrative support). By itself, such an armored brigade costs \$500 million a year to operate, including compensation for its military personnel. Those operating costs rise to about \$2,600 million per year if the costs of support units and overhead activities are included (see Summary Table 1). Those patterns are similar for major combat units in the Department of the Navy (which includes the Marine Corps) and the Department of the Air Force.

What Are the Major Elements of the Military's Force Structure?

Each of DoD's three military departments provides different kinds of forces. The composition, functions, capabilities, and costs of the departments' major combat units are often difficult to determine from budget documents and from the various reports that the military provides to the Congress. The critical roles that support units play in making major combat units function effectively are even more difficult to discern, as are the costs of supporting each type of combat unit.

This primer describes how each department is organized into major combat units, what each type of unit does,

Summary Table 1.

Number, Size, and Costs of Selected U.S. Forces

	Number of Units in 2017	Military Personnel per Unit		Annual Cost per Unit (Millions of 2017 dollars)	
		Direct	Total	Direct	Total
Department of the Army					
Active-Component Armored Brigade Combat Team	9	4,200	17,450	500	2,610
Active-Component Stryker Brigade Combat Team	7	4,440	17,180	500	2,560
Active-Component Infantry Brigade Combat Team	14	4,230	16,250	450	2,410
Department of the Navy					
Aircraft Carrier	11	3,200	6,590	470	1,180
Carrier Air Wing	10	1,630	4,860	330	910
Arleigh Burke Class Destroyer (DDG-51)	66	340	720	60	140
Attack Submarine	51	190	390	70	140
Amphibious Ship	33	710	1,450	110	270
Active-Component Marine Corps Infantry Battalion	24	1,490	5,780	140	740
Department of the Air Force					
F-16 Fighter Aircraft Squadron ^a	45	450	1,250	70	220
B-1B Bomber Aircraft Squadron ^a	4	940	3,980	270	810
C-17 Cargo Aircraft Squadron ^a	14	450	1,390	90	270
KC-135 Tanker Aircraft Squadron ^a	30	610	1,930	110	360
MQ-9 “Reaper” Unmanned Air System Squadron ^a	23	340	920	50	160

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

“Direct” personnel and costs are associated with a major combat unit. “Total” personnel and costs also include the “indirect” personnel and costs associated with units that support the major combat unit and the “overhead” personnel and costs associated with the major combat unit’s share of administrative or overhead activities. For more information, see Chapter 1. The personnel and cost 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).

how those units have been used in past conflicts, and how much it costs to operate and support those units. DoD also includes a number of smaller organizations that provide services or specialized capabilities to the military as a whole. In this analysis, CBO treats some of those defense-wide costs as part of the cost of a military unit, which means that the total cost to operate and sustain all of a military department’s units is larger than the department’s requested O&S budget (because each department

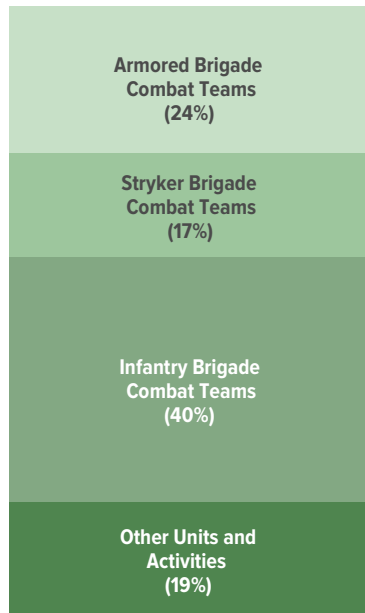
relies on services and activities funded from such defensewide accounts).

Department of the Army

According to its 2017 budget request, DoD plans to spend an average of about \$101 billion per year (in 2017 dollars) over the 2017–2021 period to operate and support Army units. The total O&S cost of those units includes an additional \$16 billion per year from defensewide accounts, CBO estimates.

Summary Figure 1.

Five-Year Average of Operation and Support Funding for Department of the Army Units



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

The main units that the Army provides to the U.S. military are brigade combat teams (BCTs), large formations that officially contain about 4,400 to 4,700 soldiers.¹ Those units come in three major types: armored BCTs, Stryker BCTs, and infantry BCTs. All three types are similar in size; they differ primarily in how many wheeled or tracked vehicles are assigned to them. All BCTs are versatile ground combat units, capable of performing a wide variety of missions, and all rely on many support units assigned to them from higher-level commands. When deployed, a BCT can expect to be supported by almost twice as many personnel in support units as it has in its own unit. BCTs account for over 80 percent of O&S funding for Army units (see Summary Figure 1).

1. Those personnel numbers are based on the Army's Table of Organization and Equipment, which serves as an official template for different types of Army units. In practice, units do not always conform to their templates for a variety of reasons. As a result, the personnel numbers for BCTs shown in Summary Table 1—which are based on DoD's 2017 budget request—are smaller than the personnel numbers in the Army's Table of Organization and Equipment.

Department of the Navy

According to its 2017 budget request, DoD plans to spend an average of about \$95 billion per year over the 2017–2021 period to operate and support Navy and Marine Corps units. The total O&S cost of those units includes an additional \$10 billion per year from defensewide accounts, CBO estimates.

The Navy's primary units are various kinds of battle force ships: aircraft carriers, surface combatants (cruisers, destroyers, and some smaller ships), attack submarines, and amphibious ships. Each type of ship is specialized for particular missions—such as carrying attack aircraft or a task force of marines—and the types differ greatly in size and cost. Battle force ships are relatively self-contained when deployed, although they receive support from some other units, including logistics ships that refuel and rearm them while they are under way, maritime patrol aircraft that scout for them, and minesweeper squadrons that clear their path of sea mines. Of Navy units (as opposed to Marine Corps units), aircraft carriers and their associated air wings account for the largest single share of O&S funding, receiving 21 percent of appropriations for the Department of the Navy's units (see Summary Figure 2).

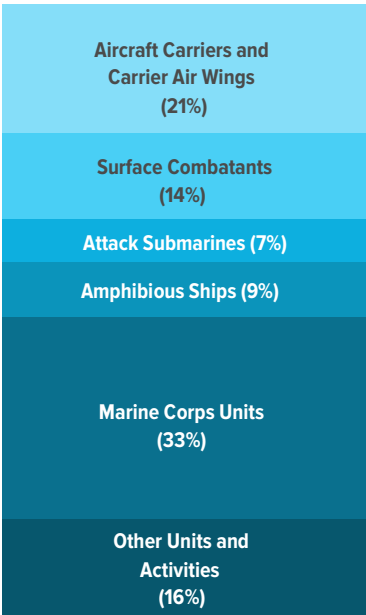
The Marine Corps' main units are Marine air-ground task forces—integrated combinations of ground combat units, air combat units, and support units that are tailored to specific operations (rather than being standardized units, as in the other services). Different kinds of task forces are distinguished primarily by the size of their ground combat forces, from the small Marine expeditionary units carried on Navy amphibious ships up to the large Marine expeditionary forces that engaged in combat operations in Iraq in 1991 and 2003. Marine Corps units account for the largest single share—33 percent—of O&S funding for the Department of the Navy's units (see Summary Figure 2).

Department of the Air Force

According to its 2017 budget request, DoD plans to spend an average of about \$82 billion per year over the 2017–2021 period to operate and support Air Force units. The total O&S cost of those units includes an additional \$8 billion per year from defensewide accounts, CBO estimates.

The majority of Air Force units consist of squadrons of different types of fixed-wing aircraft that perform a

Summary Figure 2.
Five-Year Average of Operation and Support Funding for Department of the Navy Units



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

variety of missions: short-range tactical aircraft (for engaging in air-to-air combat with other aircraft or for striking targets on the ground), long-range bombers, airlifters (for transporting cargo and personnel), tankers (for refueling other aircraft in flight), and unmanned air systems (also known as drones). Short-range tactical aircraft account for the largest single share—33 percent—of O&S funding for the Department of the Air Force's units (see Summary Figure 3).

Defensewide Activities

DoD also includes a number of defensewide organizations, which are not part of a military service, that perform specific functions. Most of those organizations—such as DoD's military health care system—provide centralized forms of support that assist each of the services. But a few—such as Special Operations Command, which organizes units from the different services' special-operations forces into an integrated force—provide distinct military capabilities to the nation (as well as generating distinct costs). Together, defensewide organizations and activities account for about \$39 billion per year of the O&S funding that DoD requested in its 2017 budget.

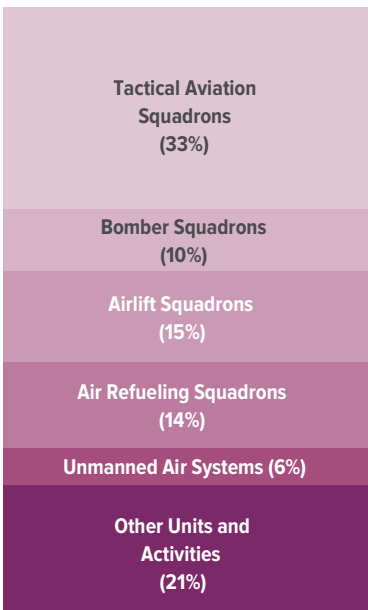
What Does This Analysis Indicate About the Budgetary Effects of Altering the Force Structure?

This report breaks down DoD's total number of military personnel and total operation and support budget and ascribes almost all personnel and O&S costs to major combat units according to three categories:

- Direct personnel and O&S costs—for a major combat unit itself;
- Indirect personnel and O&S costs—for the deployable units that support the major combat unit; and
- Overhead personnel and O&S costs—for the administrative functions within a service or DoD that are necessary to field the major combat unit and its supporting units.

CBO's numbers are based on information in DoD's latest five-year budget plan, the Future Years Defense Program for the 2017–2021 period. Thus, to the extent that DoD has overestimated or underestimated the funding needed

Summary Figure 3.
Five-Year Average of Operation and Support Funding for Department of the Air Force Units



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

to operate its forces, the estimates in this report will reflect that. The only O&S costs not divided among major combat units in this analysis are health care costs for current military retirees and their families, because those costs represent a major expense that DoD could not alter in the near term through future policy decisions.

If DoD or lawmakers decided to eliminate a major combat unit from DoD's plans, the savings might not be as large as CBO's estimate of the total O&S costs for that type of unit. DoD would achieve savings from the support units associated with a combat unit only if it also eliminated those units. And DoD would achieve savings in overhead functions only if it trimmed those activities to reflect the smaller force. In addition, some overhead activities, such as operating bases, might take several years to cut, which would delay the full savings. For related reasons, if policymakers decided instead to add a major combat unit to the military's force structure, the costs might not be as large as CBO's estimate of the O&S costs for that type of unit, at least in the near term.

However, the estimates of O&S costs for combat units presented in this report do not include the costs of developing and acquiring new weapon systems. Thus, if DoD or lawmakers chose to eliminate a major combat unit and stopped purchasing the weapon systems intended to equip that unit, the savings would be larger than CBO's estimate of the costs to operate and sustain the unit.

Similarly, if policymakers chose to add a major combat unit and to purchase weapon systems to equip that unit, the total additional costs would be larger than CBO's estimate of the corresponding O&S costs.

How Is This Report Organized?

This primer is designed to be a reference work rather than a linear narrative. Chapter 1 describes CBO's conceptual approach to analyzing the military's force structure and costs, and the following three chapters discuss the particular organizational structures and roles of the Departments of the Army, the Navy, and the Air Force. All of a department's major types of combat unit have their own entries, which discuss the size, cost, function, advantages, disadvantages, and past use of that type of unit. The final chapter includes similar entries for some major defense-wide organizations, such as Special Operations Command and the military's health care system. Each chapter also focuses on some special topics that are important for understanding the military's force structure, such as the integration of different types of units or the military's ability to conduct certain kinds of operations.

The structure of this report means that readers who are interested mainly in learning, for example, about the organization of the Marine Corps or the costs of an Air Force bomber squadron can, after reading Chapter 1, go straight to the relevant section.

Introduction

For the first time in nearly two decades, the Department of Defense (DoD) has experienced sustained budget cuts in recent years: Annual appropriations (excluding additional appropriations for ongoing military operations) for 2013 through 2016 averaged about 5 percent less, in nominal terms, than the funding in 2012. The possible need to accommodate constraints on DoD's budget in the future—because of caps on discretionary spending through 2021 enacted in the Budget Control Act of 2011, as amended—raises the question of how best to prioritize the various tasks that the department performs and how best to assess any proposed changes to the force. At the same time, the enormous size and complexity of DoD, the many specialized organizations it includes, the wide array of weapon systems and platforms it operates, and the complexity of its budget documents make the task of understanding how the department operates—and how its budget could be changed—daunting to many observers.

To increase policymakers' understanding of the choices that the nation faces when considering DoD's budget, the Congressional Budget Office has prepared this primer on the structure of the armed forces. There are many different ways to approach DoD's budget; for the purposes of this analysis, CBO treats DoD as an organization that produces, sustains, and supports combat units. The number and type of combat units, as well as the personnel and equipment they contain, are referred to as the force structure. To produce this primer, CBO developed an analytic model of the military's force structure in which DoD's costs are viewed as inputs necessary to operate and sustain the force. The advantage of that treatment is that it provides a clear view of the trade-offs that would be involved if policymakers wanted to reduce DoD's budget through cuts in the force structure—each element of the force structure has a cost associated with it, the costs of different elements can be compared, and it is possible to say how much of the force structure would have to be cut to generate a given amount of savings.

This primer contains entries that describe all of the major elements of the military's force structure. Those elements include the major combat units that are the traditional backbone of the armed forces (such as armored brigades, aircraft carrier strike groups, and tactical aircraft squadrons). They also include specialized organizations that provide specific capabilities to DoD (such as special-operations forces and missile defense). Each entry for a major element of the force structure provides the following information about that element:

- CBO's estimates of the number of military personnel and the costs associated with manning, operating, and sustaining a single unit of that type—what DoD refers to as operation and support (O&S) costs;
- The number of such units that DoD has now and whether the department plans to change that number;
- Its intended function;
- Its relative strengths and limitations;
- Its use in past operations; and
- Common measures (when possible) of how many units of that type the United States might need.

The primer also discusses some special topics that are important for understanding how DoD organizes and employs its forces but that are not specific to a single type of unit or do not have direct cost implications. Those discussions, which generally have a different format than the entries for major elements of the force structure, appear in the same chapter as the military service or types of units to which they most closely relate. (For example, the special topic of forcible-entry capability is discussed in the same chapter as Navy amphibious ships and Marine Corps battalions, since those are the forces used for amphibious assaults, the best-known form of forcible-entry operation.)

The primer concludes with three appendixes. The first, which is intended to serve as a quick reference, summarizes the size, costs, and number of each major element of the force structure included in CBO's analysis. The second shows the relationship between DoD's total O&S budget, the costs to operate and maintain each major element of the force structure, and the number and types of force structure elements in DoD's current plans. The third is a brief summary of the military operations and DoD planning scenarios referred to in this report.

What Is Force Structure?

Although DoD has many responsibilities and functions, at the most basic level it is the organization responsible for manning, equipping, and training U.S. military forces.¹ The vast majority of DoD's funding and personnel are assigned to tasks that contribute in some way to producing military forces that are prepared for combat. As such, DoD can be viewed as an organization that converts "inputs" of funding and personnel into "outputs" of combat capability, which are then available to be used as the nation sees fit.² That combat capability is best described in terms of the number and types of combat units that DoD can generate and sustain—that is, in terms of force structure.

Decisions about force structure strongly affect DoD's costs, size, and capabilities, so force structure is generally central to any discussion of making large changes to DoD's budget. Although the department has the ability to make some relatively small changes that do not affect its force structure, such changes usually have much more limited effects than changes in the force structure do. For example, the decision to field 11 aircraft carriers and their associated air wings and escort ships requires DoD to have a large number of military personnel, a large support

infrastructure, fairly specific plans for shipbuilding and aircraft procurement, and so forth. When large cuts in DoD's budget have been made in the past, they have almost always required reductions in the force structure.³

There is no generally agreed-upon way to measure combat capability directly and quantitatively. Force structure is the simplest and least subjective way to describe combat capability, although it has many limitations. The most significant drawback is that the concept of force structure inevitably invites "apples to oranges" comparisons, such as "how many aircraft carriers provide the same combat capability as an armored brigade?" More broadly, although having more combat units generally provides more combat capability, counts of the number of units available to the United States are not very useful if they do not consider the quality of those units. The same issue arises in any comparison of the force structures of different militaries: A U.S. armored brigade may have far more combat power (particularly when combined with its support units) than that of another country.

The full description of every element of the U.S. military's force structure can be overwhelming. The exact number of units in the military varies with counting methods. As an example, however, the DoD databases that contain units' reports about their readiness for combat include tens of thousands of units of thousands of different types. Thus, any widely useful description of the U.S. force structure requires some simplification.

For the purposes of this analysis, CBO divided all of DoD's activities into three broad categories:

■ **Major Combat Units.** These are the best known, most visible, and generally most important combat units in DoD's inventory—such as Army brigade combat teams, Navy warships, and Air Force tactical fighter squadrons. In many instances, they are also the units of greatest interest to policymakers. For that reason, CBO organized this primer primarily as a discussion of major combat units. To show all important elements of the force structure, CBO presented some elements, such as special-operations forces, as if

1. The actual use of those forces is also DoD's responsibility. But DoD is organized in such a way that the administrative chain of command responsible for generating forces is largely separate from, and parallel to, the operational chain of command responsible for employing forces. In recent years, budgetary practices have maintained that separation: DoD's "base" budget largely funds the administrative system for manning, equipping, and training units, whereas additional appropriations have been provided separately to fund ongoing military operations.
2. That role is sometimes described as the "force provider" function, although DoD often uses that term in a more limited sense to refer to some of its subordinate organizations rather than to itself as a whole.

3. For a discussion of ways in which DoD might need to reduce the force structure to meet the spending restrictions of the Budget Control Act of 2011, see Congressional Budget Office, *Approaches for Scaling Back the Defense Department's Budget Plans* (March 2013), www.cbo.gov/publication/43997.

they were a single, large major combat unit, although they differ from traditional major combat units in numerous ways.

■ **Support Units.** In the U.S. military, major combat units are employed alongside a vast number of units that support their activities in many different ways. In the Army, for example, brigade combat teams generally make up about one-third of the military personnel deployed to a combat theater—the other two-thirds are personnel assigned to units that are responsible for aviation, engineering, intelligence, civil affairs, ordnance, maintenance, transport, or other support services. Those additional units are essential for major combat units to accomplish their missions, but they are generally not the focus of discussions about the U.S. force structure. In this primer, every deployable combat unit in the U.S. inventory that is not classified as a major combat unit is considered a support unit. Across DoD as a whole, as many personnel are assigned to support units as to major combat units. (For a discussion of differences in how DoD and CBO use the term “support unit,” see Box 1-1.)

■ **Administrative/Overhead Organizations.** A large proportion of DoD's military personnel, and almost all of the department's 800,000 civilian personnel, are not assigned to deployable military units. Instead, they are part of various administrative or overhead organizations that perform key functions necessary for manning, equipping, and training combat and support units. Each military department has large administrative organizations devoted to such functions as recruiting, training, acquisition, maintenance, and medical care; in addition, there are various defensewide organizations that perform administrative or overhead functions for the entire military. In general, policymakers' main concern with such functions is that they be performed efficiently, so as not to divert more resources than necessary from other activities. In this primer, all nondeployable portions of DoD (including those accounted for as “individuals,” such as trainees and other nondeployable personnel) are included in the administrative/overhead category.

That division into three types of activities allows CBO to further simplify its description of the U.S. force structure. Because some units support major combat units, and because DoD plans for such types of support in a

predictable and regular way, the costs of the relevant support units can be considered part of the total cost of a major combat unit. That approach results in a package that CBO refers to as a “fully supported unit”—a major combat unit plus its support units. Similarly, because administrative or overhead activities are designed to help man, equip, and train units, and because DoD also plans for those activities in a predictable and regular way, a prorated amount of administrative/overhead costs can be considered part of the total cost of a fully supported unit.

Dividing DoD's activities into those three categories also allows for a simple visualization of the department's structure. Combat units are often described as representing the “tip of the spear” or having a “tooth-to-tail” ratio. Those metaphors capture an important point: A relatively small fraction (about one-third) of DoD's personnel and budget are dedicated directly to major combat units. Like the metaphorical spear, those major combat units (the spear point) are supported by a large mass of support units and administrative organizations (the shaft of the spear). And just as the shaft is essential to a spear's function as a weapon, DoD's support units and administrative organizations are vital to the ability of major combat units to perform their roles.

Another distinction in the U.S. military is between a service's active component (regular units belonging to the Army, Navy, Marine Corps, or Air Force) and the service's reserve component (units belonging to the Army Reserve, Army National Guard, Navy Reserve, Marine Corps Reserve, Air Force Reserve, or Air National Guard). The services rely heavily on reserve-component units, which differ from active-component units in various ways, most notably in costs. For those reasons, CBO tried to display active- and reserve-component units separately in this primer whenever it was feasible to do so. However, because of the different way that each service integrates its reserve-component units into its overall structure, CBO was able to provide a meaningful division between active- and reserve-component units only for the Army and the Marine Corps. (The Navy Reserve has almost no units that fit the definition of major combat units used for this analysis, and the Air Force integrates its active- and reserve-component units so tightly that CBO could not readily separate the costs of the two components.)

Box 1-1.**Defining Support Units**

The Department of Defense (DoD) uses the word “support” in a wide variety of ways, and the term can have very different meanings in different contexts. To develop a clear and consistent framework for describing the military’s force structure in this primer, the Congressional Budget Office used DoD’s budget documents to develop rules for categorizing some of the department’s units as support units. Those rules, however, do not necessarily align with all of the ways in which DoD uses the term.

Broadly, “support” refers to the assistance that one unit or activity provides to another to help the second unit or activity accomplish its mission. DoD uses the general term that way in many contexts—some defense agencies are described as “supporting agencies,” some categorization systems employ the term to distinguish between types of units (such as the Army’s use of the categories “combat support” and “combat service support”), and various operational missions (such as “general support” or “direct support”) are colloquially described as support.

CBO’s definition of “support units” is intended to encompass the set of deployable units that would typically be assigned missions to support major combat units during an operation. In practice, almost any type of unit could be assigned to support almost

any other type of unit. For example, during a U.S. deployment in Kosovo in 1999, plans called for ground units to support Army aircraft (by defending bases in Albania and using artillery to suppress Serbian air defenses), even though Army aircraft are typically assigned to support ground units. Thus, in actual operations, the line between a support unit and a unit being supported is dynamic—there are units that have been assigned support missions and units that receive support, but those designations are flexible, depending on the mission and the commander’s plans for accomplishing it.

For planning and budgeting purposes, however, military doctrine and administrative practice suggest that some types of units will typically be assigned to support other units. In most Army operations, for instance, brigade combat teams are the focus of ground combat operations, and most other units are assigned to support them, more or less directly. Similarly, in most Air Force operations, squadrons of combat aircraft are the focus of air operations, and most other units are assigned to support them in some fashion. In this primer, units such as brigade combat teams and combat aircraft squadrons are considered major combat units, and deployable units that provide support to them (however referred to by DoD) are considered support units.

How CBO Estimated the Costs of the Military’s Force Structure

The force structure model that CBO developed for this analysis is based on DoD’s fiscal year 2017 Future Years Defense Program (FYDP), which the department submitted to the Congress in April 2016 to provide detail for its 2017 budget request. The annual FYDP is a five-year plan that contains detailed information about DoD’s spending plans, distribution of personnel, and force structure for the budget year and the four subsequent years.

CBO’s analysis focuses on operation and support costs, which make up about two-thirds of DoD’s “base” budget—the budget excluding separate appropriations provided to fund ongoing military operations. (The other

one-third of that base budget is spent mainly on acquisition of weapon systems and on military construction and family housing.) O&S costs include compensation for military personnel, which is paid from the services’ military personnel accounts. O&S costs also include compensation for most civilian employees, health care costs for military and civilian personnel, and the expenses of running a unit (day-to-day operations, equipment maintenance, training, support contractors, and so on), all of which are paid from the services’ or defensewide operation and maintenance accounts. O&S costs are very closely related to the size of units—for instance, a unit with 10,000 military personnel will have military personnel costs commensurate with that size, and DoD has a limited ability to change those costs, particularly in the near term.

For this analysis, CBO divided O&S costs into three categories: direct, indirect, and overhead costs. Those groupings match the three categories that CBO used for DoD's units and activities: Direct costs are associated with major combat units, indirect costs with support units, and overhead costs with administrative or overhead organizations. CBO also used the direct, indirect, and overhead categories for the number of military personnel associated with a unit. That breakdown, for both costs and personnel, is shown in the table that accompanies each entry in this primer for a major element of the force structure.

Direct Costs

For most major combat units, the FYDP includes entries that show DoD's total costs for a unit of that type and the total number of military personnel assigned to that kind of unit. The numbers for direct costs (the costs of a major combat unit itself) and direct personnel (the personnel assigned to the unit itself) are annual averages of the five years of numbers shown in the FYDP. In the case of costs, those averages are in 2017 dollars.⁴ Direct costs also include a share of the costs of the Defense Health Program (DHP) that is based on the number and type of military personnel in the major combat unit.

Indirect Costs

To determine which units should be classified as providing support to major combat units for the purposes of this analysis, CBO used a variety of sources, including its past studies, DoD databases, and military doctrine. In general, ground forces (such as those of the Army and Marine Corps) have a fairly direct relationship between combat and support units that can be readily identified and described. With naval and air forces, however, those relationships are much less well defined and are more difficult to characterize. For example, naval and air forces require large numbers of higher-level maintenance units, which may support many different types of combat units. In the absence of details about the actual workload of such maintenance units, CBO made simplifying assumptions

about the likely distribution of that workload among different types of combat units. Ground forces are more likely to have maintenance shops assigned to specific units (such as the Marine logistics group that is assigned to each Marine expeditionary force), so fewer simplifying assumptions were necessary.

Once the process of ascribing support units to combat units was finished, each type of major combat unit had a set of associated support units that should reflect the additional units that DoD would probably create or disband if it created or disbanded a major combat unit of that type.⁵ With that set of units defined, CBO was able to use information from the FYDP to estimate indirect costs and personnel counts associated with that set of support units in the same way that it estimated direct costs and personnel numbers for major combat units. As with direct costs, CBO included a fraction of the DHP's costs based on the number and type of military personnel in the set of support units.

Overhead Costs

For administrative or overhead organizations, CBO determined that the majority of those organizations' workload is essentially dependent on the size of the force—for instance, a larger force requires more recruiters to find more recruits, more trainers to train those recruits, and more doctors to provide medical care. Some workload (such as that of maintenance depots) is driven by the amount of equipment in the force, but the amount of equipment is itself largely tied to the size of the force. Thus, for the majority of each service's administrative or overhead organizations, CBO assigned prorated fractions of those organizations' costs and personnel—referred to here as overhead—to the costs and personnel of each fully supported combat unit. For example, if a fully supported combat unit accounts for 2 percent of the personnel that a service devotes to major combat and support units, it is

4. Because the FYDP covers a five-year period and because, in many cases, the number of planned forces changes over that period, CBO calculates costs for a major combat unit by dividing the total five-year constant-dollar cost for that type of unit by the total five-year count of such units. That approach means that the estimate of costs is also an average over time. O&S costs generally rise over the years (because of pay raises, increases in health care costs, and other factors), so the costs that CBO estimates in this analysis are slightly higher than those in the FYDP earlier in the five-year period and slightly lower than those in the FYDP later in the period.

5. In some cases, the set of support units that CBO ascribed to a major combat unit would only approximate the changes that DoD would probably make if it added or eliminated a combat unit. For example, CBO considered an Army corps headquarters to be a type of support unit, but each corps headquarters would be expected to command a large number of brigade combat teams (BCTs). Thus, CBO assigned each BCT a fraction of a corps headquarters as a part of its support units. In practice, however, DoD would not eliminate a fraction of a corps headquarters if it disbanded a BCT; it would probably alter the number of corps headquarters only if it made large changes to the size of the Army.

assumed to require 2 percent of the service's administrative and overhead organizations to sustain it.

CBO also assigned to each type of fully supported combat unit a prorated fraction of the costs and personnel of defensewide agencies, such as the Defense Finance and Accounting Services agency, which provides payment services to DoD. Finally, as with direct and indirect costs, CBO included a share of the costs of the DHP based on the number and type of military personnel in an administrative or overhead organization.

Other Considerations

Some activities of the individual services or DoD as a whole do not fit easily into that analytic framework. Thus, for each military department, this primer includes an "Other Activities" component, which CBO treats like a major combat unit (because those activities cannot be considered support or overhead for another type of major combat unit). Such activities include a service's special-operations forces, some of its command-and-control activities, its construction engineers, and so forth.

In a similar fashion, CBO describes separately the costs of defensewide activities that cannot be categorized as support or overhead for major combat units, such as health care costs for military retirees—one of the few categories of O&S costs in this primer that CBO considered to be independent of decisions about the future size of the force. (For a discussion of CBO's approach to judging which costs depend on the size of the force and which are independent of that size, see Box 1-2 on page 14.) The end result accounts for the entirety of DoD's O&S budget—there are no activities, funding, or personnel that are not included in this analysis.

Because CBO's force structure model is based on the 2017 FYDP, its estimates of the costs of major combat units, support units, and administrative and overhead activities are the amounts that DoD estimated those units would cost over the five-year period covered by the 2017 FYDP, not what they should or could cost. As a result, if DoD underestimated or overestimated the costs of certain support activities in its five-year plan, CBO's estimates in this report will reflect that. Similarly, every FYDP reflects the implications of DoD's choices about how to direct its resources toward such goals as improving units' readiness for combat, compensating personnel, or manning units. CBO's analysis did not explore alternative scenarios for how to choose among those goals.⁶

How Changes in the Force Structure Would Affect Costs

Typically, DoD proposes changes in the force structure in its budget requests, and the Congress approves them or directs DoD to alter them. If the Congress wished to change the military's force structure in a manner independent of DoD's requests, it could use several available tools.

First, it could codify the force structure in law (as it did in section 5063 of the U.S. Code, which requires the Marine Corps to maintain at least three divisions and three air wings). Second, because the Congress is responsible for authorizing the total number of military personnel that each service maintains (the end-strength authorization), it could choose to authorize an end strength other than what DoD requests. Third, the Congress could bar DoD from using any funding to implement changes to the force structure of which it does not approve. (The Congress has used that power in recent years—for example, to prohibit the Air Force from retiring A-10 aircraft despite the service's repeated requests to do so.) Such Congressional actions would have a more rapid impact on the costs of U.S. forces than changes made through DoD's decisionmaking process would. For instance, if the defense authorization act for any fiscal year included a new end-strength authorization, DoD would be obligated to try to achieve that new end strength in the same fiscal year.

The effect on DoD's budget of cutting or adding forces would depend on how the changes were made. In the case of reducing the force structure, for example, eliminating a major combat unit would, at a minimum, eliminate within a few years the direct costs of operating that unit. If DoD was able to eliminate the unit's associated support units, it would also save the costs of operating those units within a few years of deciding to do so. In addition, if DoD was able to trim the share of administrative and overhead activities associated with the major combat unit and its support units, the department could remove those costs as well—thus eliminating the total costs that CBO attributes to the fully supported major combat unit. Historical evidence and other considerations suggest that DoD would make those associated cuts over several years.

6. Other CBO analyses have, for example, shown that DoD is planning to spend significantly more per service member to support its forces than it did before the conflicts in Iraq and Afghanistan or than historical trends would suggest. See Congressional Budget Office, *Long-Term Implications of the 2016 Future Years Defense Program* (January 2016), www.cbo.gov/publication/51050.

In the case of adding a major combat unit, direct, indirect, and overhead costs would change in the opposite direction, and the same considerations would apply.

In many instances, DoD's internal decisionmaking processes do not explicitly link major combat units with their support units and their administrative and overhead costs. Thus, DoD would have to make several separate decisions to bring about all of the changes that CBO projects could flow from the single decision to eliminate a major combat unit. Because of the great complexity of the force structure and the many roles that different types of units play, that sequential decisionmaking process gives ample opportunity for concerned parties within DoD to argue against a commensurate reduction in support units or administrative and overhead activities. For example, DoD frequently changes the mix of support units in the force, and a proposed reduction in a support activity often provokes discussion about whether that form of support has become more useful over time and thus should be protected from a planned cut.

In other cases, the size of a support or administrative activity may be based on several different missions, and cuts that reduce the need for one mission may not allow proportionate cuts in that activity because of the requirements of the other missions. For instance, the Air Force's fleet of bombers is intended to be able to conduct both conventional (nonnuclear) and nuclear bombing missions. If DoD wanted to keep its current conventional bombing capability but decrease the bomber portion of its nuclear deterrent, reductions in the bomber fleet based on nuclear bombing capability could be limited by the need to maintain the current amount of conventional bombing capability.

The range of costs that CBO attributes to each unit in this report can be thought of as representing the range of effects of making a change in the force structure. The direct cost alone should represent a lower bound for costs or savings, whereas the total costs should represent an upper bound for costs or savings that would be achievable if DoD and the Congress made the associated changes in indirect and overhead costs.

Once decided on, any large changes to the military's force structure would take a number of years to implement. In general, adding or eliminating major combat units appears to take DoD about three to five years, so savings from reducing forces would not appear immediately.

Moreover, the separate decisions that would be required to reduce support units or administrative and overhead activities might occur in subsequent rounds of decisionmaking, so the savings associated with reducing those activities might take even longer to materialize fully.⁷ During the military drawdown that occurred in the early 1990s, DoD's cuts in overhead activities lagged behind cuts in forces by several years, and savings took more than five years to be fully realized.

Other policy choices would also affect the costs or savings that would result from changes in the size of the force. Those choices include decisions about the pay and benefits of DoD's personnel, the degree to which units are kept at full strength, the type of units considered necessary to support major combat units, and the preferred balance to strike in relying on active- versus reserve-component units.⁸ For the purposes of this analysis, CBO examined only the effects of changes to the size and composition of the force structure, assuming that all other policy factors would remain unchanged. That simplifying assumption, although useful for isolating the effects of a single type of policy choice, would not necessarily be true for all proposals to change the military's forces—it is likely that several related policy decisions would be made at the same time. (For example, in its 2015 budget submission, the Army proposed both to reduce the size of its forces and to change how it assigns aviation units to its active and reserve components.)

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7. Because DoD does not mechanically link decisions about all of the elements of the force structure together, the sheer number of different decisions, and the unique considerations relating to each type of unit, might make it difficult or impossible for DoD to make all of the relevant decisions during a single budget cycle. For example, in recent years, the Army's plans in the FYDP included a "negative wedge" of funding intended to represent the difference between DoD's plans for the Army's funding and the costs of the Army's planned structure. That wedge existed because the Army required several budget cycles to decide on the full details of how it would draw down its forces to a smaller size.
 8. The cost of pay and benefits for military personnel is a key factor in the long-term affordability of the armed forces, accounting for about one-third of DoD's budget. Military compensation has been the focus of substantial public discussion and numerous policy proposals. See, for example, Congressional Budget Office, *Costs of Military Pay and Benefits in the Defense Budget* (November 2012), www.cbo.gov/publication/43574, and *Approaches to Reducing Federal Spending on Military Health Care* (January 2014), www.cbo.gov/publication/44993. This primer reflects DoD's plans as recorded in the 2017 FYDP, which do not include any changes to current compensation policies.

Box 1-2.

Why CBO Projects That Most of DoD's Operation and Support Costs Are Proportional to the Force Structure

One of the issues that the Congressional Budget Office faced in conducting this analysis was determining which of the Department of Defense's (DoD's) costs depend on the size of the force and which are independent of that size. In this analysis, CBO treats virtually all of DoD's operation and support (O&S) funding and personnel as costs of sustaining the military's force structure. In that view, costs that are unrelated to the size of the force (called independent costs, or fixed costs) make up a very small portion of the O&S budget; the only truly independent expense to DoD is health care costs for retired military personnel. Instead, the O&S budget is considered to consist almost entirely of costs that depend on the size of the force (sometimes called variable costs)—meaning that if the force structure was cut by 10 percent, for example, DoD's O&S costs would decline by almost 10 percent.

Several factors contributed to CBO's decision to treat nearly all of the O&S budget as dependent on the size of the force:

- Most of the activities funded by that budget could be affected by future policy choices;
- Few activities that might be considered independent costs are significant in size; and
- Historically, large changes in DoD's budget have eventually affected most of the department's activities.

Consequently, CBO projects that a large change in the force structure would, after several years, alter almost all of DoD's operation and support accounts, aside from health care costs for retirees.¹

CBO's approach is based on the view that some important DoD activities that might be considered fixed costs are actually the result of policy choices. For example, it is common to treat "maintaining the U.S. nuclear deterrent" as a fixed operating cost for DoD, for several reasons: That activity is fairly

straightforward and generally proceeds with stable funding year after year; it produces a valuable, if hard-to-measure, source of defense ("deterrence"); the need for such deterrence is essentially constant; and the activity can easily be treated as a flat charge to DoD in analytic frameworks. However, the size of the U.S. nuclear deterrent is not fixed; it can easily be changed by policymakers and has been many times in the past. Similarly, although such things as the size of special-operations forces or the amount of resources invested in command and intelligence activities are easy to treat as fixed costs, they represent separate and meaningful policy choices about the size of special-operations forces or about how many resources should be devoted to command and control or intelligence. By treating those activities as changeable, CBO greatly reduced the scope of costs that are considered fixed costs.

The DoD activities that are classic examples of fixed O&S costs tend to be small. The military departments' administrative and overhead costs are dominated by personnel commands, training commands, and medical commands, the size of which is largely determined by the overall number of personnel in the force, as well as by equipment commands, the size of which is indirectly determined by the number of personnel (since more personnel generally require more equipment). Similarly, the cost of defensewide activities stems mainly from providing current military personnel or their families with various services, such as health care, commissaries and exchanges, schools for dependent children, payroll services, and

1. Health care costs for current military retirees reflect the cost of fulfilling obligations that the United States has already incurred (when those service members were employed by DoD). As such, those costs do not depend on the size of future forces. Pensions and other payments to current military retirees are also independent of the size of future forces, but they do not appear in DoD's budget. Those payments are made from a mandatory account administered by the Treasury Department rather than from DoD's current appropriations.

Continued

Box 1-2.

Continued

Why CBO Projects That Most of DoD's Operation and Support Costs Are Proportional to the Force Structure

telecommunications services. The costs of all of those services depend on the total number of personnel. Defensewide activities whose size is largely independent of the number of personnel—such as cooperative security arrangements, the acquisition workforce, or the recovery of remains of personnel missing in action—make up a tiny proportion of the defensewide O&S budget.¹ According to DoD's budget documents, about 60 percent of O&S funding for administrative organizations goes for central logistics, medical care, personnel administration, personnel benefits, and training; another 20 percent represents costs for military installations. All of those activities scale with the size of the force structure, in CBO's view.

Finally, when the overall defense budget has been cut in the past, most parts of DoD's budget have declined. One reason is the practice of "top-down" budget management. For example, if fiscal pressures required DoD to reduce its budget by 5 percent, it might cut the budgets of most of its organizations by 5 percent. Such a step is feasible because many activities that are cited as classic examples of DoD's independent costs are not truly independent of DoD's

workload and can be trimmed with sufficient attention from management.

In the case of military bases, for instance, removing a small number of forces from a base will not cause the base to be closed, which can make the costs of operating bases appear largely independent of the number of military forces that DoD maintains. But many costs of operating a base can vary proportionally with the size of the force at smaller scales. For example, if a base loses half of its units, DoD can trim contracts for cafeteria services and maintenance, pay less for utilities, and so forth. At larger scales, major changes in the force structure have historically triggered base closures and consolidations, eliminating those operating costs. Thus, such costs are somewhat variable at small scales but are fully variable at larger scales over a number of years, if DoD or lawmakers decide to cut them.

Because DoD does not have the authority to close bases by itself, and the Congress has traditionally exercised a high degree of control over the base closure process, DoD tends to perceive the costs of operating bases as independent of its policy choices. For the Congress, however, such costs are indeed variable—lawmakers can change the number of bases just as they can alter any other aspect of DoD's size or funding, although the actual base closure process is time-consuming and potentially controversial.

1. Most of DoD's acquisition workforce is funded through acquisition accounts, which increase or decrease largely on the basis of DoD's acquisition plans.

Costs Not Included in This Analysis

CBO's analysis addresses operation and support costs for major combat units. Therefore, it does not include acquisition costs (for the development and purchase of major weapon systems, as well as upgrades to existing systems) or construction costs (for infrastructure such as buildings and housing at military installations). Those costs are significant, together making up almost one-third of DoD's total base budget (excluding appropriations to fund ongoing military operations).

Whereas O&S costs are tightly linked to the size of the force, DoD and lawmakers have substantial discretion over acquisition and construction costs. The size of the

force structure does not necessarily determine the appropriate size of the budgets for weapon systems or infrastructure. For example, regardless of how many fighter squadrons the Air Force maintains, it faces separate choices about whether to purchase new advanced fighter aircraft, upgrade existing aircraft, or keep the current fleet of aircraft.

In many cases, if DoD chose to add units to the force structure, there would be predictable effects on acquisition and infrastructure costs, because DoD would need to purchase additional equipment or construct additional facilities for the new units. If, however, DoD eliminated units in the near future, savings in acquisition and

infrastructure costs would be much harder to predict. One reason is that many of DoD's plans to acquire new weapon systems do not include enough purchases to replace all of the older models in the current force. A smaller force might allow DoD to scale back planned purchases of such weapon systems, or it could just as easily allow DoD to use the same funding to replace all of the older models with newer ones.

In some cases, the amount of detail in CBO's model is limited by the way in which DoD categorizes activities in discrete chunks, called program elements, for the Future Years Defense Program. For example, the FYDP does not distinguish between Navy squadrons that have different types of fighter aircraft, using the same program element for squadrons equipped with older F/A-18C/D aircraft and for those equipped with newer F/A-18E/F aircraft. Thus, the FYDP does not provide any direct information for separating the costs of F/A-18C/D squadrons from those of F/A-18E/F squadrons. When possible, CBO tried to work around those shortcomings by using supplementary information, such as databases maintained by the services that include operating costs for different weapon systems. But making such distinctions was not always possible (including in the case of the Navy's fighter squadrons). Limits on information were usually greatest in the case of weapon systems that have not yet been introduced (such as the F-35 Joint Strike Fighter), because the services often lack essential details about actual operating costs.

Guide to Reading This Report

This primer is designed to be a reference work with discrete entries, so it does not need to be read in a linear fashion. A reader who is interested in the structure of the Air Force or the costs of the Army's infantry brigade combat teams can flip to the relevant section.

The next three chapters focus on the Departments of the Army, the Navy (including the Marine Corps), and the Air Force. The last chapter focuses on defensewide organizations within DoD that are not part of those departments. Each of the chapters has the same basic structure:

- The chapter begins with an introduction to the military department in question (or to defensewide activities) that describes the size of the department; the types of major combat units it provides; the way it typically organizes those combat units with their

support units; the distribution of its personnel among direct, indirect, and overhead functions; and the relationship between units in the active and reserve components. The introduction also briefly discusses the strengths and limitations of the department's overall forces.

- The majority of the chapter consists of individual entries for each type of major combat unit (or defensewide organization). Those entries cover the costs and personnel (direct, indirect, and overhead) associated with a given type of unit, the number of such units in DoD's current and planned forces, the purpose and limitations of that type of unit, and the units' past and planned use in operations.
- The chapter concludes with entries about topics that are of special interest to a particular department or to DoD as a whole. Those special topics cover activities that do not represent separate costs but that are nonetheless important for understanding the military's force structure. For example, Chapter 4 includes separate entries that show the costs and personnel required for the Air Force's squadrons of tactical aircraft, bombers, and unmanned air systems as types of major combat units. The chapter also includes a special-topic entry about the military's strike capability (the ability to destroy a wide variety of enemy targets rather than a few specific types), which is provided in part by tactical aircraft, bombers, and unmanned air systems. In that example, strike capability is not a type of major combat unit or a separate cost, but DoD's desire to be able to carry out strike missions is crucial to understanding why the Air Force maintains the set of combat units that it does.

Following the chapters, Appendix A provides an overview of the total cost and personnel required for each type of major combat unit, as well as the number of those units that DoD plans to maintain in each year of the 2017–2021 period covered by the 2017 FYDP. Appendix B shows how the costs and personnel counts for each type of major combat unit, as estimated by CBO, sum to the totals for DoD's operation and support budget and military personnel reported in the 2017 FYDP. Finally, Appendix C summarizes the past military operations and current planning scenarios referred to in this report, with a focus on the types of forces used in each one.

Department of the Army

Overview

The Department of the Army includes the Army's active component; the two parts of its reserve component, the Army Reserve and the Army National Guard; and all federal civilians employed by the service. By number of military personnel, the Department of the Army is the biggest of the military departments. It also has the largest operation and support (O&S) budget. The Army does not have the largest total budget, however, because it receives significantly less funding to develop and acquire weapon systems than the other military departments do.

The Army is responsible for providing the bulk of U.S. ground combat forces. To that end, the service is organized primarily around brigade combat teams (BCTs)—large combined-arms formations that are designed to contain 4,400 to 4,700 soldiers apiece and include infantry, artillery, engineering, and other types of units.¹ The Army has 30 BCTs in the active component and 26 in the National Guard (there are none in the Army Reserve). It has no plans to change those numbers over the next five years (see Table 2-1). The vast majority of the Army's support units exist to support combat operations by BCTs, and the vast majority of the Army's administrative units exist to create, train, and maintain BCTs and their support units.²

The current organization of the Army into BCTs is a change from historical practice. Before the mid-2000s,

when the service launched a “modularity” initiative, the Army was organized for nearly a century around divisions (which involved fewer but larger formations, with 12,000 to 18,000 soldiers apiece). During that period, units in Army divisions could be separated into ad hoc BCTs (typically, three BCTs per division), but those units were generally not organized to operate independently at any command level below the division. (For a description of the Army's command levels, see Box 2-1.) In the current structure, BCTs are permanently organized for independent operations, and division headquarters exist to provide command and control for operations that involve multiple BCTs.

The Army is distinct not only for the number of ground combat forces it can provide but also for the large number of armored vehicles in its inventory and for the wide array of support units it contains. Those support units include units with significant firepower, such as artillery brigades (which have missile launchers as well as traditional cannon artillery), aviation brigades (which have attack, reconnaissance, utility, or cargo helicopters), and other combat arms (such as Patriot missile launchers to defend against other missiles and aircraft). Army support units include many other types of specialized units, such as construction engineers, military intelligence, military police, and the Army's extensive logistics apparatus. Many of those types of units are responsible for supporting not just Army units in the field but all of the other services in a combat operation. For example, the Army is generally responsible for all theater logistics functions, port operations, and enemy prisoner-of-war detention operations.

Besides those combat and support units, the Army contains a number of smaller organizations that provide niche capabilities unrelated to BCTs. Two noteworthy examples are the Army's special-operations forces (units such as the 75th Ranger Regiment, the 160th Special Operations Aviation Regiment, and the seven Special Forces Groups), and the Army's responsibility for

1. Formations, such as BCTs, that contain a mix of different types of units are referred to as combined arms. Such formations offer advantages over homogenous formations because the different types of units can complement one another and help offset the limitations of any single type of unit. Although all BCTs include a mix of unit types, it is customary to refer to them by their predominant type of combat unit.
2. As noted in Chapter 1, “support” can have a wide variety of meanings in the military, and whether a unit is generally considered a combat unit or a support unit does not mean that it always plays that role in a particular operation. For more details, see Box 1-1 on page 10.

Table 2-1.

Number of Major Combat Units in the Army, 2017 and 2021

	2017	2021
Armored Brigade Combat Teams		
Active component	9	9
National Guard	5	5
Stryker Brigade Combat Teams		
Active component	7	7
National Guard	2	2
Infantry Brigade Combat Teams		
Active component	14	14
National Guard	19	19
Total Brigade Combat Teams		
Active component	30	30
National Guard	26	26

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

operating the Ground-Based Midcourse Defense portion of the national missile defense system (both of which are discussed in Chapter 5).

Distribution of Army Personnel

Of the nearly 1 million military personnel serving in the Army as a whole, roughly half are in support units and a third are in combat units (see Table 2-2). The rest belong to units that perform various overhead functions, such as recruiting, training, and equipping combat units. The Army’s reserve component is slightly larger than its active component, with 54 percent of the service’s total personnel.

Since the 1970s, the Army has interpreted the Department of Defense’s Total Force Policy—which involves treating a service’s various components as a single force—by concentrating combat units in the active component and support units in the reserve component. Over the 2017–2021 period, the Army plans to have an average of 59 percent of its combat personnel in the active component and 75 percent of its support personnel in the reserve component. The practical effect of that distribution is that the Army has enough support units in its active component to conduct relatively small operations on its own, but larger combat operations usually require it to mobilize a significant number of reservists to provide support for the active-component combat units—as

occurred during the occupation of Iraq. (For more discussion of the implications of that structure, see the special-topic entry about integration of the Army’s active and reserve components on page 38.)

Command Levels and Units

The Army’s combat units are organized in a recursive pattern: A unit at any command level contains two to five subordinate units of a similar type, plus additional supporting units. For example, an infantry *brigade* has two or three infantry battalions, a cavalry squadron, and a single battalion each of special troops, artillery, engineers, and logistics.³ Similarly, an infantry *battalion* has three infantry companies, a heavy weapons company, and a headquarters company. That pattern is repeated at lower levels (a *company* consists of platoons, and *platoons* consist of squads) and at higher levels (a *division* consists of brigade combat teams, and a *corps* consists of divisions), as detailed in Box 2-1. However, some command levels have different names depending on the type of unit; for instance, cavalry squadrons are at the same command level as infantry battalions.

This analysis treats supporting units as directly connected to combat units in a fixed relationship, but that treatment is an approximation that is valid only when discussing force planning. In actual operations, most support units are assigned to higher command levels, which give them specific missions. A BCT does not include the support units that the Congressional Budget Office attributes to it in this analysis—those units are division-, corps-, or theater-level assets that would be deployed to support the BCT and without which the BCT could not function. Furthermore, although the Army’s plans involve maintaining a given set of units in the force structure, the commander of a specific operation can, and often does, tailor the mix of support units that are deployed to suit the circumstances of a particular theater of operations. For example, during the occupation of Iraq, the Army generally did not deploy artillery or air-defense units, although it had them in its force structure. Such units were considered unnecessary in that operation, and some were converted to perform roles deemed more useful during the occupation, such as protecting supply convoys.

3. Cavalry units are units that perform the same armed reconnaissance role once carried out by troops on horseback. Today, cavalry units are equipped with helicopters, tanks, armored fighting vehicles, or wheeled vehicles.

Box 2-1.**Command Levels of U.S. Ground Forces**

The Army and Marine Corps are generally organized as hierarchies of units, with each type of unit commanded by a noncommissioned or commissioned officer of a specific rank. (Officers of other ranks play essential roles in those units but typically do not command them.) Those units are described here from smallest to largest:

Squad/Section: A squad is commanded by a sergeant and has 4 to 12 personnel. A section is a group of vehicles, generally two in number.

Platoon: A platoon is commanded by a second lieutenant and includes varying numbers of subordinate squads or sections. It has 16 to 50 personnel. Heavy platoons have four armored vehicles (such as tanks or infantry fighting vehicles, depending on the type of platoon).

Company/Troop/Battery: A company is commanded by a captain and includes two to five subordinate platoons (usually three or four). It has about 60 to 200 personnel. Heavy companies have 14 armored vehicles. Cavalry companies are called troops; artillery companies are called batteries.

Battalion/Squadron: A battalion is commanded by a lieutenant colonel and usually includes three to five combat companies and one support company. It has about 400 to 1,000 personnel. Heavy battalions have 58 armored vehicles. Cavalry battalions are called squadrons.

Brigade Combat Team/Functional Support

Brigade/Regiment/Group: A brigade is commanded by a colonel and is generally configured as either a

brigade combat team (BCT) or a functional support brigade (FSB). A BCT has about 4,400 to 4,700 personnel, depending on whether it is an armored, Stryker, or infantry BCT. An FSB has about 3,000 to 5,000 personnel, depending on its type (of which there are 20). Cavalry brigades are called regiments; some types of support brigades are called groups. Marine Corps units at this level are also called regiments. (The term “Marine expeditionary brigade” refers to a task force, which is larger.)

Division: A division is commanded by a major general and includes two to five BCTs (usually four), an aviation brigade, an artillery brigade, an engineer brigade, and a logistics brigade. Divisions have about 12,000 to 16,000 personnel.

Corps: A corps is commanded by a lieutenant general and includes two to five divisions and numerous support brigades and commands. Corps have about 40,000 to 100,000 personnel. The Marine Corps does not have corps, although a Marine expeditionary force is similar in size and is also commanded by a lieutenant general.

Army: An army is the highest command level in a given theater of operations and typically has 100,000 to 300,000 personnel. It is an element of a joint command structure—the Army's component is commanded by a general. An operational theater is established to support one or more corps (usually two) and includes numerous support brigades and support commands. (The term “theater” is also used frequently, including in this primer, to refer to the area in which a military operation takes place.)

Historically, ground combat units have been classified using weight-related terms, which reflect the weight of the units' equipment and their commensurate speed and ability to maneuver. For decades, the Army broadly classified its forces in that way: Armored and mechanized infantry units, which had the heaviest armored vehicles, were considered “heavy” forces, whereas infantry,

air-assault, and airborne units, which had only a few or no armored vehicles, were considered “light” forces.

Today, the Army has three types of brigade combat teams, which are roughly analogous to heavy, medium, and light forces—armored BCTs have large numbers of the heaviest armored vehicles, Stryker BCTs have large numbers of

Table 2-2.

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

Number of Personnel			
	Active Component	Reserve Component	Total
Combat Units	194,000	133,000	328,000
Support Units	119,000	352,000	472,000
Overhead ^a	138,000	44,000	183,000
Total	452,000	530,000	982,000

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.

lightly armored vehicles (called Stryker vehicles), and infantry BCTs have few armored vehicles.⁴ The Army maintains a mix of BCTs so it can use the type of unit most appropriate for a given military operation.

A possible source of confusion when discussing Army units is that although combat units generally have a fixed set of subordinate units assigned to them, many support units do not have such a fixed composition. Instead, they are intended to have units assigned to them as the need arises.⁵ For example, a combat brigade typically has more than 4,000 personnel assigned to it, but a support brigade might have only about 100 personnel. That difference does not indicate a large variation in size between the two types of brigades; rather, it reflects the fact that the support brigade does not have permanently assigned subordinate units. (Support brigades are perhaps better thought of as brigade headquarters, which are company-size units of about 100 personnel that provide command and control for subordinate support units.) Thus, it is important to note whether a given Army unit includes or does not include subordinate units. Similarly, descriptions of the total number of brigades in the Army can be misleading because of differences between BCTs and other types of brigades.

4. For much of the 2000s, the Army formally called some brigade combat teams "heavy BCTs," but it has since renamed them "armored BCTs."

5. That practice is most common for support units that perform logistics functions, such as transportation or maintenance. By contrast, units that support BCTs by providing artillery or aviation generally have a full set of subordinate units assigned to them.

Another possible source of confusion involves differing ways to count the number of personnel in a unit. The size and organization of Army units is based on an official template, the Army's Table of Organization and Equipment for that type of unit. However, actual Army units do not always conform to their template for a variety of reasons—they may not include all of the subordinate organizations, they may be manned at a higher or lower level than 100 percent, or they may be transitioning from one template to another. (In recent years, for example, the Army has transitioned many of its BCTs from an older template, with two subordinate maneuver battalions, to the current design, with three subordinate maneuver battalions.) When discussing the size of BCTs, this report uses the personnel numbers in the Army's official templates. For the aforementioned reasons, those numbers sometimes differ from the personnel numbers shown in the tables in this report, which are five-year averages based on the plans underlying DoD's 2017 budget request.

Strengths and Limitations of Army Forces

Although each type of BCT has its own strengths and weaknesses, the Army's ground forces overall are exceptionally powerful combat units that are generally considered capable of defeating any conventional ground forces—such as other national armies—that they might be expected to fight. The United States has not suffered a serious defeat from other conventional ground forces since 1950, when the Chinese military intervened in the Korean War. Since then, the U.S. Army has consistently been able to overwhelm opponents who have attempted conventional operations against it. (Its record is less clear-cut in unconventional warfare, as discussed below.)

The use of ground forces is generally thought to represent a high level of military commitment for the United States. In the past, the U.S. military has typically been able to achieve more ambitious goals in conflicts that have involved large Army deployments than in conflicts in which the U.S. commitment was limited to air and naval strikes. Ground forces were considered essential to the defense of South Korea in the 1950s, the liberation of Kuwait in 1991, and the overthrow of the Iraqi and Afghan governments in the 2000s. Although U.S. efforts to defend South Vietnam in the 1960s and 1970s were ultimately unsuccessful, conventional operations by the North Vietnamese to conquer South Vietnam did not succeed until after U.S. ground forces withdrew from the theater. (For a discussion of those and other past military operations, see Appendix C.)

Army ground forces have had more difficulty, however, in achieving U.S. aims against adversaries who have employed unconventional methods of combat, such as guerrilla warfare. Notable examples of those difficulties include attempts to suppress Viet Cong and North Vietnamese army units during the Vietnam War, insurgents in Iraq, and the resurgent Taliban in Afghanistan. Because Army units generally performed well in direct combat, those adversaries often tried to avoid direct combat and achieve their objectives through other means. Unconventional operations can be extremely long, and U.S. adversaries frequently achieve their goals by surviving as a viable force until the United States leaves the theater.

The Army has periodically tried to change its structure in ways that would make it more successful at fighting unconventional conflicts. Historically, those attempts have often included efforts to increase the size and capability of special forces (units that specialize in unconventional missions such as guerrilla warfare and counterinsurgency). The Army's special forces have tried to help U.S. allies train their own militaries to a higher level of capability or conduct their own counterinsurgency campaigns. Although special forces have had some success in such efforts, the United States has a limited ability to influence the governments of its allies. Moreover, as events in South Vietnam, Iraq, and Afghanistan demonstrate, some allies have difficulty defending themselves despite substantial long-term training and investment by the United States.

The future size and makeup of the Army will be affected by the types of conflicts and commitments that U.S. leaders expect to face as well as by the size of the defense budget. 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 at the mouth of the Persian Gulf—the need for Army ground forces may decline. (For a discussion of DoD's planning scenarios for those and other areas, see Appendix C.) Conversely, the need for Army ground forces may increase if the United States has to contend with circumstances such as Russian aggression in Europe.

What This Chapter Covers

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

- Armored brigade combat teams (24 percent); see page 22.
- Stryker brigade combat teams (17 percent); see page 28.
- Infantry brigade combat teams (40 percent); see page 32.
- Other units and activities, such as aviation brigades and special-operations forces (19 percent); see page 36.

This chapter also examines three topics of special concern to the Department of the Army:

- The integration of the Army's active and reserve components; see page 38.
- The role of manning levels in units' readiness for deployment; see page 40.
- Deployment times and rotation ratios; see page 42.

Major Element of the Force Structure

Army Armored Brigade Combat Teams

	Total	Direct	Indirect	Overhead
Active-Component Armored Brigade Combat Team				
Military Personnel per Unit	17,450	4,200	9,090	4,160
Annual Cost per Unit (Millions of 2017 dollars)	2,610	500	840	1,280
National Guard Armored Brigade Combat Team				
Military Personnel per Unit	14,440	4,140	9,090	1,210
Annual Cost per Unit (Millions of 2017 dollars)	820	180	390	240

“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.

Armored brigade combat teams (BCTs) are large tactical formations that operate fairly independently. They are designed to include about 4,700 personnel and are equipped with the heaviest and most powerful armored combat vehicles in the U.S. inventory: M1 Abrams series tanks, M2/M3 Bradley series infantry vehicles/scout vehicles, M109 series self-propelled howitzers, and numerous M2- and M113-derived support vehicles. (See Figure 2-1 on page 24 and the legend in Figure 2-2 on page 26 for the size and organization of an armored BCT.) Vehicles such as those—which run on tracks for off-road mobility and are heavily armored to protect against attack—are not assigned to all elements of an armored BCT. Each BCT also has several hundred wheeled vehicles that generally are not armored. Nevertheless, armored BCTs are, by a large margin, the most heavily armed and armored variety of U.S. ground forces.

Current and Planned Structure. The Army will field nine armored BCTs in its active component and five in the National Guard in 2017, with no plans to change those numbers through 2021. In all, the armored BCTs in the active and reserve components—along with their supporting units and overhead—account for about 24 percent of the Army’s operation and support funding.

Purpose and Limitations. Armored BCTs are descendants of the heavy divisions that were intended, during the Cold War, to defend Europe in the event of a large-scale attack by Soviet forces. Although in recent years the Army has not focused specifically on the ability to destroy

opponents’ armored vehicles, armored BCTs still have strong antiarmor capability, particularly when supplemented with Army helicopters and other U.S. airpower. Armored BCTs can also be used against lighter conventional forces that do not include heavy armored vehicles. However, because armored BCTs are far superior to lighter forces in terms of firepower, protection, and cross-country mobility, few adversaries are likely to willingly commit their lighter forces in open combat against armored BCTs. (In ground combat, light forces tend to be less mobile than heavy forces because they are intended to fight on foot and because the wheeled vehicles that transport them to the battlefield have less off-road capability than tracked armored vehicles do.)

The main drawback of armored BCTs is that they lose many of their combat advantages in complex terrain (such as forests, jungles, mountains, or urban areas) as well as in unconventional combat (such as guerrilla warfare). In such conditions, armored vehicles are more vulnerable to attack, have less ability to use their firepower, and cannot benefit from their tactical mobility. Although armored BCTs still have some advantages over lighter forces under those conditions, defense planners generally believe that the high costs of armored BCTs relative to those of lighter forces make them less well suited for such missions. In addition, in areas with poor infrastructure, armored BCTs may be less suitable for some operations because of their logistics demands (such as high fuel consumption) and related issues (such as the need for bridges that can support the weight of armored vehicles).

A frequent concern raised about armored BCTs is that their weight and extensive support requirements make them harder and slower to deploy to distant locations than light forces are. In many cases, however, that limitation does not significantly hinder an operation. One reason is that although an armored BCT has much heavier equipment than, for example, an infantry BCT, the United States rarely deploys a single brigade of any type on its own, using air transport, to an unexpected location with great haste. Rather, a brigade is deployed as part of a full “force package” that typically includes a large number of support units, which diminishes the difference in equipment weight between heavy and light forces. Moreover, a deployment could involve many BCTs, which would overwhelm air-transport capabilities and make sea transport mandatory, and it could involve a location (such as the Korean Peninsula or the Persian Gulf) where the United States has stockpiled prepositioned equipment on land or on board ships.

In addition, in many conflicts—such as the removal of Iraqi forces from Kuwait in 1991 (Operation Desert Storm) and the invasion of Iraq in 2003 (Operation Iraqi Freedom)—the United States had a long time to deploy forces, reducing the importance of deployment speed. (For a description of those and other past military operations, see Appendix C.) To the extent that U.S. planners are concerned about deployment speed, investments in stocks of prepositioned equipment and additional cargo ships can greatly reduce deployment times in most scenarios, without requiring the military to forgo the combat capabilities of heavy forces.

Past and Planned Use. Armored BCTs evolved from Cold War–era armored divisions and mechanized infantry divisions, which were referred to as heavy divisions.⁶ Their equipment and organization have historically been oriented toward high-intensity combat with conventional armored opponents, as was envisioned during the Cold War, when U.S. heavy forces were prepared to defend West Germany against massive Soviet armored assaults.

More recently, the United States relied extensively on heavy divisions during Operations Desert Storm and Iraqi Freedom, but it did not use any heavy forces in the

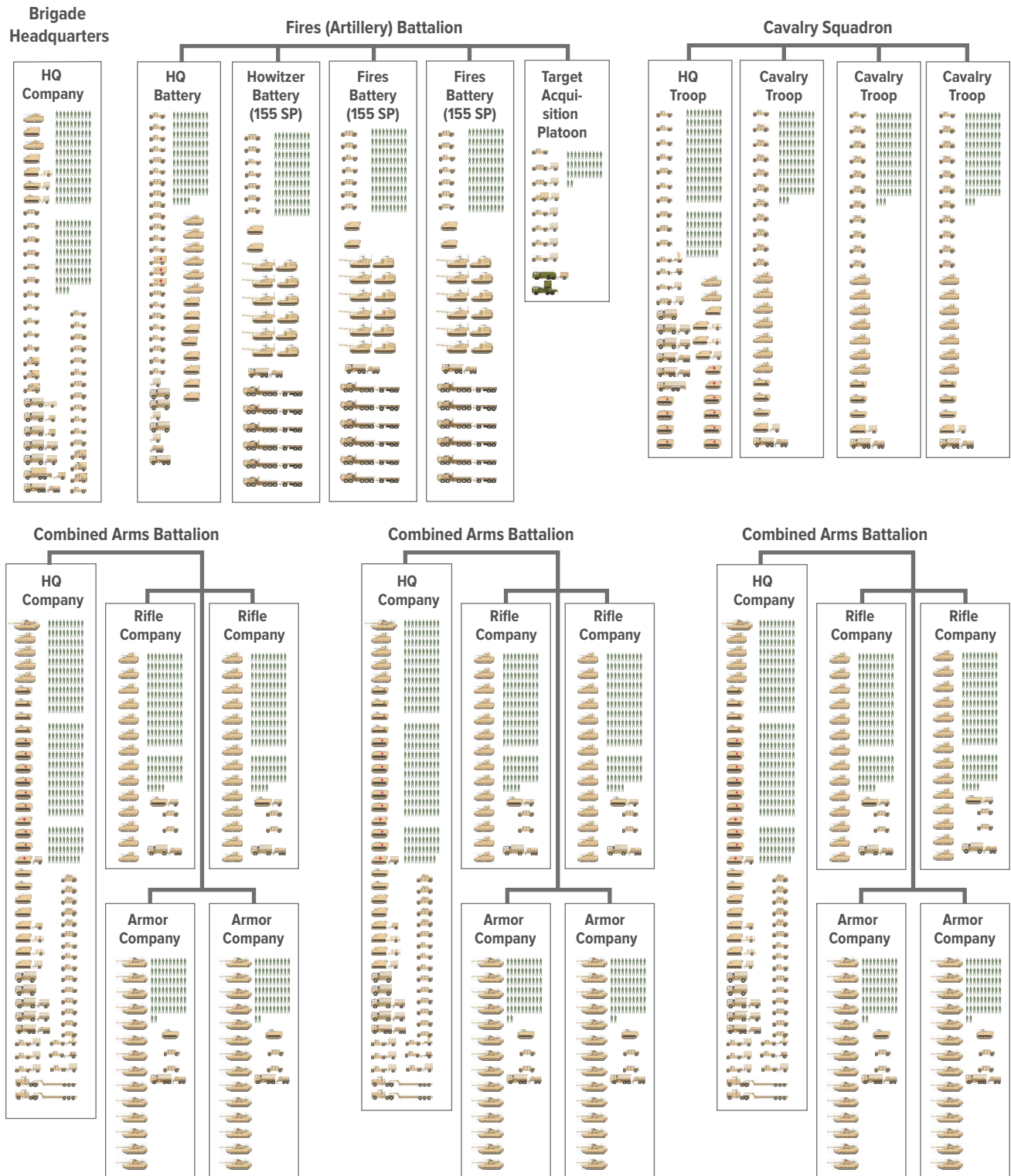
invasion of Afghanistan in 2001 (Operation Enduring Freedom). In later counterinsurgency operations in Iraq and Afghanistan, that pattern was repeated: The United States employed large numbers of heavy BCTs in Iraq but none in Afghanistan. However, the heavy BCTs used in Iraq often operated in a modified configuration without their heavy vehicles, which made them better suited to counterinsurgency and urban operations—an example of the way the Army adapts its units to meet the needs of each operation.

In the 1990s, the Department of Defense’s post–Cold War planning focused on the ability to fight two theater-size wars at the same, or nearly the same, time (see Appendix C). DoD generally assumed that each of those wars would require the equivalent of about 11 heavy brigades. (At the time, the Army used divisions as its basic units; it assumed that three heavy divisions and two armored cavalry regiments would be necessary for the combat phase of each war.) Subsequent planning has been more flexible but envisions that a similar number of combat brigades would be needed for a major conflict. Thus, according to that standard, the Army’s planned 2021 force of nine active-component armored BCTs and five National Guard armored BCTs would probably not be sufficient for such a two-war scenario. In practice, however, the United States currently has few, if any, potential opponents that can field enough modern armored forces to require the Army to use large numbers of armored BCTs against them in a conflict. In addition, the United States has other types of BCTs (Stryker and infantry) that would be capable of contributing in a conflict, although they do not have the same characteristics as an armored BCT.

6. The Army sees substantial advantages in using armored units together with mechanized infantry units (infantry that are equipped with infantry fighting vehicles rather than with tanks). Thus, it combines the two types of units at all but the very lowest command levels. For a long time, such combined units were referred to generically as heavy forces. The Army recently changed their name from “heavy BCTs” to “armored BCTs,” but those brigades have the same mixture of armored and mechanized infantry units as before.

Figure 2-1.

Units, Equipment, and Personnel in an Army Armored Brigade Combat Team

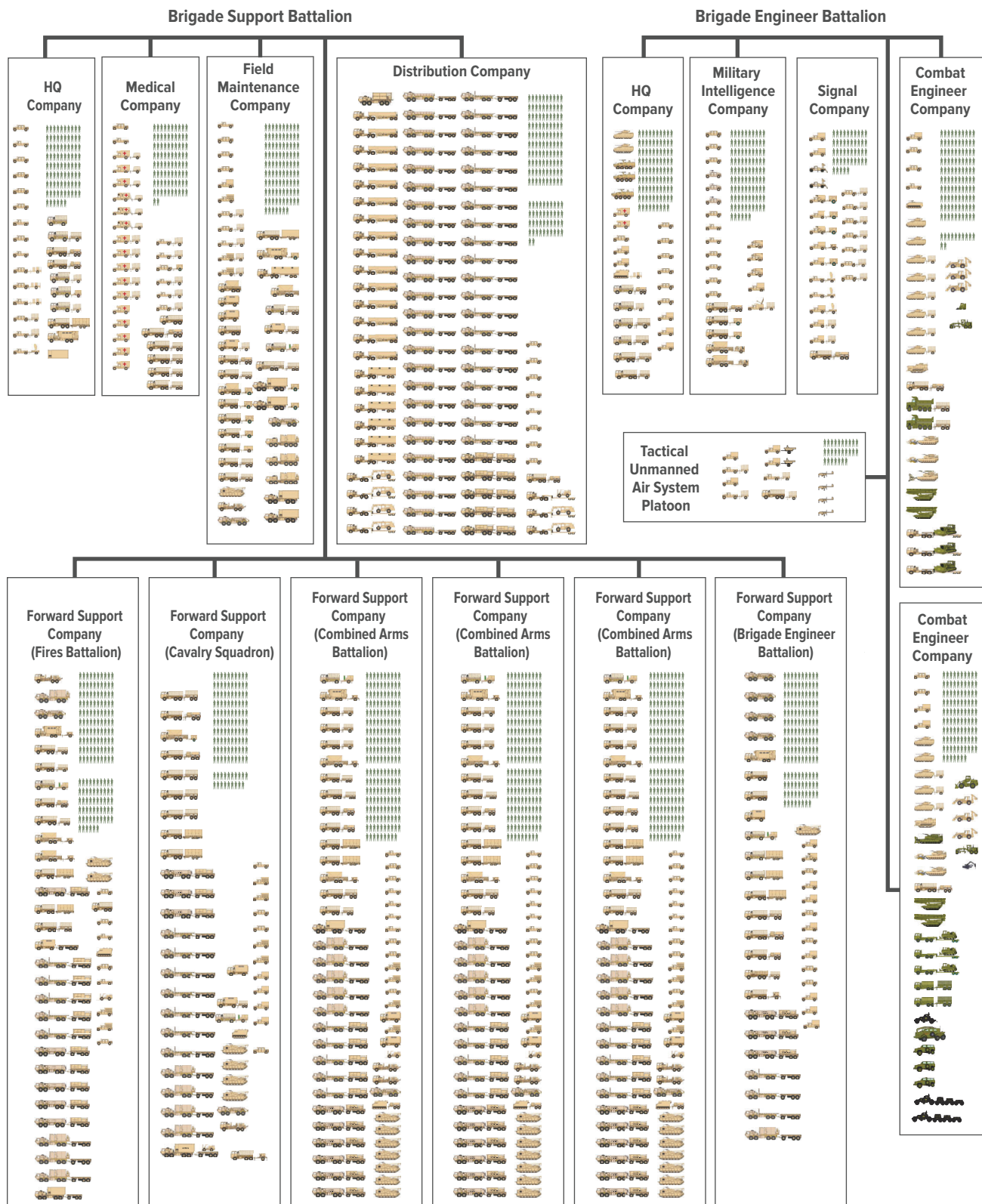


Continued

Figure 2-1.

Continued

Units, Equipment, and Personnel in an Army Armored Brigade Combat Team



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

For a key to the icons in this figure, see Figure 2-2.

Figure 2-2.

Legend for Army Equipment and Personnel

Armored Vehicles			
	M1A2 Abrams Main Battle Tank		M2/3 Bradley Engineer Vehicle With Trailer
	M2/3 Bradley Fighting Vehicle/ M7 Bradley Fire Support Vehicle		M104 Wolverine Heavy Assault Bridge
	M109A6 Paladin 155 mm Howitzer		M1126 Stryker Infantry Carrier
	M992A2 Ammo Support Vehicle		M1127 Stryker Reconnaissance Vehicle
	M577A1 Command Post Carrier		M1128 Mobile Gun System
	M113A3 Armored Personnel Carrier/ M1064 120 mm Mortar Carrier		M1129 Stryker Mortar Carrier
	M113A3 Ambulance		M1130 Stryker Command Vehicle
	M577A1 Medical Treatment Vehicle		M1131 Stryker Fire Support Vehicle
	M1117 Armored Security Vehicle		M1132 Stryker Engineer Support Vehicle
	M88A1 Medium Recovery Vehicle/ M88A2 Improved Recovery Vehicle (Hercules)		M1133 Stryker Medical Evacuation Vehicle
	XM1150 Assault Breacher Vehicle With Mine Plow		M1134 Stryker Antitank Guided Missile Vehicle
	XM1150 Assault Breacher Vehicle With Blade		M1135 Stryker Nuclear Biological Chemical Reconnaissance System
	M9 Armored Combat Earth Mover (ACE)		

Continued

Figure 2-2.

Continued

Legend for Army Equipment and Personnel

Light Trucks	
	M998/M1038 High Mobility Multipurpose Wheeled Vehicle (HMMWV)
	M1114/1151A1 Uparmored HMMWV
	M1113 Expanded Capacity HMMWV With Rigid Wall Shelter
	M1097A2 Heavy Variant HMMWV With Shelter
	M997 HMMWV Ambulance
	Secure, Mobile, Antijam, Reliable Tactical-Terminal (SMART-T)
	AN/TSQ-190 Trojan Spirit HMMWV/Trailer
	Unmanned Air System Ground Control Station
	AN/MLQ-40 Prophet Detecting System Countermeasures
Heavy Trucks	
	M1120 Heavy Expanded Mobility Tactical Truck Load Handling System and Trailer
	M1074/M1075 Heavy Cargo Truck Palletized Load System Transporter
	M1074 Palletized Load Transport With Forward Repair System
	M984A1 Heavy Expanded Mobility Tactical Truck Wrecker
	M978 Heavy Expanded Mobility Tactical Truck Fuel Tanker With Fuel Trailer
	M977/M985 Heavy Expanded Mobility Tactical Cargo With Trailer
	M916 Tractor Truck With M172A1 Lowbed Semitrailer
	M1977 Common Bridge Transporter With Rapidly Emplaced Bridge Systems
Medium Trucks	
	M1078 Light Medium Tactical Vehicle
	M1083 Medium Tactical Vehicle
	M1083 Medium Tactical Vehicle With M1095 Cargo Trailer
	M1083 Medium Tactical Vehicle With Kitchen or Tool Set Trailer
	M1083 Medium Tactical Vehicle With Water Tank Trailer
	M1083 Medium Tactical Vehicle With Generator or Welding Trailer
	M1083 Medium Tactical Vehicle With Power Plant Trailer
	M1088 Medium Tactical Vehicle Tractor With M129A3 Semitrailer
	M1089 Medium Tactical Wrecker
	M1088 Medium Tactical Vehicle Tractor With M172A1 Lowbed Semitrailer
Other	
	M198 Towed 155 mm Howitzer
	M119A1/A2 Towed 105 mm Howitzer
	Rough Terrain Forklift
	Interim High Mobility Engineer Excavator
	All Terrain Lifter Articulated System (Atlas) Forklift
	Shadow Launch/Recovery Trailer and RQ-7 Shadow Tactical Unmanned Air System
	Deployable Light Engineer Tractor (Deuce)
	Multipurpose Loader
Personnel	
	Ten Personnel
	One Person

Source: Congressional Budget Office.

Major Element of the Force Structure

Army Stryker Brigade Combat Teams

	Total	Direct	Indirect	Overhead
Active-Component Stryker Brigade Combat Team				
Military Personnel per Unit	17,180	4,440	8,590	4,150
Annual Cost per Unit (Millions of 2017 dollars)	2,560	500	790	1,280
National Guard Stryker Brigade Combat Team				
Military Personnel per Unit	14,230	4,450	8,590	1,190
Annual Cost per Unit (Millions of 2017 dollars)	800	190	370	240

“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.

Like armored brigade combat teams (BCTs), Stryker BCTs are large tactical formations that can operate relatively independently. However, Stryker BCTs are designed to have about 200 fewer personnel than armored BCTs are designed to have (approximately 4,500) and are equipped not with heavy, tracked armored vehicles but with medium-weight, wheeled armored vehicles of the Stryker family. (That general type of vehicle is sometimes called an armored personnel carrier.) Not all of the elements of a Stryker BCT are assigned Stryker vehicles; each BCT also has several hundred wheeled vehicles that generally are not armored. (See Figure 2-3 on page 30 and the legend in Figure 2-2 on page 26 for the size and organization of a Stryker BCT.) Even so, Stryker BCTs provide the Army with more infantry in armored personnel carriers than any other type of brigade combat team.

Current and Planned Structure. The Army will field seven Stryker BCTs in the active component and two in the National Guard in 2017. In its 2017 budget request, it indicated no plans to change those numbers through 2021. Those Stryker BCTs—along with their supporting units and overhead—account for about 17 percent of the Army’s operation and support (O&S) funding.

Purpose and Limitations. Stryker BCTs were created as part of a 1999 initiative to transform the Army into a more mobile and responsive force. The Stryker family of vehicles was intended to provide a medium-weight force that would be easier to deploy rapidly than heavy forces

but that would have more combat power and ability to move around the battlefield than light forces. Plans at the time called for making Stryker vehicles small and light enough to fit on C-130 transport aircraft. However, combat experience in Iraq has led the Army to improve the armor of most of its vehicles, and Stryker vehicles have become much too heavy to be transported on C-130s.

Although the Stryker force was originally envisioned as capable of rapid deployment to conventional operations, it has proved helpful in fighting unconventional forces, such as those in Iraq and Afghanistan. Such operations require large numbers of infantry personnel and benefit when all of those personnel have access to armored transport vehicles—both traits that Stryker BCTs possess. Similarly, the infrastructure in Afghanistan is too poor for the tanks and fighting vehicles of armored BCTs to operate there, but the lighter-weight Stryker vehicles can operate in parts of that country.

The main limitation of Stryker BCTs is that they truly are middle-weight forces. They are not as light as infantry BCTs (described in the next section), which makes them difficult to deploy by air on short timelines. But they also are not as well armed and protected as armored BCTs, which means they would suffer in a confrontation with a modern conventional armored force. Those disadvantages might not be meaningful in the context of long-term operations against insurgents, but they could be significant in a future conflict against conventional forces. Furthermore, although they can cope with poor infrastructure

better than armored BCTs can, Stryker BCTs still face some constraints when operating in areas with poor road networks, and they pose a fairly significant logistics burden.

For the past decade, the Army has been reducing the fraction of armored BCTs in its force in favor of Stryker and infantry BCTs. The Army has often cited the cost of maintaining heavy forces as one of the reasons for that shift. However, the analysis that the Congressional Budget Office conducted for this report indicates that there is virtually no difference in operation and support costs between armored and Stryker BCTs. (The costs of acquiring Stryker vehicles and heavy armored vehicles can differ, however.) Although Stryker BCTs do not have a major O&S cost advantage over armored BCTs, their operational advantages in counterinsurgencies and areas with poor infrastructure may provide a sufficient rationale for the Army's shift.

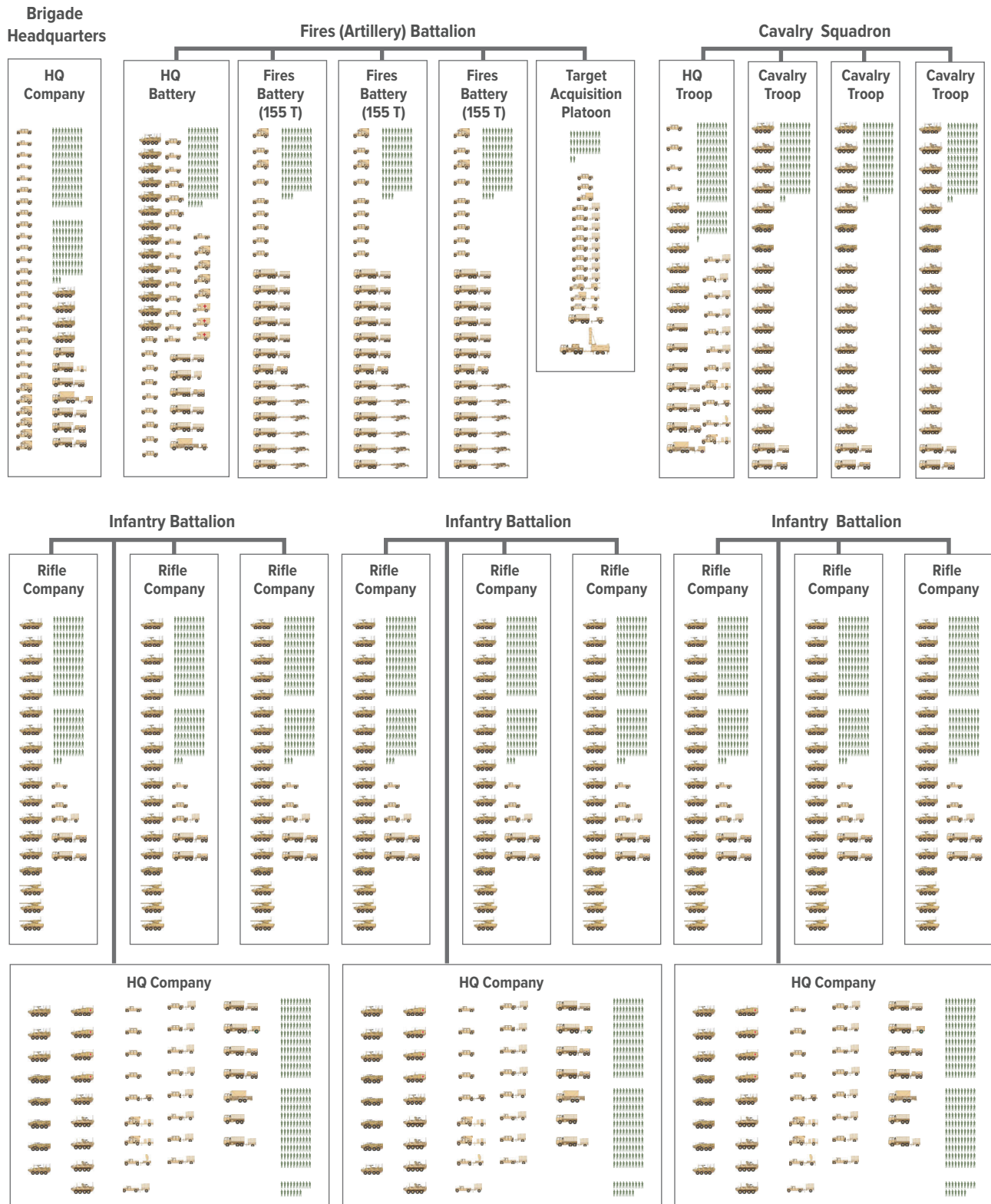
Past and Planned Use. Stryker BCTs are a relatively new type of unit and have been employed in only two major

operations: the occupations of Iraq and Afghanistan. The Marine Corps used wheeled Light Armored Vehicles (known as LAVs), which are similar to Stryker vehicles, in a brigade-size formation during the invasion of Iraq in 2003, reportedly to good effect. And the Army has deployed Stryker brigades to Afghanistan, despite (or perhaps because of) the relatively poor infrastructure there. (For a discussion of those and other past military operations, see Appendix C.)

Stryker BCTs did not exist during most of the 1990s, when the Department of Defense's post-Cold War planning called for being able to fight two wars simultaneously (or nearly simultaneously). The Army's force of seven active-component Stryker BCTs and two National Guard Stryker BCTs appears likely to be capable of contributing in any conflict: DoD envisions few scenarios in which infrastructure constraints are worse than those in Afghanistan, and few, if any, potential U.S. opponents have enough armored forces to threaten the viability of the medium-weight Stryker BCTs (see Appendix C).

Figure 2-3.

Units, Equipment, and Personnel in an Army Stryker Brigade Combat Team

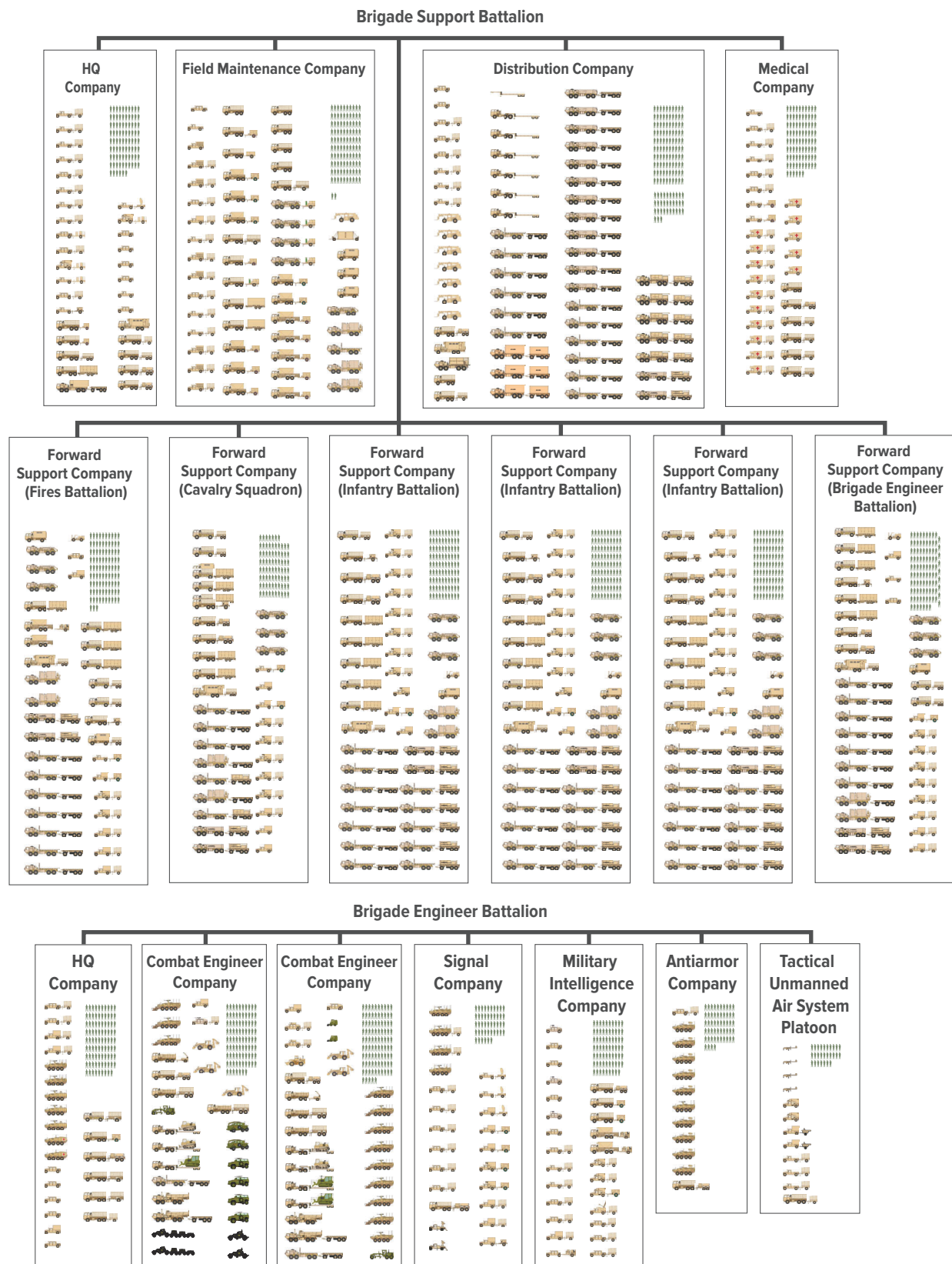


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Figure 2-3.

Continued

Units, Equipment, and Personnel in an Army Stryker Brigade Combat Team



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

For a key to the icons in this figure, see Figure 2-2 on page 26.

Major Element of the Force Structure

Army Infantry Brigade Combat Teams

	Total	Direct	Indirect	Overhead
Active-Component Infantry Brigade Combat Team				
Military Personnel per Unit	16,250	4,230	8,090	3,920
Annual Cost per Unit (Millions of 2017 dollars)	2,410	450	750	1,210
National Guard Infantry Brigade Combat Team				
Military Personnel per Unit	12,720	3,560	8,090	1,060
Annual Cost per Unit (Millions of 2017 dollars)	700	140	350	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.

Infantry brigade combat teams (BCTs)—also commonly called light BCTs—are relatively independent tactical formations that are designed to include approximately 4,400 personnel.⁷ Most of those personnel are expected to engage in combat on foot, although each infantry BCT also has several hundred wheeled, generally unarmored, vehicles assigned to it for transport. (See Figure 2-4 on page 34 and the legend in Figure 2-2 on page 26 for the size and organization of an infantry BCT.) Unlike armored or Stryker BCTs, infantry BCTs come in some specialized variants. For example, airborne units (such as the brigades of the 82nd Airborne Division) are specially trained and equipped to drop by parachute from fixed-wing aircraft, and air-assault units (such as the brigades of the 101st Air Assault Division) are given special training and additional supporting helicopters to conduct assaults from rotary-wing aircraft. Because they have the least equipment weight, infantry BCTs are considered the easiest to deploy of all types of brigade combat teams.

Current and Planned Structure. Infantry brigade combat teams are the most numerous type of BCT. The Army will field 14 in its active component and 19 in the National Guard in 2017, with no plans to change those numbers through 2021. Together, infantry BCTs and

their supporting units and overhead are responsible for about 40 percent of the Army's operation and support funding.

Purpose and Limitations. Infantry BCTs are a product of the Army's renewed focus in the 1980s on the concept of light infantry, in which troops fight entirely on foot, although with some motor transport available. Such forces are designed to be capable of deploying rapidly to distant locations. However, because they have no armored vehicles and few vehicle-mounted weapons, the Army's light forces lack the protection and combat power of heavy forces. Nevertheless, infantry BCTs have significant firepower, and they are capable of calling on the same array of support assets—such as artillery, attack helicopters, and air strikes—as any other type of BCT. In addition, infantry BCTs can often operate more effectively than armored forces in such difficult locations as cities, forests, or mountains, where they can derive substantial defensive benefits from the terrain. For those reasons, unless infantry BCTs are facing large armored forces in unfavorable terrain, they are considered suitable for a wide variety of operations.

The Army's different types of light forces are often grouped together in discussions of their utility in conflicts, but the specialized abilities of airborne and air-assault units are intended to provide important and unique capabilities. For example, both types of forces contribute to the Army's ability to conduct forcible-entry operations, which involve gaining access to enemy

7. In the table above, the number of direct personnel is much smaller for a National Guard infantry BCT than for an active-component infantry BCT because the Guard BCTs are still making the transition from a structure that includes two infantry battalions to a structure that includes three infantry battalions.

territory that cannot be reached from adjacent land areas. (The capability for such operations is discussed in a special-topic entry on forcible-entry capability on page 72.)

Although infantry BCTs are touted for their ability to deploy quickly, that characteristic may be less advantageous than it would seem at first glance. With support units excluded, an infantry BCT has roughly one-quarter of the unit weight of an armored BCT, and all of its equipment can be transported by air. However, for a variety of reasons, that difference is likely to be valuable only in certain types of small operations. Support units for heavy and light forces are fairly similar in weight; though tanks require more logistical support than people do, the hundreds of wheeled vehicles in both armored and infantry BCTs require similar logistical support (compare Figure 2-1 on page 24 and Figure 2-4 on page 34). Moreover, unless infantry BCTs are deployed without support (which is unlikely except for very short and low-risk missions), the need to deploy support units as well as combat units makes fully supported infantry BCTs only a little faster to deploy than heavier BCTs—and means that both types of units would probably require sea transport for any large operation. The Army is most likely to benefit from the light weight of infantry BCTs when deployment speed is more important than combat power (such as in some humanitarian interventions) or when the total force to be committed is fairly small (such as in the initial phase of the invasion of Afghanistan).

Past and Planned Use. Infantry BCTs evolved from the Army's various infantry, airborne, and air-assault divisions, all of which had substantial similarities in organization and equipment. After focusing for many years on trying to fully mechanize all nonairborne infantry units, the Army revived the light-infantry concept in the 1980s.

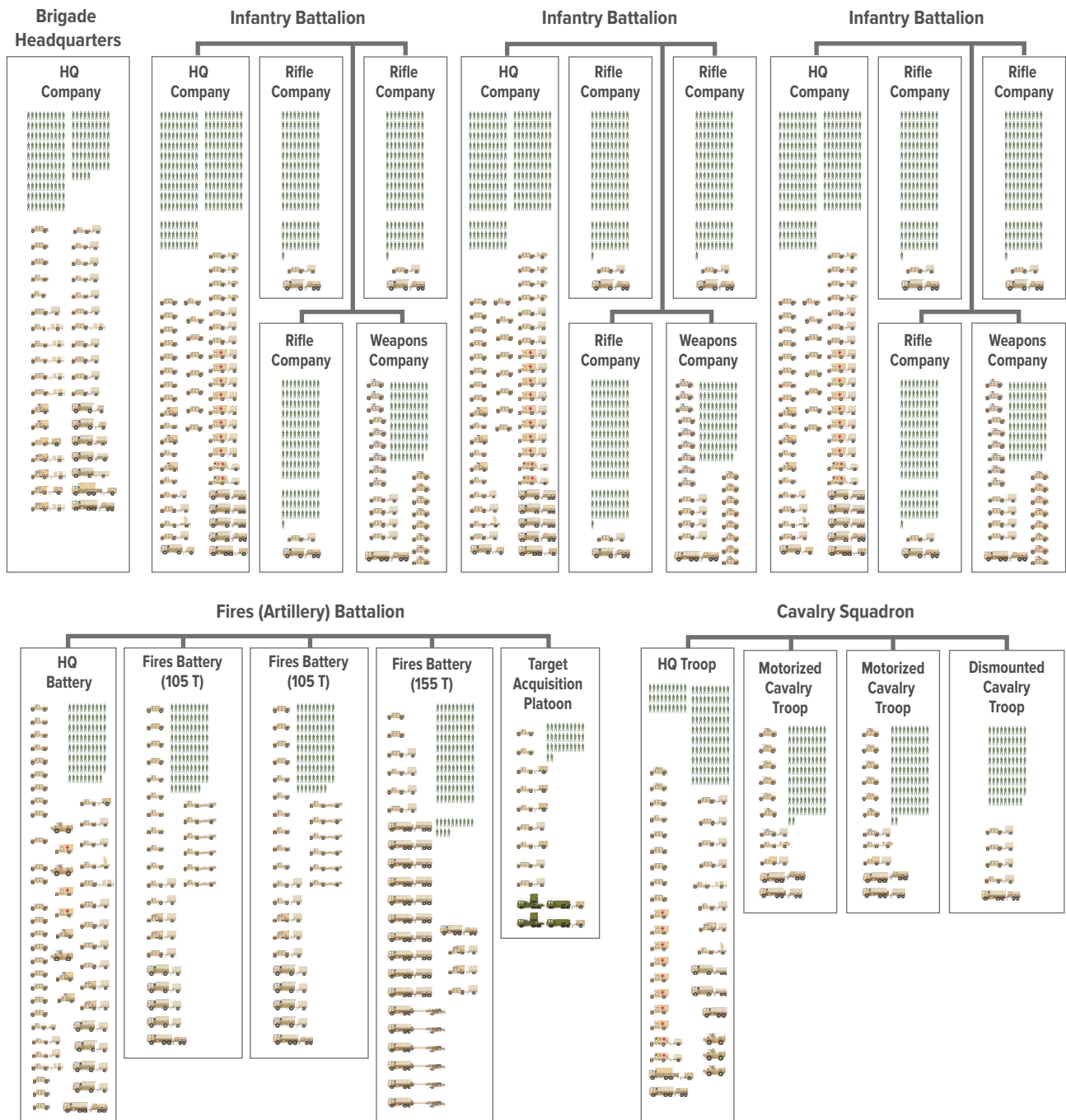
Light units were seen as a cost-effective way to increase the size of U.S. ground forces, especially for scenarios other than defending against Soviet armored assaults.

In recent decades, the operation to remove Iraqi forces from Kuwait in 1991 and the invasion of Iraq in 2003 involved light forces (at the time, infantry divisions rather than BCTs) to only a limited extent. By contrast, the invasion of Afghanistan in 2001 depended entirely on light forces, including Marine Corps and special-forces units. That pattern recurred in subsequent counterinsurgency operations in Iraq and Afghanistan: The United States used limited numbers of infantry BCTs in Iraq but relied heavily on them in Afghanistan (for a discussion of those and other past military operations, see Appendix C). However, in those operations, infantry units were assigned more vehicles than usual for mobility, and they were given armored vehicles for protection against improvised explosive devices as the use of those devices became more common.

In the 1990s, the Department of Defense's post-Cold War planning focused on the ability to fight two theater-size wars at the same, or nearly the same, time (see Appendix C). DoD generally assumed that each of those wars would require the equivalent of about six light brigades. (At the time, the Army used divisions as its basic units; it assumed that two light divisions would be necessary for the combat phase of each war.) Subsequent planning has been more flexible but envisions that a similar number of combat brigades would be needed for a major conflict. Thus, according to that standard, the Army's planned 2021 force of 14 active-component infantry BCTs and 19 National Guard infantry BCTs would probably be more than sufficient for a two-war scenario (see Appendix C). The United States currently has few, if any, potential opponents that can field large enough armored forces to make the use of infantry BCTs infeasible.

Figure 2-4.

Units, Equipment, and Personnel in an Army Infantry Brigade Combat Team

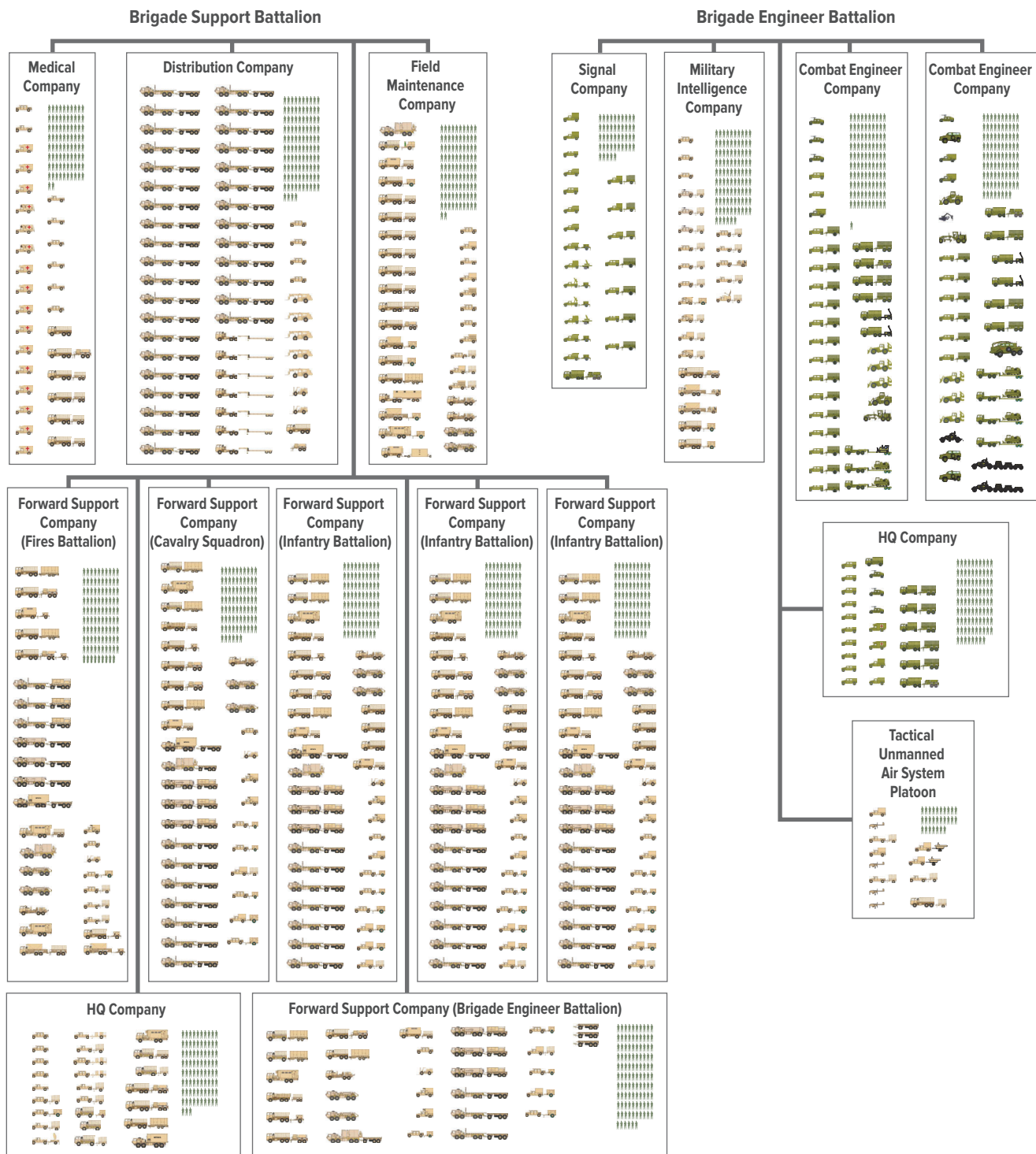


Continued

Figure 2-4.

Continued

Units, Equipment, and Personnel in an Army Infantry Brigade Combat Team



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

For a key to the icons in this figure, see Figure 2-2 on page 26.

Major Element of the Force Structure

Other Department of the Army Units and Activities

	Total	Direct	Indirect ^a	Overhead
Active-Component Aviation Brigade				
Military Personnel per Unit	4,300	3,020	0	1,280
Annual Cost per Unit (Millions of 2017 dollars)	890	490	0	410
Reserve-Component Aviation Brigade				
Military Personnel per Unit	2,750	2,520	0	230
Annual Cost per Unit (Millions of 2017 dollars)	200	160	0	50
Army Special-Operations Forces				
Total Military Personnel	45,100	32,370	0	12,730
Total Annual Cost (Millions of 2017 dollars)	7,210	3,190	0	4,020
Rest of the Army				
Total Military Personnel	12,570	8,860	0	3,710
Total Annual Cost (Millions of 2017 dollars)	3,180	2,000	0	1,180

"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. 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 Army units are connected with brigade combat teams (BCTs), the service has a small number of other units that are not directly linked to BCTs, such as helicopter units and various special-operations forces. Together, those units, along with their associated overhead, account for 19 percent of the Army's operation and support funding.

Through World War II, the Army used various types of fixed-wing combat aircraft. After the war, however, the Air Force was spun off as a separate service from the Army. Since then, interservice agreements have prohibited the Army from using fixed-wing aircraft for combat (although it continues to use them for other purposes, such as reconnaissance and transport). Instead, the Army's **aviation brigades** rely on helicopters.

In most respects, aviation brigades are similar to other types of supporting forces (as defined in this analysis),

but they merit separate treatment because of their visibility and cost, the Army's occasional use of them as independent forces, and the ease of distinguishing them from other supporting forces. The Army will field 11 aviation brigades in its active component in 2017 but plans to reduce that number to 10 by 2019. It will also field 11 aviation brigades in the reserve component but plans to increase that number to 12 by 2018.

The Army's aviation brigades provide important forms of support in almost all operations involving Army forces. Those brigades include attack helicopters (AH-64 Apaches to attack targets on the ground) and utility and cargo helicopters (UH-60 Blackhawks and CH-47 Chinooks to transport soldiers, equipment, and supplies). Until recently, the Army also fielded reconnaissance helicopters (OH-58 Kiowas to scout for enemy forces), but it has since retired them. For light-infantry forces operating in poor terrain with limited infrastructure—such as

portions of Afghanistan—helicopter transportation is often the only practical method of deploying troops to and from combat operations.

The role of the Army's attack helicopters (and, to a lesser degree, its former reconnaissance helicopters) has been the subject of debate, however. Those aircraft had a mixed record in some combat operations, such as in Kosovo in 1999 and in the initial phases of Operation Iraqi Freedom in 2003. Some observers argue that the Army's attack helicopters are a relatively wasteful and duplicative means of providing close air support (attacks by aircraft on hostile targets that are close to friendly ground or naval forces). In that view, close air support is better provided by more capable fixed-wing aircraft from the other services. Other observers maintain that unmanned aerial vehicles (discussed in Chapter 4 in an entry "Air Force Unmanned Air System Squadrons," on page 100) are well suited to take over the roles traditionally performed by attack and reconnaissance helicopters. Still other observers argue that the Army's attack helicopters have a number of unique advantages—such as the ability to fly at low speeds—that are useful for working closely with ground forces. Adding fuel to the debate is the fact that the Army has had difficulty developing new reconnaissance helicopters; it canceled two attempts to develop a replacement for the former Kiowa fleet. (Army officials maintain that they continue to need reconnaissance helicopters, but they currently have no active program to purchase a replacement.)

Aviation brigades are one of the most costly types of supporting forces in the Army, and helicopters are some of the most expensive weapon systems that the Army

procures. Thus, any future developments that reduced the Army's use of attack and reconnaissance helicopters could yield substantial savings.

The Army's **special-operations forces** include the 75th Ranger Regiment, the 160th Special Operations Aviation Regiment, and seven special-forces groups. (The costs and personnel numbers shown in the table above are for the Army's special-operations forces as a whole rather than for individual units.) Those units—along with the special-operations forces of the other military services—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 in an entry, "Special Operations," on page 111.

By the Congressional Budget Office's estimate, more than 12,000 military personnel and almost \$3.2 billion a year are devoted to **units and activities of the Army other than those described in this chapter**. They include a variety of smaller organizations providing niche capabilities that are neither BCTs nor units organized to support BCTs. The largest example is the Army's operation of the Ground-Based Midcourse Defense portion of the national missile defense system. That system is the subject of a special-topic entry in Chapter 5, "Missile Defense," on page 120. Other examples include the Army's contributions to various joint commands and defensewide organizations, as well as some miscellaneous command-and-control functions.

Special Topic

Integration of the Army's Active and Reserve Components

Each U.S. military service has an active and a reserve component, but the nature and size of the Army's reserve component—as well as the way in which the Army integrates its two components—make the relationship among the active Army, the Army Reserve, and the Army National Guard a topic of special interest. Roughly two-thirds of the reserve-component personnel in the U.S. military are in the Army. Thus, in most cases, the Army's policies toward its reserve component have a greater effect on how heavily the Department of Defense employs reserve personnel than do the policies of any other service.

In a traditional reserve system, reserve units represent additional increments of force that can be used if forces in the active component prove insufficient—as was the case in the Army in earlier decades and as is still largely the case in the Marine Corps. However, since the end of the Vietnam War, the Army has structured itself in a way that concentrates its combat forces in the active component and concentrates the units that provide essential support for those combat forces in the reserve component. (The active component contains only 46 percent of the Army's total military personnel but 59 percent of the personnel in combat units; likewise, the reserve component contains 54 percent of the Army's military personnel but 75 percent of the personnel in support units.)

That structure requires the Army to commit support units from the reserve component in order to deploy even modest numbers of combat units from the active component.⁸ The need for reserve-component units to support active-component combat forces was the main reason that the Army activated large numbers of reservists during the occupation of Iraq, for example. (Combat units in the reserve component were also activated and deployed

for the occupation, but in much smaller numbers than active-component combat units.) Another result of that heavy reliance on reserve support personnel is that the Army can maintain a much larger number of combat units in its active component, at lower cost, than it could if it were organized in a less integrated way.

The benefits and drawbacks of the Army's integrated structure have been the subject of numerous public debates and several Congressionally mandated commissions. Many of those debates have focused on intangible effects of that structure on reserve-component personnel or on the decisions of policymakers. However, some effects of that structure can be quantified.

If the Army stayed the same size but ceased having specialized active and reserve components and instead adopted a policy of supporting active-component combat units with active-component support units (and supporting reserve-component combat units with reserve-component support units), the active component would be able to support about 21 brigade combat teams (BCTs) rather than the current 30 BCTs. At the same time, the Army would be able to sustain 37 BCTs in the reserve component rather than the current 26.

If, instead of remaining the same size, the Army wanted to fully support its current 30 active-component BCTs with active-component support units rather than reserve-component support units, it would need to add at least 148,000 support personnel to the active component. And if the additional personnel had costs similar to those of current active-component Army personnel, the Department of Defense would require an additional \$20 billion a year in operation and support funding.

The Army does not appear to be considering any dramatic changes to its current policies for integrating the active and reserve components (although smaller changes are frequently under consideration). However, the above examples show that any proposal to eliminate the active component's dependence on reserve-component support units would entail trade-offs—either by requiring a much larger active-component force or by requiring the Army to shift combat units from the active component to the reserve component.

8. The ratio of active- to reserve-component personnel varies for each type of support unit. For example, the Army has a fairly large complement of aviation brigades in the active component, so it does not necessarily have to activate reserve-component aviation brigades for smaller deployments. At the other end of the spectrum, support units that focus on civil affairs or psychological operations have historically been overwhelmingly concentrated in the reserve component (with few, if any, units in the active component), so the Army must activate reservists for any operation requiring such units.

The Marine Corps and the Navy seem unlikely, in the foreseeable future, to adopt a model similar to the Army's integration of its active and reserve components. The Marine Corps' combat units deploy more frequently and routinely during peacetime than the Army's combat units do. That deployment schedule would make the Army's integrated model difficult for the Marine Corps to adopt unless DoD was willing to require frequent and routine peacetime mobilizations of reserve support units. The

Navy is generally more constrained by the number of ships in its inventory than by the number of personnel it has. (The Air Force already uses a model in which its active and reserve components are even more deeply integrated and interdependent, in some respects, than the Army's are, as discussed in more detail in a section in Chapter 4, "Distribution of Air Force Personnel," on page 82.)

Special Topic

Manning Levels, Readiness, and Deployability of Units

Discussions of the size of the force structure, costs per unit, or the readiness of units for deployment are complicated by the fact that many units do not operate with the number of military personnel officially required to fill them.⁹ Conceptually, all units in the U.S. military have a required number of personnel, and each service has a given force structure, which means that each service should theoretically have a set number of personnel it needs for its units. However, for various reasons, the Department of Defense frequently operates units with more or fewer personnel than they are designed for—a practice known as overmanning or undermanning.

Manning levels affect the number of units that a service can field from its total personnel, as well as the readiness and deployability of those units, especially in the Army and Marine Corps.¹⁰ Thus, decisions about manning levels are closely tied to the cost and utility of any given force structure. Such decisions also mean that the number of personnel included in a given force structure could vary widely, so there is no single correct number for how many people a service theoretically requires.

In this report, estimates of funding and personnel per unit are based on the actual manning levels that DoD has planned for the future. In most cases, changes to DoD's decisions about manning levels would alter units' costs, generally in almost linear fashion: A force consisting of units with lower manning levels than required would cost less (and need fewer personnel) but would be less ready and deployable; the opposite would be true for a force consisting of units with higher manning levels than required.

9. Units generally have a "required" number of personnel (the number of people that the unit is theoretically designed for) and an "authorized" number of personnel (the number of people that the service has funded). The difference between those two numbers is usually small and fairly technical, so for this analysis, the Congressional Budget Office chose to focus on authorized numbers. With units that are not subject to deployment—primarily administrative organizations—personnel requirements are essentially dictated by the units' expected workloads.

10. Decisions about manning levels are less significant for the Navy and Air Force because the number of units they can field depends to a greater extent on the number of ships and aircraft they are able to purchase.

Reasons for Overmanning or Undermanning Units.

Assigning more people to a unit than required can be useful for a number of reasons. The most important is that when a unit is deployed, some fraction of its personnel will be unable to accompany the unit because of such issues as medical problems or impending separation from military service. If the unit is exactly at its required personnel level, the absence of those nondeployable personnel will leave the unit below full strength for its deployment. Overmanning nondeployed units provides a cushion of extra personnel, increasing the likelihood that they will be able to deploy with their full complement of required personnel. Experience suggests that units need a cushion of at least 10 percent of their required personnel in order to be realistically expected to deploy at full strength.

At some level, further overmanning would probably have diminishing returns, such that a force structure would be unlikely to benefit significantly from more personnel. In practice, however, the Army and Marine Corps do not appear to have neared that level at any point in recent years.

Undermanning units has its own advantages: reducing the cost of maintaining a given set of units or allowing a service to maintain more units with a given number of personnel than it could otherwise. However, undermanning makes it harder for a service to deploy combat units with their full complement of personnel. One possible use of undermanning that can avoid that problem involves what are known as cadre units. Such units are maintained with a small number of highly trained and experienced personnel but few junior personnel; when the need arises to expand the force, junior personnel can be added to the unit fairly rapidly (for instance, through a draft). That practice allows a service to increase its number of units much faster than it could if it created units from scratch. The Soviet Union used cadre units frequently, but the United States has historically preferred to have smaller numbers of readier units.

In the U.S. military, when undermanned units are required to deploy, they generally receive an infusion of personnel from other units to bring them up to their required numbers. Those transfers, referred to as

cross-leveling, alleviate the short-term problem of an individual unit's being below required strength. But because the additional personnel must come from other units, cross-leveling is likely to leave nondeployed units even more short of personnel, causing a cascade of personnel shortages when the "donor" units in turn are required to deploy. (Integrating the transferred personnel into a new unit can also cause problems with that unit's cohesion and readiness.) For example, during the late 1990s and early 2000s, combat brigades in the Army National Guard were often kept at only 80 percent to 90 percent of their required strength. Cross-leveling led to exactly that problem when the Army began deploying large numbers of National Guard brigades to Iraq in 2005.

Effects of Manning Levels on Readiness and

Deployability. Most units in the U.S. military receive periodic ratings of their readiness for deployment. Under DoD's assessment system, those ratings are based partly on the percentages of required personnel and equipment a unit has and on the training the unit has completed. Unit commanders have some leeway to adjust the ratings if they consider it necessary. Barring such adjustments, a unit must have a manning level of more than 90 percent to be considered fully ready for combat, and the more undermanned the unit is, the further it is considered from being ready.

Manning levels have a more direct connection with unit readiness than do other relevant factors, such as funding.¹¹ Any given force structure requires a specific number of personnel to allow each unit to achieve a manning level of more than 90 percent. If the number of personnel available to the force is smaller than that specific number, some units will fall below the 90 percent threshold and be considered less than fully ready. DoD and the individual

services commonly give higher priority to some units, manning them at higher levels than a service's average and leaving other units at below-average levels. Such decisions change the distribution of personnel, but they do not change the average manning level overall.

A related characteristic used to describe units is deployability. Unlike a readiness rating, deployability is not a formal measure; rather, it refers to the real-world ease of actually deploying a unit to military operations. In general, a unit must be kept at more than 100 percent of its required manning level to be deployable, unless it receives an infusion of additional personnel.

Because the services have an incentive to overman units that are likely to be deployed, even a force that notionally has enough personnel to man all units at 100 percent may choose to overman deployable units and underman nondeployable ones (such as administrative organizations). The Army engaged in that practice during the 2000s, for example. Personnel are costly, so allocating them as scarce resources toward higher-priority uses and away from lower-priority uses can be a reasonable way to maximize the combat potential of a limited pool of people. However, such considerations mean that the readiness or manning of any given unit is not a reliable indicator of the readiness or manning of the whole force. A unit's manning level may reflect the priority a service assigns to that unit more than it reflects the manning level of the service as a whole.

11. For a discussion of the relationship between readiness and funding, see Congressional Budget Office, *Linking the Readiness of the Armed Forces to DoD's Operation and Maintenance Spending* (attachment to a letter to the Honorable C.W. Bill Young, April 25, 2011), www.cbo.gov/publication/22105.

Special Topic

Deployment Times and Rotation Ratios

When making plans for units, the Department of Defense distinguishes between a unit at its home station (typically, its permanent base) and a unit deployed away from that station. Units can be deployed away from home for numerous reasons, such as training exercises. But the most significant types of deployment are those required to sustain U.S. forces overseas—either for military operations, such as the occupations of Iraq and Afghanistan, or for routine military presence in various parts of the world. The Navy and Marine Corps have a long-standing tradition of conducting routine peacetime deployments to provide presence overseas, whereas the Army and Air Force have not traditionally deployed units overseas during peacetime. (Military personnel stationed at some overseas bases, such as in Germany or Japan, are considered to be at their home station rather than on deployment.)

An important factor about current deployments is that DoD does not keep units away from their home station indefinitely. Instead, units return home periodically to limit the stress of deployments on personnel and their families, to repair and replace their equipment, to engage in training exercises, and so forth. Because of that policy, any long military operation or continuing overseas presence requires DoD to have other units available that it can deploy to replace returning units—a practice known as unit rotation. By contrast, in earlier conflicts, such as in Korea and Vietnam, the United States pursued a policy of individual rotation, in which ground and air units remained overseas indefinitely and individual personnel were cycled through them. DoD changed that practice because individual rotation was thought to lead to poor unit cohesion. With unit rotation, the need to alternate units between their home station and deployment means that the military's forces can be thought of as a pool of units, divided into deployed and nondeployed subsets.

Each military service has its own policies governing how long its units can be deployed and how long they should remain at their home station. Such policies result in a theoretical maximum number of units that can be sustained on extended deployments at any point in time while adhering to a service's policies. For example, the Army's official policy for most of the past decade has been for units in the active component to be deployed for up to

one year and then spend at least two years at their home station between deployments. (The Army was not able to meet those goals during the occupation of Iraq.)¹² That policy implies that the Army can sustainably deploy one-third of its active-component force to extended operations overseas while the other two-thirds is at home—for a rotation ratio of home-station units to deployed units of 2 to 1.¹³ Deploying a unit over several rotation cycles through a theater in excess of that rotation ratio is generally considered unsustainable, in part because it affects the desire of the unit's members to stay in the military.

Because of differences between types of units and the policies of the individual services, there is no single rotation ratio for all military forces. In general, the services expect units in the active component to be able to sustain more deployments than units in the reserve component. (In many cases, DoD prefers to minimize reserve-component deployments, if possible.)

When necessary, DoD can deploy more forces than suggested by rotation ratios, as it did for extended periods during the occupation of Iraq. Moreover, rotation ratios are the result of policy decisions and can be changed. Thus, in times of great military need, nothing prevents DoD from deploying as many units as are available for as long as necessary, as it did during World War II. However, the performance of units generally degrades over time when they are deployed, so such a decision can have drawbacks, which worsen as time goes on. But in an operation expected to be of limited duration (such as Operation Desert Storm in 1991), DoD can realistically deploy far more units than the sustainable level because it does not have to plan on sustaining the force involved in the operation indefinitely.

Given the need to have several units in the force to sustain a single deployed unit, if DoD has plans to keep large

12. The Army had a different standard for deploying reserve-component forces, which it also had trouble adhering to in Iraq.

13. Previously, DoD defined a rotation ratio as the ratio of the total number of units in the force to the number of units deployed. Thus, in the Army example, what is currently called a 2:1 ratio (two-thirds of the force at home station and one-third deployed) was previously called a 3:1 ratio (for every three units in the force, one was deployed).

numbers of forces deployed overseas, those plans will generally require larger forces than plans that only anticipate operations of a limited duration. For example, the Army grew to 45 active-component brigade combat teams (BCTs) and 28 National Guard BCTs in the mid-to late 2000s in order to sustain 20 deployed BCTs. (The 45 active-component BCTs provided 15 of the 20 deployed

BCTs, and the 28 National Guard BCTs provided the other 5.) Currently, however, the need to sustain forces deployed overseas is not part of the Army's planning strategy, which has allowed the service to shrink to a force of 30 active-component BCTs and 26 National Guard BCTs (which would be sufficient to sustain about 15 deployed BCTs).

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

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

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.

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.

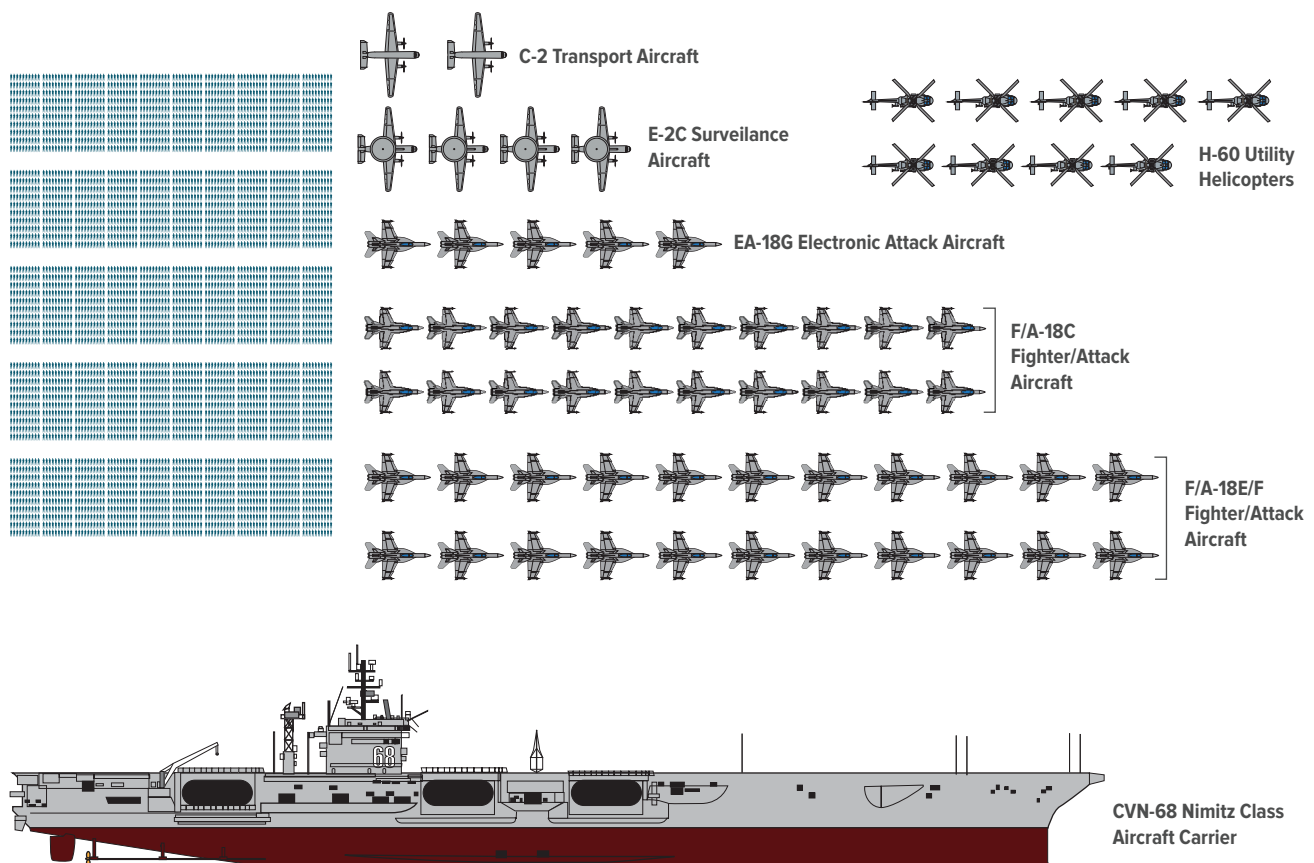
Although no adversary has successfully attacked a U.S. carrier since 1945, the importance of aircraft carriers for the United States' ability to project power has created strong incentives for hostile states to develop weapons and tactics to counter those ships and their aircraft. For example, some states 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.)

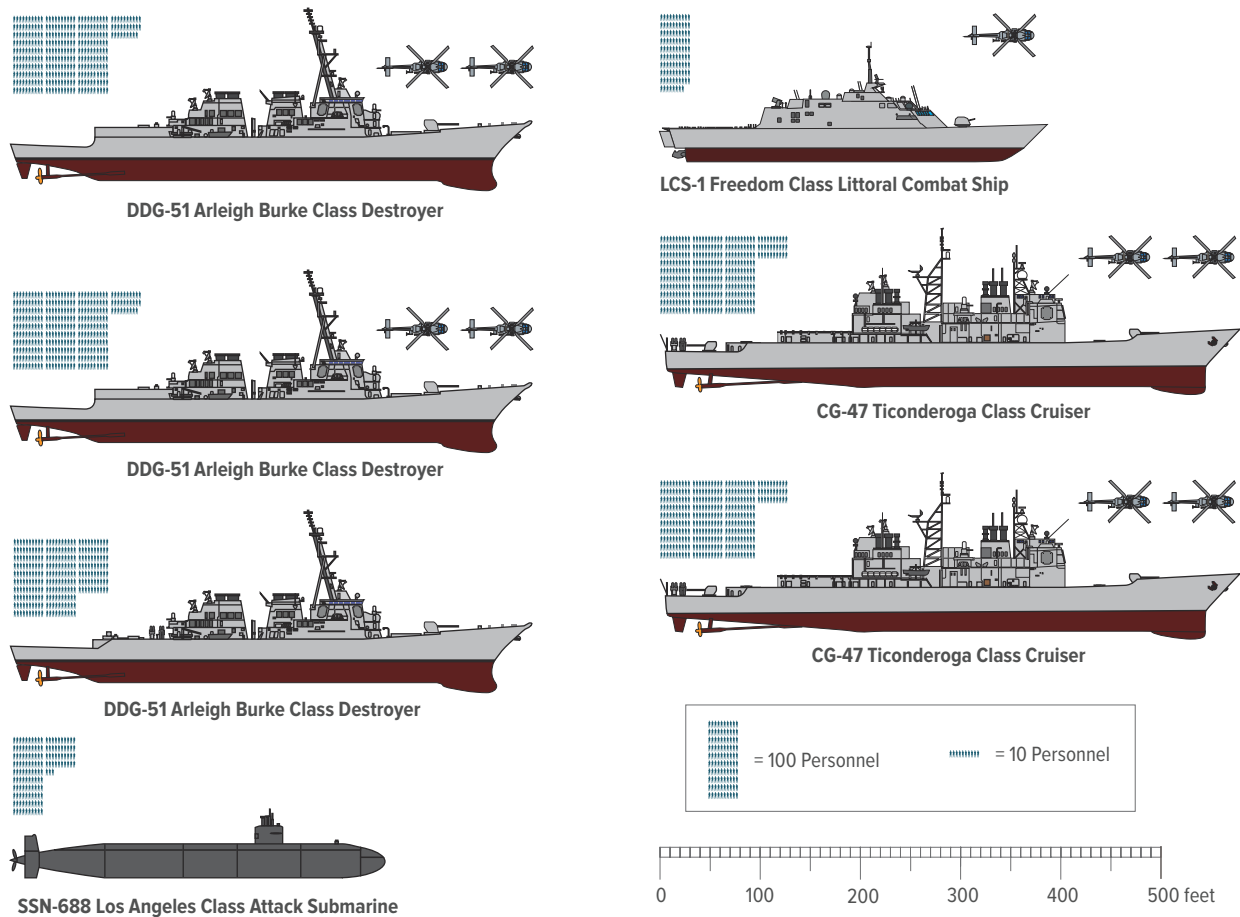
Having more carriers, longer deployments, or more carriers based overseas would increase the fleet's capability to provide forward presence, whereas having fewer carriers or shorter deployments, or withdrawing the carrier based in Japan, would decrease that capability.¹⁷

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.

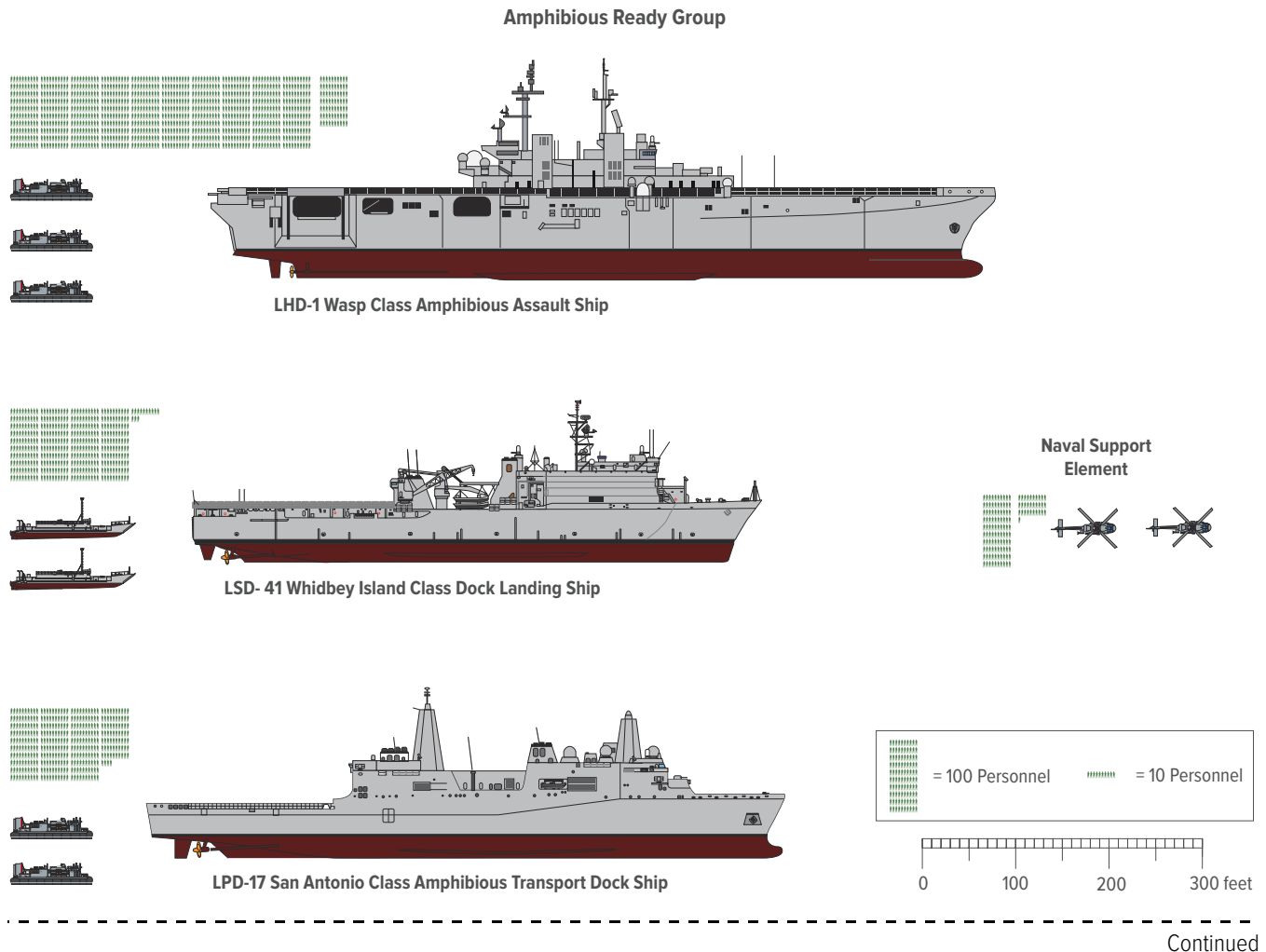
The Navy’s three main types of amphibious ships vary greatly in size and capability. However, data from DoD do not distinguish between the different types, so for this analysis, CBO reports average values for personnel and costs for amphibious ships, even though none of the different types of ships exactly 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



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

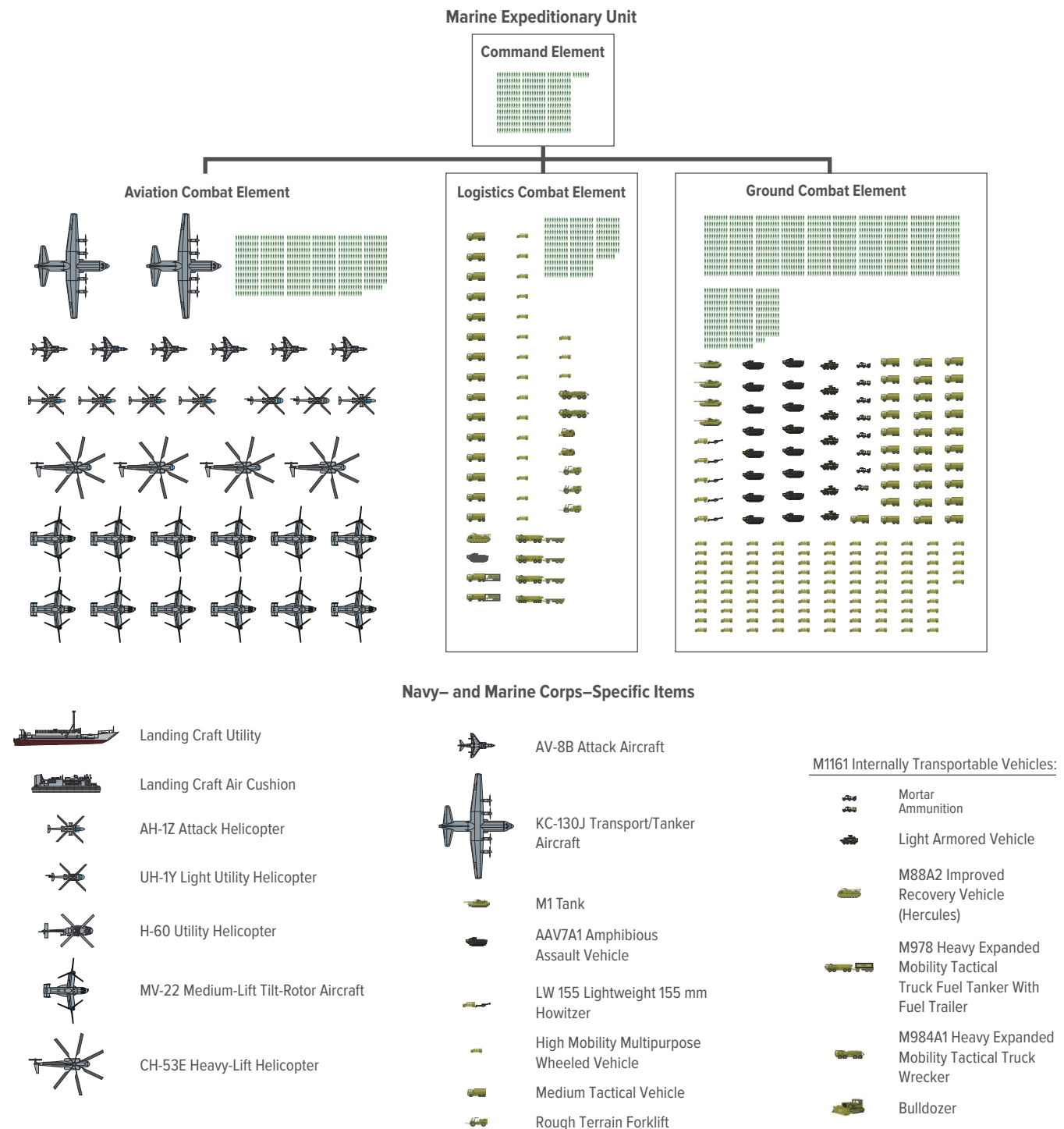
can be used to evacuate embassy personnel and other noncombatants from a conflict zone, and they are considered extremely useful for humanitarian assistance, disaster response, antipiracy missions, and other types of operations that do not involve major conflicts.

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.

Department of the Air Force

Overview

The Department of the Air Force includes the Air Force's active component, the two parts of the service's reserve component—the Air Force Reserve and the Air National Guard—and all federal civilians employed by the Air Force. It is the smallest of the three military departments in terms of both number of personnel and operation and support (O&S) budget.

The Air Force is responsible for the majority of the U.S. military's air power. However, each of the military services has a substantial number of aircraft; thus, the Air Force's specialty is not simply providing air power but providing a wide range of capabilities and types of aircraft. In addition, the Air Force is responsible for most of the U.S. military's space assets and for the ground-based ballistic missiles that carry about one-third of the United States' deployed nuclear weapons.¹

The Air Force operates a fleet of aircraft of widely varying sizes that are designed to accomplish a broad array of missions. Types of aircraft unique to the Air Force include long-range bombers, large transport aircraft, and large tanker aircraft. (The other services operate a number of smaller cargo and tanker aircraft, but the Air Force's are bigger and more numerous.) The Air Force also operates a large number of fighter and attack aircraft; aircraft that provide capabilities for airborne command and control, intelligence, reconnaissance, and surveillance (ISR), and electronic warfare (EW); and helicopters and tilt-rotor

aircraft for combat rescue and special-operations missions. In addition, the Air Force operates a fleet of unmanned air systems (drones) that can carry equipment for ISR and EW missions as well as weapons to attack ground targets. Because the Air Force's aircraft are expected to operate mainly from established air bases, their designs do not have to give up performance capabilities in exchange for specialized adaptations, such as the ones that enable the Navy's aircraft to operate from aboard ships. The Air Force is also responsible for most of the military's space systems that provide important support to the entire Department of Defense (such as Global Positioning System satellites).

Combat units in the Air Force are generally organized as squadrons of aircraft. Those squadrons vary widely in size—with anything from 8 to 24 aircraft being common—as well as in types of aircraft. Such variation makes it difficult to provide a single measure of force structure for the Air Force similar to an Army brigade combat team or a Navy carrier strike group. For consistency, the Congressional Budget Office focused in this analysis on notional squadrons of 12 aircraft each.² The Air Force's planned numbers of aircraft and personnel equate to roughly 220 such squadrons during the 2017–2021 period (see Table 4-1). The Air Force also includes support units (the vast majority of which are used to support combat operations by aircraft squadrons) and administrative units (almost all of which exist to create or maintain the service's combat units and support units).

1. As noted in Chapter 3, the Navy's ballistic missile submarines carry roughly the other two-thirds of the United States' deployed nuclear weapons. Air Force bombers can also carry nuclear weapons, but because of the conventions used in arms control agreements, bombers are counted as carrying very few such weapons (officially, just one nuclear warhead each). Those conventions reflect a judgment that bombers are less dangerous in a crisis because they take much longer to reach their targets than ballistic missiles do and they can be recalled after they have been launched, which is not the case for ballistic missiles.

2. CBO decided to use a notional squadron of 12 aircraft as a standard measure simply to provide a normalized “apples to apples” way of comparing the sizes of different fleets of aircraft (and changes to those fleets over time). Actual counts of Air Force squadrons do not provide such a measure. A simple count of the number of official “slots” in each fleet would provide the same benefit analytically and is a fairly common way of describing the Air Force's fleets. Had CBO used that metric, its estimates for the personnel and costs of each type of Air Force aircraft would be the same as those presented here but divided by 12 in each case.

Table 4-1.
Number of Major Combat Units in the Air Force, 2017 and 2021

	2017	2021
Tactical Aviation Squadrons	101	100
Bomber Squadrons	9	9
Airlift Squadrons	42	43
Air Refueling Squadrons	36	36
Unmanned Air System Squadrons	35	30

Source: Congressional Budget Office, using data from the Department of Defense’s 2017 budget request.
All units presented are notional squadrons of 12 aircraft (actual squadrons vary in size).

In addition, the Air Force contains some smaller organizations that provide capabilities unrelated to aircraft or space systems. The most noteworthy include squadrons of Minuteman ballistic missiles, special-operations forces, and squadrons of construction engineers.

Distribution of Air Force Personnel

Of the nearly half a million military personnel serving in the Air Force as a whole, 29 percent are in support units and 37 percent are in combat units (see Table 4-2). The rest belong to units that perform various overhead functions, such as training and maintenance.

More than the other services, the Air Force integrates the personnel from its active and reserve components very tightly—in many cases, it is misleading to treat the Air Force as composed of separate active- and reserve-component units. Many Air Force units are “multi-compo” (multiple component) units, made up of personnel and equipment from both the active and the reserve components. In other cases, equipment assigned to one component may be operated by personnel from the other component. About one-third of the Air Force’s aircraft are assigned to the reserve component, which more closely resembles the Army’s practice than that of the Navy or Marine Corps. The Air Force’s reserve component is also unusual in that its pilots, unlike reservists in the other services, are frequently more experienced than their active-component counterparts.³

Such tight integration—combined with the way in which budget information is presented in DoD’s Future Years Defense Program (in which units must be classified as belonging to one component or the other, even when that

is not strictly the case)—limited CBO’s ability to produce meaningful estimates of costs for active- or reserve-component squadrons. Instead, the costs presented in this report for Air Force squadrons represent those of “average” squadrons, even though there may be no actual squadrons with those precise sizes and costs.⁴

Command Levels and Units

Today’s Air Force typically does not operate with formations larger than squadrons. In the past, the service relied more heavily on wings (groups of three squadrons, with 24 aircraft per squadron). It also experimented with a larger formation, called an air expeditionary force, composed of several different types of squadrons. Currently, however, the Air Force generally deploys a group of squadrons organized for a specific mission, with higher-level commands such as wings used to provide command and control for the deployed squadrons. As noted above, squadron sizes vary greatly, making counts of squadrons a somewhat misleading measure of force structure, which is why CBO translated all Air Force units into notional 12-aircraft squadrons for this analysis.⁵

- 3. Statistically, the most important determinant of a pilot’s proficiency is total hours spent flying during a career. Pilots in the Air Force’s reserve component are almost always former active-duty military pilots, many of whom have gone on to careers in civilian aviation; as a result, they have often spent more hours flying than active-component pilots.
- 4. For example, about one-quarter of the Air Force’s fleet of C-17 cargo aircraft is assigned to the reserve component. However, cargo aircraft are commonly crewed by personnel from both the active and the reserve components, so it would not be accurate to treat one-quarter of C-17 squadrons as being in the reserve component and the other three-quarters as being in the active component (in actuality, about 90 percent of the personnel assigned to C-17 squadrons are reserve-component personnel). For that reason, CBO calculated per-unit costs for this report by estimating the cost of a single notional C-17 squadron rather than by estimating one cost for the C-17s assigned to the reserve component and another cost for the C-17s assigned to the active component. Although that approach almost guarantees that the estimated cost of a notional squadron does not reflect the cost of any actual squadron, if the Air Force made large cuts or additions to its forces that were not disproportionately targeted toward one component or the other, CBO’s notional cost would approximate the average savings or additional cost per squadron cut or added.
- 5. Today, larger aircraft, such as cargo lifters and bombers, are generally grouped into smaller squadrons, whereas tactical aircraft tend to be grouped into larger squadrons. However, squadron sizes are not standardized even for specific types of aircraft. For example, although fighter aircraft are often described as organized into squadrons of 24 aircraft, the Air Force actually organizes F-16s in squadrons of 15, 18, or 24 aircraft.

Table 4-2.
Average Distribution of the Department of the Air Force's Military Personnel, 2017 to 2021

Number of Personnel

	Active Component	Reserve Component	Total
Combat Units	98,000	86,000	184,000
Support Units	100,000	40,000	141,000
Overhead ^a	119,000	48,000	167,000
Total	317,000	174,000	491,000

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.

Support units in the Air Force have also evolved over time. In the past, a wing was a relatively fixed organization with a definite support structure, organized into several functional groups, such as an operations group or an aircraft maintenance group. Although modern wings still have functional support groups, those groups vary in size depending on the numbers and types of squadrons they need to support (which also differ in size and type). Moreover, detachments can be split off from those groups fairly easily to support individual squadrons when they deploy. Thus, in practice (if not in formal structure), the Air Force has shifted to using a number of smaller, more flexible kinds of support units that are capable of supporting individual squadrons rather than entire wings.

One reason that is cited for the decline of the wing and the rise of the squadron as the Air Force's main element of force structure is that traditional tactical fighter wings were large and homogenous (generally composed of a single type of aircraft). As tactical aircraft became more expensive, more capable, and less numerous, 72-aircraft wings came to be seen as relatively inflexible, cumbersome units. Similarly, as the Air Force began conducting more sophisticated operations with different types of aircraft working together, mixed forces (a "composite wing") became more useful than forces consisting of just one type of aircraft. In a sense, that shift has brought the Air Force closer to the way in which the other services handle aviation. For example, most of the Army's aircraft are in aviation brigades that contain more than one type of helicopter; the Navy has always used composite carrier air wings, which include several smaller squadrons of mixed

aircraft types; and the Marine Corps has long used Marine aircraft wings that are intended to be divided into smaller, task-organized groups for deployments.

At various times in the past decade, the Air Force has suggested a new form of higher-level organization: an air expeditionary force or, more recently, an air and space expeditionary task force. So far, however, those formations appear to be largely administrative conveniences (essentially, lists made in advance of disparate units that would be deployed together for an operation) intended to bring some predictability to the deployment of Air Force units. In practice, the Air Force appears to be evolving toward a system more like that of the Marine Corps, in which actual deployments involve task-organized formations drawn from standing units. Current Air Force doctrine supports creating ad hoc squadrons or wings during deployments. For example, a deployed force of fewer than 700 personnel would warrant having one squadron, but if that force grew to exceed 700 personnel, commanders would be expected to form a second squadron and split assets and responsibilities between the two.

Like the other military services, the Air Force differentiates between the total number of fixed-wing aircraft it has and the number of official "slots" for those aircraft in its force structure. For instance, 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 example, the United States purchased 21 B-2 bombers but maintains 16 slots for B-2s in the force structure.) In this report, all aircraft numbers represent primary aircraft authorizations.

Strengths and Limitations of U.S. Air Forces

Each type of aircraft has its own strengths and weaknesses, but overall, Air Force squadrons are exceptionally powerful units. Very few other countries' air forces have sufficient combat power to consider challenging U.S. control of the air; in many of the conflicts that the United

States has engaged in over the past few decades, opponents have chosen to safeguard their air forces by keeping them grounded for the duration of the conflict. In addition, few nations currently have ground-based air defenses capable of seriously hindering U.S. air operations. The United States has faced only limited competition from hostile fighter aircraft since 1950 (when China intervened in the Korean War), and it has been able to overcome every opposing country's air-defense systems. In the majority of U.S. conflicts since World War II, U.S. air forces have been able to operate essentially at will, either from the beginning of the conflict or a short time thereafter, once the opponent's air defenses had been destroyed.⁶ (For a discussion of those and other past military operations, see Appendix C.)

The United States has historically had a lower threshold for using air and naval forces in combat than for using ground forces. And although flexibility and response time have made aircraft carriers a commonly used option for conducting aerial attacks in small interventions, Air Force aircraft have played a role in almost every U.S. conflict since the service was created. Through international agreements, the United States has access to an extensive network of air bases around the world. In addition, the Air Force's tanker fleet is capable of extending the range of Air Force aircraft to allow attacks on almost any possible hostile country. Air Force squadrons can also be deployed more quickly than ground forces, and their ability to fly at high speeds to distant locations allows them to put virtually any location at risk of attack (provided that its air defenses have been sufficiently degraded or can be avoided).

Views on the use of air power have long fallen into two major camps, one focused on strategic airpower (generally associated with the Air Force) and the other focused on tactical airpower (generally associated with the other military services). Both schools of thought agree that the first priority in any air campaign is to destroy enemy fighter aircraft and air-defense systems to ensure that U.S. air forces can operate freely in enemy airspace. Beyond achieving air superiority, however, the two schools have very different views on the form that airpower should take and the way it should be used in a conflict; they also

have very different historical records. (The terms "strategic airpower" and "tactical airpower" originated from a time when the former was largely synonymous with long-range bombers and the latter with fighters. Modern aircraft have blurred that distinction, so those terms might be more accurately called "strategic use of airpower" and "tactical use of airpower." However, CBO uses the more common terms here for simplicity.)

Strategic Airpower. Strategic airpower is a catchphrase for attempts to use air power to win a conflict directly— independent of naval and ground forces—either by severely limiting an opponent's ability to conduct effective military operations or by coercing the opponent's leaders into acceding to U.S. demands. In that school of thought, the main way to achieve those ends is generally through bombardment of "strategic" targets, such as command-and-control assets, infrastructure, or key components of an adversary's economy. Consequently, proponents of strategic airpower have historically favored long-range bombers (although it is possible to employ tactical aircraft to attack strategic targets) and have regarded attempts to use airpower to influence ground battles as a diversion from the primary air campaign of a conflict.

The effectiveness of strategic airpower has been hotly debated for decades. Proponents cite a number of theories and point to various examples—such as the ending of World War II after U.S. nuclear attacks on Japan and the 1999 air campaign intended to force Serbia to withdraw from Kosovo—as evidence that air forces can win wars largely independent of naval or ground campaigns. Proponents generally also assert that having the ability to win wars through the use of strategic airpower is a highly appealing strategy given U.S. preeminence in the air and the tendency of airpower to result in fewer U.S. casualties than traditional ground campaigns. (Some advocates of strategic airpower also contend that, in an era of precision munitions, an air campaign can result in fewer enemy civilian casualties as well, making it a more humanitarian option than a ground campaign. That position is controversial, however.)

The use of air forces alone to conduct strikes on opposing states, without the commitment of U.S. or allied ground forces, has had mixed results in achieving the United States' strategic goals. Although air strikes or cruise missile strikes by themselves have sometimes been able to achieve more limited U.S. goals, opponents of strategic

6. A notable exception was the Vietnam War, in which the U.S. military did not maintain a vigorous effort to neutralize North Vietnam's air defenses. Despite those defenses, the United States was able to conduct substantial air operations.

airpower point to numerous operations without ground forces in which the United States failed to achieve its aims. Examples include U.S. bombing of North Vietnam between 1969 and 1973 and cruise missile attacks in Afghanistan and Sudan in 1998 (Operation Infinite Reach). Some theorists have argued that the credible threat of attack by ground forces is a necessary component of a strategy focused on strategic air attacks. In recent years, the United States has often sought out local ground forces to assist in operations that do not involve U.S. ground forces, as it did in Afghanistan in 2002 and Libya in 2011 and as it has recently tried to do in Syria.

Tactical Airpower. Tactical airpower is a catchphrase for attempts to use air power in support of naval and ground forces, to assist in winning a conflict by amplifying the power of those forces (generally through attacks on an opponent's ground forces or naval vessels). Proponents of tactical airpower have historically favored short-range fighter aircraft (although bombers can be used in this role as well) and have regarded attempts to use air power to prosecute a separate air campaign as a diversion from the primary naval or ground campaign in a conflict.

Tactical airpower is often described as having a powerful synergy with ground forces. The reason is that methods for defending against ground forces make an opponent more vulnerable to attacks from the air, and methods for defending against attacks from the air make an opponent more vulnerable to ground forces. During the combat phase of Operation Iraqi Freedom, for example, DoD sources frequently illustrated that synergy when describing how U.S. ground forces could pressure Iraqi units to respond to their assaults. Hostile ground forces are more vulnerable to airpower when they are moving (because soldiers are not protected by field fortifications, vehicles travel in clusters on roads, and so forth), whereas they can sometimes resist aerial attack very effectively when they are stationary. But if they are trying to defend against mobile U.S. ground forces, hostile ground forces may need to move to protect key locations or to keep from being surrounded. In a similar vein, hostile ground forces can resist aerial attack much more easily if they are widely dispersed, but such dispersion makes it much harder for them to resist attack from other ground forces. Those synergies mean that combining tactical airpower with ground forces makes the application of tactical airpower much more effective than it would be otherwise. Tactical

airpower has also long been thought to be decisive in naval combat. Examples include the United States' experience in such World War II battles as Pearl Harbor and Midway and Britain's experience during the Falklands War.⁷

Although strategic and tactical airpower can be seen as competing approaches, U.S. air forces have used a hybrid approach during recent conflicts, attacking the sorts of targets favored by both groups of airpower proponents. Part of the reason is that modern U.S. air operations have generally been limited not by the number of air assets available (which would force the military to make choices between competing sets of targets) but instead by the amount and quality of information that can be gathered about prospective targets.

What This Chapter Covers

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

- Tactical aviation squadrons (33 percent); see page 86.
- Bomber squadrons (10 percent); see page 89.
- Airlift squadrons (15 percent); see page 92.
- Air refueling squadrons (14 percent); see page 96.
- Unmanned air systems (6 percent); see page 100.
- Other units and activities of the Department of the Air Force, such as intercontinental ballistic missiles and special-operations forces (21 percent); see page 103.

This chapter also examines one topic of special concern to the Air Force: the modern U.S. military's strike capability, which allows many different types of aircraft to attack and destroy a wide range of ground targets; see page 105.

7. The Navy and Air Force have had few opportunities to cooperate in large-scale naval battles since World War II, partly because of the absence of significant naval opponents since then and partly because of the capability and large quantity of U.S. naval aircraft. However, in recent years, the two services have developed an "Air-Sea Battle" concept to develop ways to integrate their forces in future conflicts.

Major Element of the Force Structure

Air Force Tactical Aviation Squadrons

	Total	Direct	Indirect	Overhead
A-10 Attack Aircraft Squadron				
Military Personnel per Unit	1,190	350	440	400
Annual Cost per Unit (Millions of 2017 dollars)	230	80	60	90
F-15 Fighter Aircraft Squadron				
Military Personnel per Unit	1,540	430	590	520
Annual Cost per Unit (Millions of 2017 dollars)	300	100	80	120
F-16 Fighter Aircraft Squadron				
Military Personnel per Unit	1,250	450	370	420
Annual Cost per Unit (Millions of 2017 dollars)	220	70	50	100
F-22 Fighter Aircraft Squadron				
Military Personnel per Unit	2,390	430	1,150	810
Annual Cost per Unit (Millions of 2017 dollars)	470	120	160	190
F-35 Fighter Aircraft Squadron^a				
Military Personnel per Unit	2,940	430	1,510	1,000
Annual Cost per Unit (Millions of 2017 dollars)	570	130	210	230

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

"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. 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.

Tactical aircraft, which make up the majority of the Air Force's combat fleet, consist of relatively small aircraft designed to engage in air-to-air combat (fighters), to strike targets on the ground (attack aircraft), or both (multirole aircraft, which the Air Force designates as fighters).

Current and Planned Structure. Between its active and reserve components, the Air Force plans to field the equivalent of about 101 notional 12-aircraft squadrons of tactical aviation in 2017, consisting of 185 attack aircraft (A-10s) and 1,019 fighter aircraft (294 F-15s, 537 F-16s,

157 F-22s, and 31 F-35s). The number of notional squadrons is expected to decline slightly in the next few years, mostly because of the planned retirement of the A-10 fleet, and then rise back to 100 squadrons by 2021 as production of F-35s increases. (For an example of the structure of a tactical aviation squadron, see Figure 4-1.) Tactical aviation accounts for about 33 percent of the Air Force's total operation and support funding.

Purpose and Limitations. In the past, most types of tactical aircraft were highly specialized for either air-to-air or air-to-ground combat. Today, those two forms of combat

Figure 4-1.

Aircraft and Personnel in Notional Air Force Tactical Aviation Squadrons

A-10 Attack Aircraft



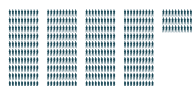
F-15 Fighter Aircraft



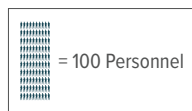
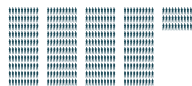
F-16 Fighter Aircraft



F-22 Fighter Aircraft



F-35 Fighter Aircraft



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

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

are still the main roles for the Air Force's tactical aviation fleet, but the most numerous type of aircraft in the fleet is a multirole aircraft (the F-16). Only a small portion of the tactical aviation fleet consists of purely attack aircraft (A-10s). Moreover, the Air Force's newest air-to-air fighter (the F-22) was designed with some ground-attack capability. The emphasis on multirole aircraft is likely to continue in the future with the introduction of the F-35, which was designed primarily to attack ground targets but has air-to-air capability as well. (The ground-attack mission is discussed in detail in the special-topic entry about strike capability on page 105.)

Despite their versatility, multirole fighters are most likely to be used for specific missions according to their individual strengths. For example, F-22 fighters are considered best suited to perform the most difficult air-to-air combat missions, and F-16s and F-35s are best suited to carry out ground-attack missions.

A-10 attack aircraft have almost no air-to-air combat ability; they were designed mainly to provide air support for friendly ground forces (by attacking hostile ground forces engaged in combat). The A-10 is noteworthy for its large cannon, a 30-millimeter (mm) Gatling gun designed for

attacking armored combat vehicles. (By comparison, other types of Air Force tactical aircraft have a 20 mm Gatling gun.) A-10s have good visibility from the cockpit and can fly relatively slowly, factors that give pilots an excellent view of the battlefield they are supporting. However, in recent years, the Department of Defense proposed retiring the A-10 fleet, arguing that those aircraft cannot withstand modern air defenses and are too expensive to maintain in the force.⁸

F-15 fighter aircraft come in several versions, including the C model (“Eagle”), intended mainly for air-to-air combat, and the E model (“Strike Eagle”), intended mainly for ground-attack missions. Until the introduction of the F-22, the F-15C was the Air Force’s primary vehicle for achieving air superiority in a theater of operations; it is still considered a highly capable fighter plane. The F-15E model is a relatively large strike aircraft—by the standards of tactical aviation—with a fairly long range and large capacity for carrying bombs and extra fuel.

F-16 fighters are the most numerous aircraft in the Air Force’s tactical aviation fleet. Originally designed as a low-cost air-to-air fighter that could operate only during daylight hours, the F-16 has evolved into a very effective multirole fighter that can operate at any time of the day. F-16s are relatively small and lightweight, with a correspondingly limited range and payload capacity. Part of the F-16 fleet has been upgraded with specialized equipment for attacking and suppressing enemy air-defense systems.

F-22 fighters are the Air Force’s newest aircraft designed specifically for air-to-air combat. They incorporate “stealth” design characteristics that make them difficult to observe with radar, and they are generally considered the most capable air-to-air combat aircraft being fielded by any nation. The F-22 was initially designed with limited

ground-attack capability, but the Air Force has been modifying the aircraft to improve that capability.⁹

The F-35A, the Air Force’s variant of the Joint Strike Fighter, is currently in production but is not slated to enter service until 2017 (the first few aircraft are now being used for testing and training). The F-35 is intended to replace the A-10 and F-16 as the Air Force’s main tactical strike platform. The largest improvement it provides is stealth; once fielded, it will give the Air Force a large fleet of hard-to-observe strike aircraft. The F-35A will also be capable of air-to-air combat, although not to the same degree as the F-22. Capabilities that the F-35A will not offer are a cannon comparable to that of the A-10 and the slow flying speed useful for finding and attacking ground targets.¹⁰

Past and Planned Use. The Air Force’s tactical aircraft have been used extensively in almost every conflict in which the United States has taken part since the 1940s. Likewise, most potential scenarios for future conflicts are likely to include the heavy use of tactical aviation. In general, tactical aircraft are responsible for securing U.S. control of the air (by destroying an opponent’s air forces and air defenses) and for supporting U.S. war efforts by attacking ground targets. In a few cases, such as the enforcement of “no-fly zones,” securing U.S. control of the air is the sole mission. That mission is overwhelmingly the responsibility of Air Force tactical aviation.

8. Through prohibitions in national defense authorization acts, the Congress has so far not allowed the Air Force to carry out plans to retire the A-10 fleet. In its 2017 budget request, the Air Force did not propose to retire the A-10 fleet as rapidly.

9. Generally speaking, for a combat aircraft to be stealthy, the bombs, missiles, and other ordnance it carries must fit inside an internal bay rather than being carried externally. The F-22’s internal bays are small relative to the size of many air-to-ground weapons (and the aircraft has no external mounting points for such ordnance). Thus, even after it has been upgraded for strike missions, the F-22 will carry smaller amounts of air-to-ground ordnance than other tactical fighters can.

10. Like the F-22, the F-35A will have to carry ordnance in a relatively small internal bay to retain its stealth characteristics, although the aircraft’s bay has been sized to accommodate most types of air-to-ground weapons. Unlike the F-22, the F-35 has external mounting points available, so if stealth is not necessary (as may be the case after hostile air defenses have been suppressed), the F-35 can carry an ordnance load comparable to that of other tactical aircraft.

Major Element of the Force Structure

Air Force Bomber Squadrons

	Total	Direct	Indirect	Overhead
B-52 Bomber Aircraft Squadron				
Military Personnel per Unit	3,830	1,310	1,220	1,300
Annual Cost per Unit (Millions of 2017 dollars)	740	270	170	300
B-1B Bomber Aircraft Squadron				
Military Personnel per Unit	3,980	940	1,680	1,350
Annual Cost per Unit (Millions of 2017 dollars)	810	270	230	310
B-2 Bomber Aircraft Squadron				
Military Personnel per Unit	8,660	2,120	3,600	2,940
Annual Cost per Unit (Millions of 2017 dollars)	1,840	670	490	680

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

"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 Air Force's bomber fleet has two main roles: delivering nuclear weapons and performing strikes with conventional weapons. (Those strike missions are discussed in more detail at the end of this chapter, and the nuclear weapons capability of the U.S. military is discussed in the next chapter.) Historically, the Air Force viewed the delivery of nuclear weapons as the primary purpose of long-range bombers, with conventional strikes as a secondary role. However, events since the collapse of the Soviet Union have generally increased the emphasis on conventional strike missions for the bomber fleet. One of the Air Force's three types of long-range bombers, the B-1B, is no longer capable of delivering nuclear weapons and is now devoted entirely to conventional strike missions. In addition, many of the Air Force's B-52s are slated for conversion to a conventional-only configuration to comply with the New START arms control treaty.

Current and Planned Structure. Between its active and reserve components, the Air Force plans to field the equivalent of about 9 notional 12-aircraft squadrons of long-range bombers in 2017, consisting of 45 B-52s, 51 B-1Bs, and 16 B-2s. It has no plans to change the number of notional squadrons through 2021. (For an

example of the structure of a bomber squadron, see Figure 4-2.) Bombers account for about 10 percent of the Air Force's total operation and support funding.

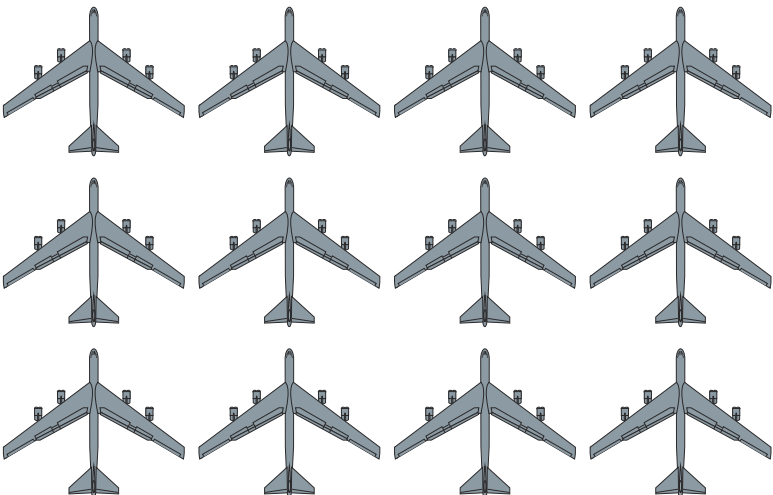
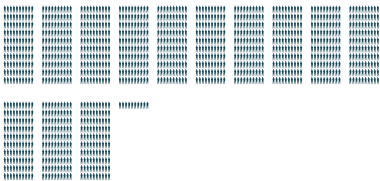
Purpose and Limitations. Unlike tactical aviation, bombers are large aircraft that can travel long distances and loiter above an area for an extended period without refueling (characteristics referred to as endurance) and can deliver a large payload of munitions. Those capabilities make bombers especially well-suited to performing strike missions—their long range allows them to be based relatively far from the theater of operations (freeing up space in closer air bases for shorter-range aircraft); their loitering time lets them remain in an area longer, allowing them to respond more rapidly to requests from ground forces for air support; and their large load of munitions enables them to provide substantial air support before needing to return to bases to rearm.

The enormous weapons payload of the bomber fleet allows it to contribute a very substantial share of the U.S. military's capability to strike targets, despite its relatively small numbers. For example, a B-1B can carry 84 500-pound bombs in a single sortie, whereas an F-16

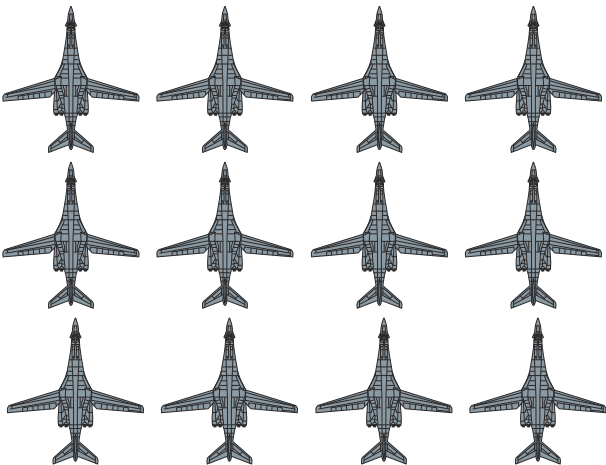
Figure 4-2.

Aircraft and Personnel in Notional Air Force Bomber Squadrons

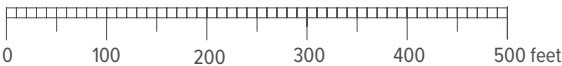
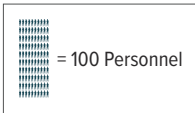
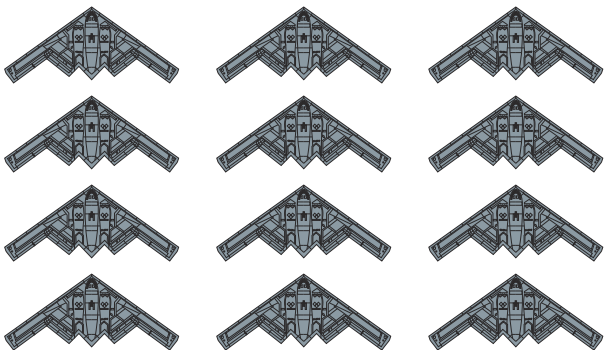
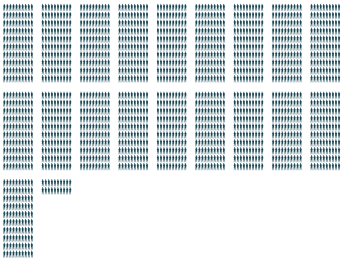
B-52 Bombers



B-1B Bombers



B-2 Bombers



Source: Congressional Budget Office, using data from the Department of Defense.
All units presented here are notional squadrons of 12 aircraft (actual squadrons vary in size).

could carry 12, although an F-16 typically flies more sorties per day and thus could deliver those 12 bombs more often. However, the Air Force can capitalize on bombers' large payloads only on missions in which enough targets can be identified to use the number of weapons carried.

B-52s are the oldest of the Air Force's bombers, dating to the 1960s.¹¹ The Air Force plans to keep them in service at least through 2040. B-52s have the ability to carry a great variety of weapons and have the longest unrefueled endurance of the Air Force's bomber fleet. Because of their age, however, B-52s would probably have trouble penetrating modern air-defense systems and thus are best suited to operating in undefended airspace or to delivering cruise missiles from outside defended airspace.¹²

The B-1B fleet is younger than the B-52 fleet, having been built in the 1980s. Although B-1Bs were designed to deliver nuclear weapons, the United States modified them to remove that capability in order to comply with arms control treaties. Today, B-1Bs are intended only to perform conventional strikes. Although they incorporate some features that make them harder to observe than B-52s, they are not considered as capable of surviving in hostile airspace as the more recent B-2s. Nevertheless, the Air Force has used B-1Bs to conduct air strikes in hostile airspace in recent operations—the B-1B fleet delivered more bombs in Operation Iraqi Freedom than any other type of aircraft—albeit often with support from other aircraft.

B-2s are the newest and most modern U.S. bombers. Built in the late 1980s and the 1990s, they are notable for the extensive stealth design features that help them

penetrate hostile airspace undetected, and they are considered more difficult to target and attack than other U.S. bombers. However, unlike with other bombers, the Air Force is reluctant to deploy B-2 squadrons to bases overseas, preferring to have them conduct strikes directly from their base in Missouri. Two reasons, according to the Air Force, are the planes' demanding maintenance requirements (associated with the special radar-absorbing coating on the outside of the aircraft) and the need for atmospherically controlled hangars. Nevertheless, the B-2 can be deployed overseas, if necessary, and has been on occasion. In practice, flying most missions from U.S. bases means that B-2 sorties are extremely long and demanding, which limits the number of sorties that the small B-2 fleet (16 aircraft) can conduct to those in which stealth is most essential.

Past and Planned Use. Air Force bombers have been employed with increasing frequency in modern U.S. conflicts. Their use was relatively limited in Operation Desert Storm—B-52s delivered cruise missiles during the initial wave of strikes and conducted some bombing missions afterward—but at the time, the Air Force still saw bombers as primarily dedicated to nuclear missions. Since then, with the collapse of the Soviet Union, bombers have been used in larger roles in more conflicts. For example, the B-1B fleet was first employed for conventional air strikes during the 1990s enforcement of no-fly zones over Iraq; later it was used during operations in Kosovo, in Operations Enduring Freedom and Iraqi Freedom, and in the subsequent occupations of Afghanistan and Iraq. The B-2 fleet was first employed for conventional strikes in Kosovo and was also used during Operations Enduring Freedom and Iraqi Freedom. (It is not clear whether B-2s played a role in the subsequent occupations of Afghanistan and Iraq.) B-52s have often been mentioned as being particularly useful during the occupations of Afghanistan and Iraq because their large fuel load allows them to remain on station, waiting for requests for fire support, for long periods.

11. The earliest models of the B-52 were introduced in the 1950s, but those models have since been retired.

12. Although B-52s have sometimes been used to launch cruise missiles from outside heavily defended airspace, that role is generally performed by the Navy, which has extensive capability to fire Tomahawk cruise missiles from long range.

Major Element of the Force Structure

Air Force Airlift Squadrons

	Total	Direct	Indirect	Overhead
C-130 Cargo Aircraft Squadron				
Military Personnel per Unit	2,120	800	590	720
Annual Cost per Unit (Millions of 2017 dollars)	360	110	80	170
C-5 Cargo Aircraft Squadron				
Military Personnel per Unit	2,430	780	820	830
Annual Cost per Unit (Millions of 2017 dollars)	430	130	110	190
C-17 Cargo Aircraft Squadron				
Military Personnel per Unit	1,390	450	460	470
Annual Cost per Unit (Millions of 2017 dollars)	270	90	60	110

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

"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 Air Force's fleet of cargo aircraft exists to "airlift" (transport by air) personnel and equipment between or within theaters of operations. Intertheater transport is generally conducted by the larger, longer-range, and more expensive C-5 and C-17 aircraft. Intratheater transport is usually performed by the smaller, shorter-range, and less expensive C-130 aircraft, although the C-17 was designed to operate from shorter runways, making it an option for transport missions between theaters as well.

Current and Planned Structure. Between its active and reserve components, the Air Force plans to field the equivalent of about 42 notional 12-aircraft squadrons of cargo aircraft in 2017, consisting of 292 C-130s, 39 C-5s, and 172 C-17s. That total number is planned to increase slightly, to 43 squadrons, by 2021. (For an example of the structure of such a squadron, see Figure 4-3 on page 94.) Cargo aircraft account for about 16 percent of the Air Force's total operation and support funding.

To supplement its airlift capabilities, the Air Force runs a program called the Civil Reserve Air Fleet (CRAF). Under that program, U.S. civilian air carriers that operate certain models of aircraft receive preferential access to air

transport contracts with the Department of Defense; in return, those carriers allow the Air Force to use their aircraft for military transport missions in times of conflict. The CRAF program ensures that the Air Force has a large reserve of transport aircraft available in situations in which it may need more airlift capability than its own fleet can provide. Most eligible U.S. civilian airlines participate in the CRAF program, which generally gives the Air Force access to an additional 400 intertheater transport aircraft and 100 intratheater transport aircraft (although the numbers vary over time).

Because CRAF aircraft are designed for civilian use, they are not suitable for certain military missions, such as transporting the largest armored vehicles. But for some purposes, such as carrying passengers, CRAF aircraft are frequently a better alternative in times of conflict than the Air Force's transport aircraft.

Purpose and Limitations. The primary advantage of moving cargo and passengers by air is that it is much faster than transport by sea. In many scenarios for possible conflicts, the use of air transport would let U.S. forces reach a theater of operations within a day, rather than the weeks that sea transport might require. In addition,

aircraft can move supplies to almost any portion of the globe, whereas many theaters of operations (such as Afghanistan) are far from the sea and would require additional land transportation to move personnel and cargo from ports to the theater. Even in an ongoing operation, the speed and responsiveness of air transport can be extremely valuable in providing logistics support—for example, being able to bring in crucial supplies on a day's notice is preferable to needing a month's notice.

To minimize deployment times, virtually all U.S. military personnel are deployed to and from theaters of operations by air. Moving cargo, however, by air has two major disadvantages. First, cargo aircraft are much more expensive to purchase and operate than the equivalent amount of sea transport capacity. Second, although air transport is less subject to geographical constraints than sea transport, it can be subject to infrastructure constraints, such as limited numbers or quality of airfields. Because the United States has a large fleet of cargo aircraft (and has access to an even larger fleet through the CRAF program) but often operates in regions with poor infrastructure, the Air Force's ability to airlift equipment is frequently limited not by how many cargo aircraft it has but by the quality and quantity of airports available in the theater of operations. Many countries and regions do not have enough airports with the capacity to accommodate the flow of large cargo aircraft the military might need. Often, there are few airports, with small numbers of airstrips of insufficient size or strength and limited facilities for cargo operations. The Air Force has engineering units that can improve the capacity of those airports over time. Nevertheless, in most potential conflicts outside highly developed areas (such as Western Europe, Japan, or South Korea), the capacity of local airports tends to be the factor that limits cargo volume.¹³

Past and Planned Use. The Air Force's cargo aircraft have been employed extensively in every U.S. conflict in the modern era. Notable examples include the use of those aircraft to rapidly deploy elements of the 82nd Airborne Division to Saudi Arabia in 1990 after the Iraqi

invasion of Kuwait and the parachuting of special-forces personnel into Afghanistan in 2001 during the early phases of U.S. operations there. The U.S. military has relied especially heavily on air transport throughout its operations in Afghanistan because that country is landlocked, with the closest access to seaports being in neighboring Pakistan.

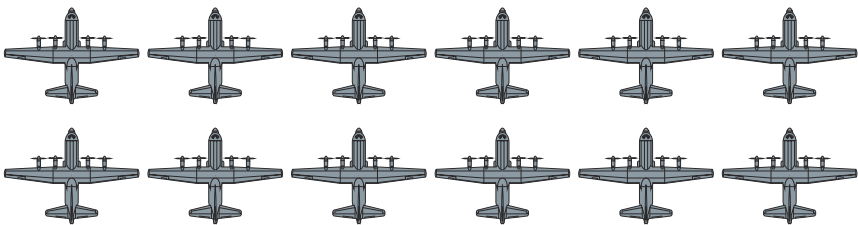
Most of DoD's potential scenarios for future conflicts envision heavy reliance on air transport. DoD has set several goals over the years for the amount of air transport capability it needs. The analytic measure generally used to assess the capacity of the airlift fleet is ton-miles per day (the ability to transport 1 ton of cargo 1 mile every day). That measure can be difficult to translate into numbers of aircraft because it depends greatly on the characteristics of a given scenario.¹⁴ In general, however, because the U.S. military's ability to transport cargo to a theater of operations is more likely to be limited by the infrastructure in that theater than by the number of aircraft in the Air Force's inventory, a larger inventory of cargo aircraft would allow the United States to support more operations simultaneously or to reduce reliance on CRAF aircraft. Conversely, a smaller inventory of cargo aircraft would either lessen the Air Force's ability to support large operations in multiple theaters simultaneously or require greater reliance on CRAF aircraft.

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13. In cases in which a friendly government seeks U.S. protection from hostile neighbors, it is possible to improve infrastructure during peacetime in anticipation of a possible conflict. For example, Saudi Arabia cooperated with the United States to improve its infrastructure for sea and air transport in the 1980s and 1990s so U.S. forces could respond more effectively if the country was threatened.
 14. Broadly speaking, scenarios involving more distant locations require more transport aircraft to move a force of a given size in a given amount of time. Thus, the number of transport aircraft needed to respond to a crisis in, say, Southeast Asia would be larger than the number needed to respond to a crisis in Latin America. As a result, the number of transport aircraft that the U.S. military needs depends critically on where DoD foresees crises emerging.

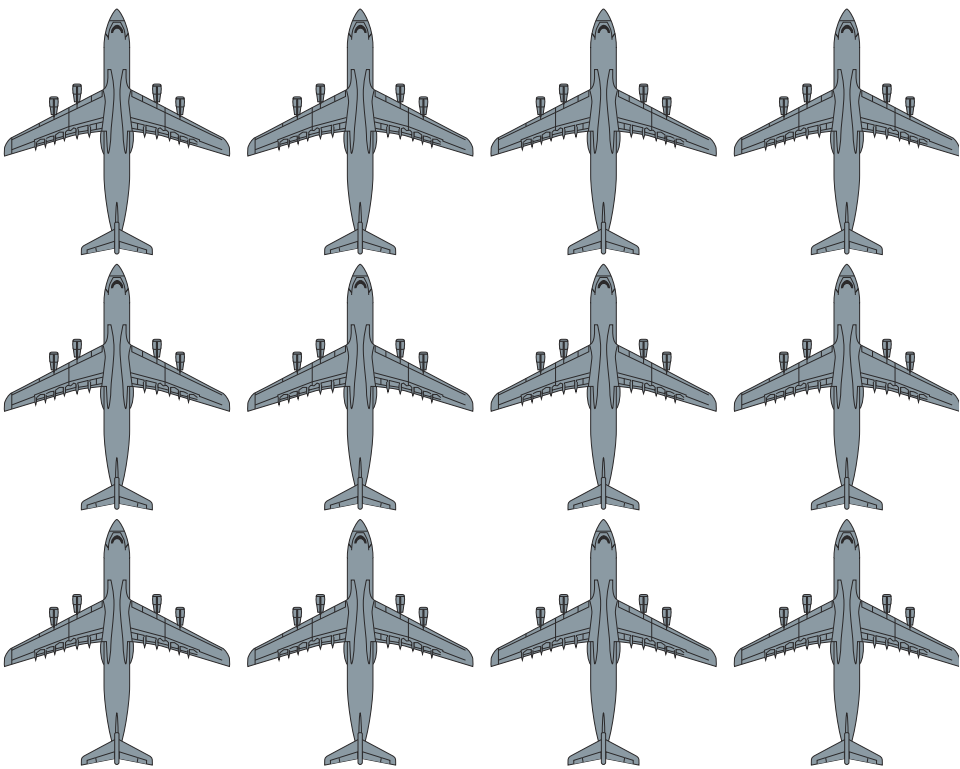
Figure 4-3.

Aircraft and Personnel in Notional Air Force Airlift Squadrons

C-130 Cargo Aircraft



C-5 Cargo Aircraft



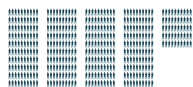
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Figure 4-3.

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Aircraft and Personnel in Notional Air Force Airlift Squadrons

C-17 Cargo Aircraft



Source: Congressional Budget Office based on data from the Department of Defense.

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

Major Element of the Force Structure

Air Force Air Refueling Squadrons

	Total	Direct	Indirect	Overhead
KC-135 Tanker Aircraft Squadron				
Military Personnel per Unit	1,930	610	660	650
Annual Cost per Unit (Millions of 2017 dollars)	360	110	90	150
KC-10 Tanker Aircraft Squadron				
Military Personnel per Unit	3,140	900	1,170	1,060
Annual Cost per Unit (Millions of 2017 dollars)	580	180	160	250
KC-46 Tanker Aircraft Squadron^a				
Military Personnel per Unit	1,070	640	70	360
Annual Cost per Unit (Millions of 2017 dollars)	180	80	10	80

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

"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. Because KC-46s 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 tanker fleet exists primarily to refuel the Air Force's other aircraft while they are in flight. Although the fleet was originally established to refuel strategic bombers on long-range nuclear strike missions into the Soviet Union, tankers have proved valuable for refueling tactical aircraft in almost every U.S. operation of the post-Cold War era. In addition, all of the Air Force's tankers are capable of transporting cargo as a secondary mission.

Current and Planned Structure. Between its active and reserve components, the Air Force plans to field the equivalent of about 36 notional 12-aircraft squadrons of tanker aircraft in 2017, consisting of 357 KC-135s, 54 KC-10s, and 16 KC-46s. The number of notional squadrons is set to remain roughly steady through 2021 as KC-46 tankers are introduced and some KC-10s are retired. (For an example of the structure of a tanker squadron, see Figure 4-4 on page 98.) Tanker aircraft account for about 14 percent of the Air Force's total operation and support funding.

Purpose and Limitations. Without aerial refueling, tactical aircraft would typically have ranges of only a few

hundred miles, so they would have to be based close to their areas of operations, would have less ability to loiter in a location for very long during a mission, and in some cases would have to reduce the weight of the weapons they carried. With aerial refueling, by contrast, the endurance (range and loitering time) of tactical aviation is limited largely by pilots' endurance, and aircraft can be fully loaded with weapons. Those differences increase the utility of tactical aircraft during a conflict in various ways:

- In many theaters, infrastructure constraints limit how many tactical aircraft the United States can deploy near an area of operations. Aerial refueling expands the number of bases from which tactical aircraft can reach a given area, allowing the United States to use more tactical aircraft in a conflict than it could otherwise.¹⁵

15. Similarly, naval aircraft operating from carriers would be unable to reach areas of operations far inland, such as Afghanistan, without aerial refueling by Air Force tankers. The Navy currently relies on a system known as "buddy tanking" that uses some of the fighter aircraft in a carrier air wing to refuel other fighter aircraft. However, using tactical aircraft in that way offers a much more limited ability to expand the range of tactical aircraft.

- An aircraft's fuel consumption increases when it carries a heavy load of weapons; aerial refueling can reduce the need to make trade-offs between the number of weapons an aircraft can carry and the distance it can carry them.¹⁶
- In many types of missions, it is beneficial for tactical aircraft to be able to loiter, on call, until needed so they can respond more rapidly to requests from ground forces for air support. Aerial refueling can enhance the U.S. military's effectiveness in those types of missions by allowing tactical aircraft to loiter for longer periods.
- In some large theaters, tactical aircraft would be unable to reach distant targets at all without aerial refueling.

Bombers are larger than tactical aircraft and have longer ranges, but aerial refueling offers some of the same benefits to bomber missions. For example, B-2 bombers require specialized basing infrastructure that makes them difficult to deploy overseas. But with aerial refueling, B-2 bombers can strike targets anywhere in the world from their base in Missouri.

The Air Force's transport aircraft generally do not require aerial refueling, although it is possible and might improve the efficiency of airlift operations in some situations. Aerial refueling also helps U.S. deployments to overseas theaters indirectly by allowing some shorter-range aircraft to "self-deploy" (be flown themselves to the theater) rather than needing to be carried there on a cargo plane or ship.

One limitation of the current aerial refueling fleet is that its tankers are large and slow with few defenses. During a conflict in which the United States had not yet neutralized an opponent's fighter aircraft, tankers would be vulnerable to attack. In practice, however, the United States has not faced any major aerial threats since the end of the Cold War, so that limitation has not been significant.

Another drawback of the U.S. tanker fleet results from the use of two different, and incompatible, methods of

aerial refueling. The Navy and Marine Corps employ "probe and drogue" refueling systems on their tankers, fixed-wing aircraft, and rotary-wing aircraft, whereas the Air Force employs a "boom" refueling system on its tankers, tactical aircraft, and bombers.¹⁷ Many Air Force tankers are also equipped to allow for probe-and-drogue refueling, so they can refuel tactical aircraft from the Navy and Marine Corps during operations. However, the need to accommodate both systems in joint operations requires the Air Force to equip some tankers to make them capable of both methods—at a higher cost than would be necessary otherwise—and to coordinate to ensure that the correct types of tankers are assigned to support the correct types of aircraft.

Past and Planned Use. The Air Force's tanker aircraft have been used extensively in every major U.S. conflict since the 1960s. Tankers were especially important in operations such as the invasion of Afghanistan, in which the United States had very limited access to air bases near the area of operations, so aerial refueling was vital to enable the Air Force's tactical aircraft and the Navy's carrier aircraft to attack targets in the theater. Many of the Department of Defense's potential scenarios for future conflicts also envision heavy reliance on aerial refueling.

Although the Air Force's tanker fleet is large, it tends to be quite old. The bulk of the fleet consists of KC-135s built in the 1950s and 1960s. (Until the end of the Cold War and Operation Desert Storm in 1991, the Air Force mainly saw tankers as useful for supporting a nuclear attack on the Soviet Union rather than for supporting tactical aviation in ongoing conflicts.) Leaders of the Air Force have often stated that KC-135s are too old and need to be replaced immediately, but many analysts have suggested that those tankers are in good enough shape to continue serving for many years. Consequently, the major issue relating to the future of the tanker fleet is not its size but the speed with which the Air Force should replace the KC-135 with the new KC-46, which is in development.

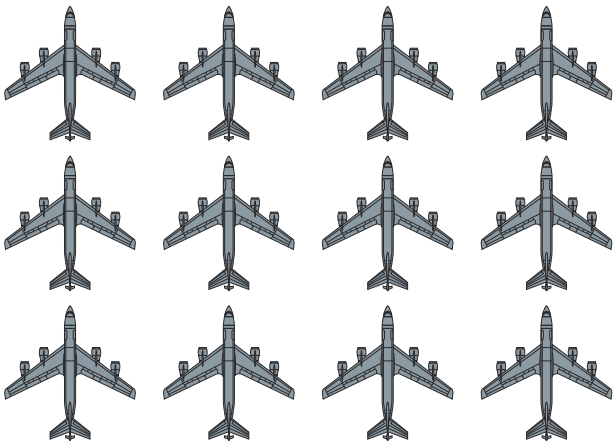
16. For example, one specific trade-off is that most tactical aircraft can carry external fuel tanks to extend their range, but those tanks add weight to the aircraft, reduce the number of weapons it can carry, and decrease its in-flight performance. It is generally considered preferable to minimize the number and size of external fuel tanks, and aerial refueling often allows that.

17. In probe-and-drogue systems, the tanker tows a hose with a receptacle at the end, and the receiving aircraft has a probe that fits into the receptacle. Such systems are relatively lightweight, can be fitted on smaller aircraft, and can refuel more than one small plane at a time. They are also the only option for refueling rotary-wing aircraft. In boom systems, by contrast, the tanker has a boom that fits into a receptacle on the receiving aircraft. Those systems are relatively heavy, are only fitted on larger tankers, and can refuel just one aircraft at a time. However, they also transfer fuel more quickly and are the preferred method for refueling large planes, such as bombers or cargo aircraft.

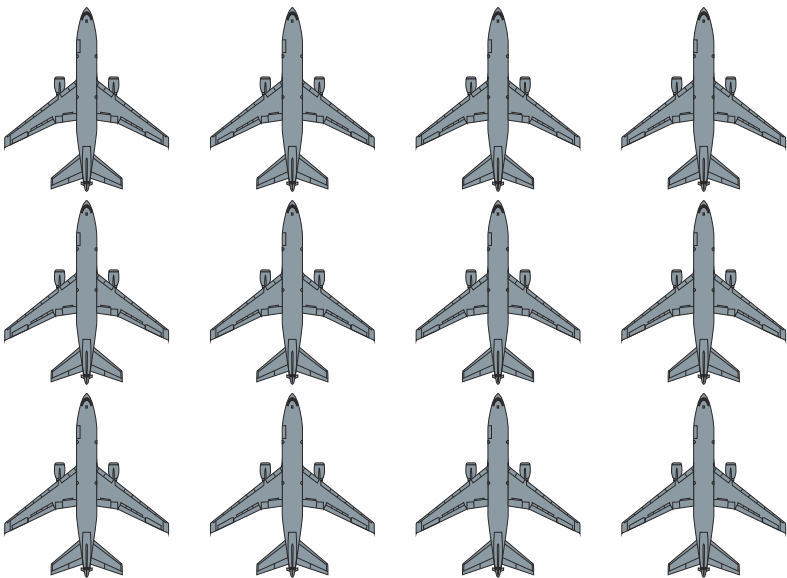
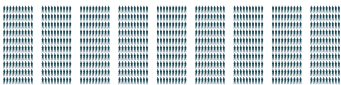
Figure 4-4.

Aircraft and Personnel in Notional Air Force Air Refueling Squadrons

KC-135 Tankers



KC-10 Tankers



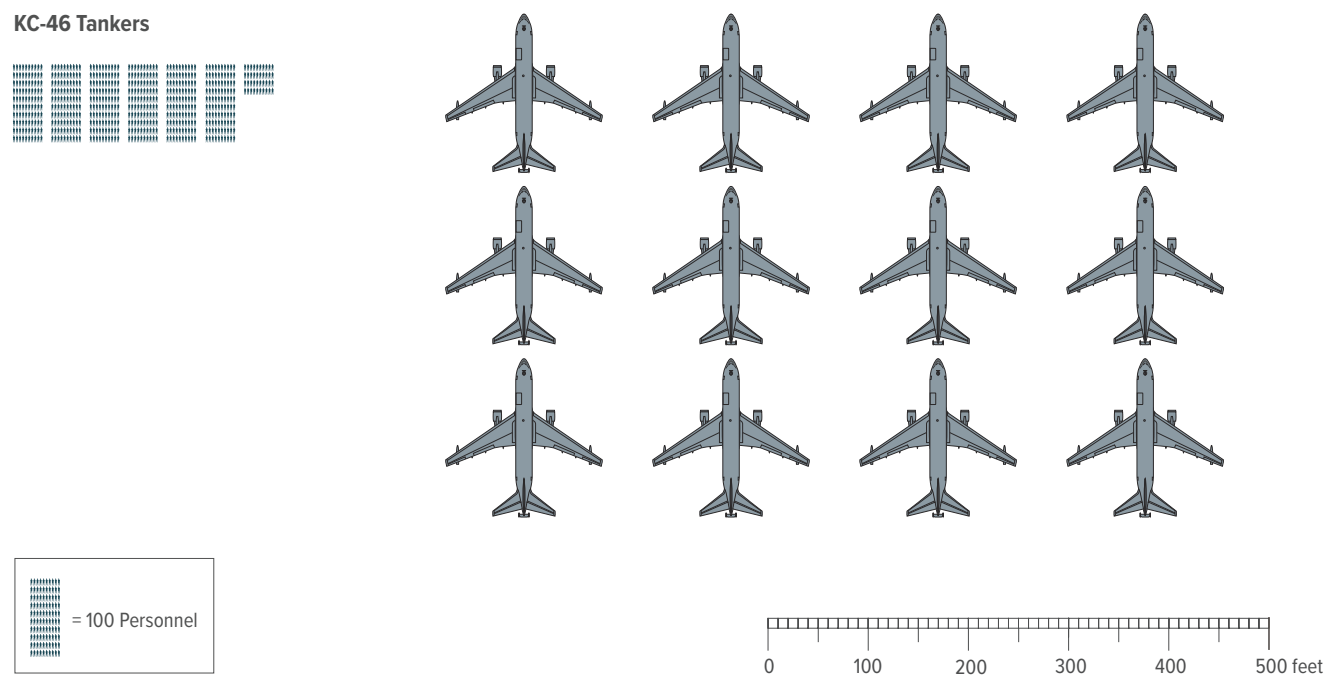
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Figure 4-4.

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Aircraft and Personnel in Notional Air Force Air Refueling Squadrons

KC-46 Tankers



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

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

Major Element of the Force Structure

Air Force Unmanned Air System Squadrons

	Total	Direct	Indirect	Overhead
MQ-1 "Predator" Squadron				
Military Personnel per Unit	260	90	80	90
Annual Cost per Unit (Millions of 2017 dollars)	70	40	10	20
RQ-4 "Global Hawk" Squadron				
Military Personnel per Unit	1,840	470	750	630
Annual Cost per Unit (Millions of 2017 dollars)	440	190	100	140
MQ-9 "Reaper" Squadron				
Military Personnel per Unit	920	340	270	310
Annual Cost per Unit (Millions of 2017 dollars)	160	50	40	70

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

"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 Department of Defense uses unmanned air systems (UASs)—also known as unmanned aerial vehicles or drones—mainly for surveillance and intelligence gathering. Each of the military departments operates a variety of unmanned aircraft, but the Air Force's models tend to be larger and to possess greater endurance and payload capacity.

Current and Planned Structure. Between its active and reserve components, the Air Force plans to field about 75 notional 12-aircraft UAS squadrons in 2017. Those aircraft consist of 110 MQ-1s, 36 RQ-4s, and 279 MQ-9s. The number of notional squadrons is expected to decline to 30 by 2021 as the Air Force retires its MQ-1s. (For an example of the structure of a UAS squadron, see Figure 4-5.) Unmanned air systems account for about 6 percent of the Air Force's total operation and support funding.¹⁸

In addition to those aircraft, the Air Force has acknowledged that it operates at least one other type of UAS, a

stealthy aircraft called the RQ-170. The quantities and characteristics of that system remain classified.

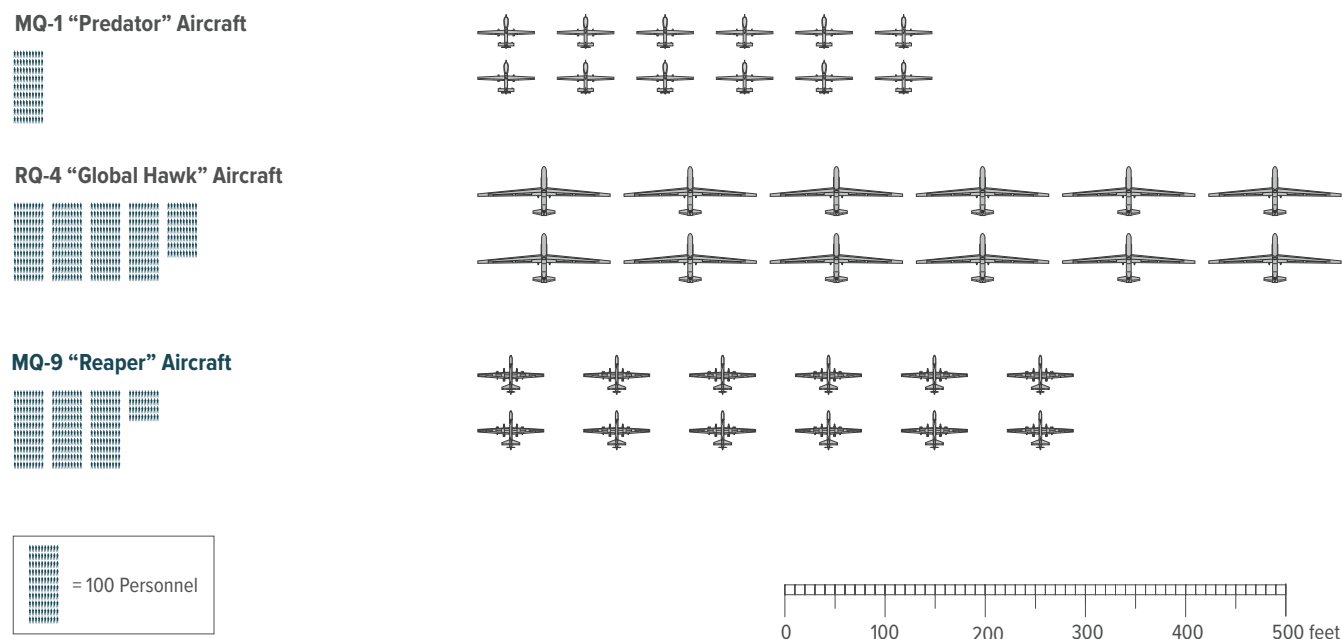
Purpose and Limitations. The Air Force's unmanned aircraft are used primarily for surveillance. In addition, MQ-1s and MQ-9s can be armed with a few missiles or small bombs to conduct limited strike operations. An example of that capability is the United States' well-publicized use of unmanned aircraft to kill suspected terrorists in Pakistan, Yemen, Somalia, and other countries. (Little information about such attacks has been released publicly, but it appears that many of those attacks have been conducted by the Central Intelligence Agency rather than by DoD. Those drones form a separate UAS fleet from the Air Force's and are not covered in this report.)

Today's drones have several advantages: They are generally less expensive to buy than manned aircraft, they can fly very long missions without being limited by the endurance of human aircrews, and they can operate without putting a pilot at risk of injury, capture, or death. Disadvantages of drones include their vulnerability to air defenses and the lack of a human onboard to address split-second issues in ways that might not be possible by a

18. For more information about such systems, see Congressional Budget Office, *Policy Options for Unmanned Aircraft Systems* (June 2011), www.cbo.gov/publication/41448.

Figure 4-5.

Aircraft and Personnel in Notional Air Force Unmanned Air System Squadrons



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

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

remote operator. Not all of those factors are inherent to unmanned systems; rather, they have resulted from the state of available technology and from specific choices about what capabilities the military needed during the past decade and a half—the span over which most of today's drones were purchased.

If desired, it should be possible to design a drone with fewer of those disadvantages. However, improved capability almost always means higher cost. For example, current unmanned aircraft are generally less expensive than manned aircraft largely because their airframes were designed for fairly low-performance, undemanding flight; basically, they need to be able to carry a package of sensors (and, in many cases, a few weapons) to a target area and have enough fuel to loiter there for extended periods. They are not expected to have high speed and maneuverability, to carry heavy payloads, or to operate in defended airspace like many manned combat aircraft—characteristics that can significantly increase costs. Unmanned aircraft with those more advanced capabilities have been proposed, including an unmanned version of a new long-range bomber. But such advanced drones are not expected to be low-cost aircraft.

In their current configuration, most of the Air Force's unmanned aircraft are intended to operate mainly in undefended airspace and would generally not be capable of surviving engagements with modern air defenses. Thus, they would have limited utility in a high-intensity conventional conflict; they are most useful in low-intensity and unconventional conflicts, such as the occupations of Iraq and Afghanistan and counterterrorism missions.

According to publicly available accounts, drones have been very effective at attacking small numbers of targets in counterterrorism operations. However, their use by the United States to kill suspected terrorists has generated public controversy (in some cases because drone strikes have killed people other than the intended targets). In particular, the use of unmanned aircraft to attack targets in countries with which the United States is not at war (such as Pakistan) risks generating significant hostility to the United States in those countries. In addition, the strategic utility of targeted killings is not clear—many organizations are resilient enough to quickly replace leaders and other personnel who are killed, so occasionally eliminating members of an organization may not significantly

reduce its long-term effectiveness. At the same time, however, the security measures that many terrorist groups appear to take to avoid drone strikes also degrade the groups' effectiveness in various ways. For example, senior leaders who are in hiding cannot freely direct their subordinates because such communication puts them at risk of being detected and killed.¹⁹

Past and Planned Use. The United States has had small numbers of unmanned aircraft for many decades, but the widespread deployment of highly capable unmanned air systems is a fairly recent phenomenon. The MQ-1 and RQ-4 were developed in the 1990s and fielded in the 2000s, and the MQ-9 was developed in the 2000s and fielded in the 2010s. Despite their recent introduction, those unmanned aircraft have been used heavily in recent operations, particularly in the war on terrorism and the occupations of Iraq and Afghanistan. Although efforts to arm unmanned surveillance aircraft began before the invasions of Afghanistan and Iraq, the current widespread practice of arming drones to attack ground targets appears to have evolved from their extensive use in those conflicts. Mounting weapons on an unmanned surveillance aircraft has proved to be particularly useful in counterinsurgency and counterterrorism operations because it has enabled DoD to attack small, mobile targets as soon as they are detected and identified without having to summon another aircraft to carry out the attack (such "fleeting" targets would often be lost before the strike aircraft could arrive). For missions requiring substantial

firepower, however, the strike capacity offered by today's drones, though useful, is minor compared with that of tactical aircraft or bombers.

For the immediate future, unmanned air systems will probably continue to be particularly useful in two types of situations. First, as part of U.S. counterterrorism operations, DoD is likely to remain responsible for monitoring many different theaters over a very large area for suspected terrorists, insurgents, and militants. Having access to large numbers of relatively low-cost and long-duration aerial sensors, such as those provided by unmanned aircraft, has proved extremely useful in that role. Second, in higher-intensity operations, the Air Force's unmanned aircraft have the potential to increase the rate at which ground targets can be detected and identified. That potential, when combined with the increased capacity to strike targets that has resulted from the widespread adoption of precision-guided munitions (as described at the end of this chapter), could increase the rate at which targets can be destroyed.

For the more distant future, the Air Force is likely to continue pursuing advances in the capabilities of drones, particularly their ability to face the advanced air defenses postulated in some of DoD's planning scenarios. (The Navy is already grappling with that issue as it tries to field a drone that can operate from aircraft carriers. It faces a choice between a relatively inexpensive unmanned aircraft, akin to the Air Force's MQ-9, that is optimized for surveillance and a more advanced system that is capable of penetrating advanced air defenses and conducting both surveillance and strike missions.) Unmanned aircraft may also be considered an option as the Air Force begins to define requirements for its next-generation air superiority aircraft, which is tentatively slated to be fielded in the 2030s.

19. As an example, Mohammed Omar, former leader of the Taliban, was dead for two years before his death became widely known, even to some members of the Taliban itself. Possibly because of the threat of drone strikes, Omar had been secluded from contact with his organization (and the rest of the world) as a security measure. Such extreme seclusion prevents a leader from freely directing and controlling an organization.

Major Element of the Force Structure**Other Department of the Air Force Units and Activities**

	Total	Direct	Indirect	Overhead
Minuteman III Missile Squadron^a				
Military Personnel per Unit	2,040	690	650	690
Annual Cost per Unit (Millions of 2017 dollars)	380	130	90	160
RED HORSE Construction Engineers				
Total Military Personnel	19,340	12,780	0 ^b	6,560
Total Annual Cost (Millions of 2017 dollars)	2,170	660	0 ^b	1,520
Air Force Special-Operations Forces				
Total Military Personnel	24,070	15,900	0 ^b	8,170
Total Annual Cost (Millions of 2017 dollars)	3,730	1,840	0 ^b	1,890
Rest of the Air Force				
Total Military Personnel	49,010	32,370	0 ^b	16,630
Total Annual Cost (Millions of 2017 dollars)	10,000	6,160	0 ^b	3,840

"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. Squadron of 50 Minuteman missiles.

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 majority of the Air Force's units are connected with aircraft squadrons, the service includes a number of other units with special capabilities that are not directly related to aircraft squadrons. Together, those units account for 21 percent of the Department of the Air Force's operation and support funding.

Minuteman III ballistic missiles armed with nuclear warheads are the Air Force's land-based contribution to the U.S. nuclear deterrent (in addition to the air-based contribution provided by long-range bombers capable of carrying nuclear weapons). Land-based ballistic missiles are generally considered to have the fastest response time of any system for delivering nuclear weapons, and they are deployed in dispersed, hardened silos that would require an adversary to use a relatively large number of nuclear weapons to destroy the entire Minuteman force.

Bombers, by contrast, can be vulnerable to air defenses, and ballistic missile submarines can be attacked by ships or other submarines before they launch their missiles or while they are in port.

As with all strategic nuclear forces, the number of Minuteman missiles is generally determined by national nuclear policy and by the outcomes of arms control negotiations rather than by the considerations that typically apply to other military units. Such agreements can affect not only the number of ballistic missiles that the Air Force deploys but also the number of warheads on each Minuteman missile. The United States has an inventory of 450 deployed Minuteman III missiles, but current plans call for reducing that number to 400 by 2018 to comply with the New START treaty.

Air Force **construction engineers**, known as RED HORSE (Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers) squadrons, provide a variety of engineering services to the Air Force. In the past, they have contributed to the success of U.S. military operations in distant theaters by building or improving air bases in places with poor infrastructure and few basing options. Because the United States has often intervened in countries with limited infrastructure—and because the deployment of U.S. forces can place great demands on the ports and air bases that receive them—the ability to improve that infrastructure has typically been highly valuable, despite its relatively low visibility. The majority of RED HORSE personnel are in the Air Force's reserve component.

The Air Force also maintains **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, and 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 49,000 military personnel and \$10.0 billion a year are devoted to **units and activities of the Department of the Air Force other than those described in this chapter**. They include a variety of smaller organizations providing capabilities that are neither aircraft squadrons nor organized in support of aircraft squadrons. An important example is the Air Force's space infrastructure, which includes the service's constellations of Global Positioning System communications, weather, and missile-warning satellites. Other examples include the Air Force's contributions to various joint commands and defensewide organizations, as well as some command-and-control and intelligence functions.

Special Topic

The U.S. Military's Strike Capability

Many of the military assets available to the Department of Defense can be thought of as almost generic tools able to attack and destroy a wide variety of enemy targets. That ability, called strike capability, is a marked departure from past practice. Previously, U.S. forces were more specialized in their ability to attack a given type of target, and that specialization often restricted their ability to perform more than a few specific types of missions. Today, the array of systems that exist to identify and destroy targets provides DoD with a unified strike capability that, in most conflicts, is limited more by the ability to gather information about hostile targets than by any other factor.

The full array of U.S. strike assets includes cruise missiles (Air Force and Navy); artillery, rockets, and attack helicopters (Army and Marine Corps); bombers (Air Force); fixed-wing tactical aircraft (Air Force, Navy, and Marine Corps); and armed unmanned air systems (Air Force and Army). To receive information about targets, those assets depend on a vast network of sensors and communications—everything from requests by infantry for fire support to imagery from satellites. The ability to gather information about potential targets and communicate it to versatile strike assets is at the heart of the current U.S. strike system—allowing military commanders to treat a theater of operations as essentially a single list of targets and a single list of assets available to destroy those targets. The two lists can be centrally managed by commanders to match the “supply” of strike assets with the “demand” of targets in a single system that will rapidly destroy all available targets.

The key developments that have produced the modern strike system have narrowed the differences not only between types of strike assets (particularly aircraft) but also between types of targets, thus greatly improving the capability of U.S. forces. As a result, in most recent conflicts, the United States has been able to destroy all known fixed infrastructure targets within the first few days of an operation. Subsequent attacks could then focus almost entirely on supporting ground forces, preventing previously destroyed targets from being rebuilt (“regenerated,” in technical parlance), and attacking new targets that were not identified earlier. All of those activities depend crucially on intelligence and surveillance, which

is why U.S. strike capability today is often constrained more by the ability to gather intelligence than by the ability to deliver weapons.

Developments That Have Reduced the Differences Between Types of Strike Assets. The evolution of the strike system has been particularly dramatic in the case of aircraft, which provide the majority of U.S. strike capability. Historically, tactical aircraft and bombers faced extreme challenges in attacking targets on the ground. Broadly speaking, they needed to be able to operate in potentially hostile airspace, possibly far from friendly bases; locate targets that might be moving or obscured; and attack them with relatively inaccurate weapons.

Those challenges led to the creation of highly specialized aircraft, capable of performing only a small range of tasks, as well as to highly specialized missions, reflecting the different problems involved in attacking different kinds of ground targets. As a result, there was little commonality between the sort of aircraft that could provide close air support (attacking hostile ground forces that were in contact with friendly ground forces) and the sort of aircraft that could perform strategic bombing (attacking enemy infrastructure or other fixed targets deep within a hostile state).

For example, the A-10 attack aircraft was designed mainly to support U.S. ground forces by destroying enemy armored forces. Originally, its weaponry included antitank guided missiles and armor-penetrating cannons; it depended primarily on the pilot spotting targets visually; its airframe was developed to operate efficiently at relatively low altitudes and speeds; its range was fairly short; and its defenses included armor to protect its pilot from antiaircraft guns. The B-1 bomber, in contrast, was designed mainly to penetrate Soviet airspace in a nuclear attack. Originally, its weaponry included nuclear-armed cruise missiles and bombs; it received information about its targets before takeoff; its airframe was developed for efficient cruising, with limited low-altitude flight; its range was relatively long; and its defenses included complex jamming systems to foil attacks by radar-guided missiles. Neither aircraft could perform the other's role, and the two would be treated very differently in operational usage.

In modern operations, however, both the A-10 and the B-1 can attack and efficiently destroy a wide variety of targets with conventional weapons, and they can substitute for each other in some circumstances. Although the two platforms still differ, with greater strengths in some specific roles, there is now substantial overlap in their capabilities and in the types of missions they can perform. Unlike the previous situation—in which the A-10 fleet would have been irrelevant in a nuclear attack and the B-1 fleet would have been irrelevant in a defense against armored forces—both fleets can be used in most current conventional combat operations. Four primary developments have led to that convergence:

- The U.S. military's recent ability to quickly achieve air supremacy in a conflict, which gives all strike aircraft a much better chance of surviving their missions;
- The widespread use of tankers for aerial refueling, which greatly improves the range of all strike aircraft;
- The development of better methods for spotting targets and communicating information about them, which greatly improves the ability of all strike aircraft to find their targets; and
- The development of relatively affordable and accurate precision munitions, which greatly improves the ability of all strike aircraft to actually destroy their targets.

Today, the major differences between the strike capabilities of most U.S. combat aircraft relate to their electronics and software rather than to traditional design factors such as range, speed, or payload capacity. Effective strike missions require aircraft that are capable of accepting up-to-date information about a target from a wide range of sources, carrying the most modern munitions, and communicating targeting information to those munitions. Such aircraft, if properly supported, can effectively attack almost any ground target in a modern conflict.

Although the developments listed above have had the greatest consequences for aircraft, most of them have affected other strike assets as well. For instance, the Army's and Marine Corps' attack helicopters have benefitted from almost all of those developments in much the same way that fixed-wing aircraft have. In addition, the Army's artillery is vastly more capable when equipped with affordable and accurate munitions that are provided with high-quality targeting data.

DoD and many outside observers have cautioned that the freedom U.S. forces have had to strike targets in recent conflicts might not exist in future conflicts against more competent or well-armed opponents. The effectiveness of the U.S. strike system depends on several factors that opponents could disrupt. As examples, an effective method of jamming Global Positioning System (GPS) signals could degrade the effectiveness of U.S. munitions, and the loss of air superiority could imperil strike aircraft and greatly limit the use of aerial refueling.

Developments That Have Reduced the Differences

Between Types of Targets. Before the creation of cheaper and more accurate munitions that could receive targeting information from many sources, the limitations of sensors and weapons meant that attacking different types of targets required very different approaches. Whether a target was mobile or stationary, situated close to friendly forces or not, and heavily armored or not were all crucial factors in determining how challenging the target would be to destroy and how it would be attacked.

Traditional unguided bombs (now often referred to as "dumb" bombs) were notoriously difficult to hit targets with. As a result, attacking a fixed target generally required having several aircraft drop large loads of bombs to increase the chances of a close hit—and even then, multiple attacks were frequently necessary before a target was destroyed. Mobile targets were often impossible to destroy with any certainty in such a manner, armored targets (even when stationary) could not reliably be hit closely enough to penetrate their armor, and the inaccuracy of weapons led to sharp restrictions on using them in proximity to friendly ground forces and noncombatants. Previous U.S. efforts to improve munitions frequently focused on developing specialized warheads and sensors that could attack a specific type of target more effectively, but in many cases they were too expensive to field in large numbers.

Many modern precision munitions incorporate specialized sensors, such as radar or infrared guidance systems, but they are notable for their heavy reliance on GPS guidance sets, which are cheaper than other types of guidance systems. By itself, GPS guidance is usually accurate enough for attacks on stationary targets, and munitions with other sensors are usually accurate enough for attacks

on mobile targets.²⁰ Crucially, the ability to accept GPS targeting data from other sources means that any strike asset equipped with such munitions, connected to communications networks, and able to pass target coordinates to the munitions can effectively attack the target. For example, a U.S. bomber pilot need not see enemy infantry in contact with U.S. ground forces to engage

20. GPS guidance tends to be equally effective regardless of the type of target being attacked because munitions equipped with that guidance move toward a specific set of physical coordinates; if the target is at those coordinates, the munition will generally strike it.

that enemy; instead, the bomber can receive targeting data from the U.S. ground forces and attack the target they have identified.

When provided with accurate targeting data, such modern munitions are precise enough that a single bomb has a good chance of destroying most types of ground targets. That ability in turn allows a single aircraft to destroy many targets, rather than requiring several aircraft to destroy a single target—an enormous increase in U.S. strike capability.

Defensewide Activities

Overview

The Department of Defense contains a number of organizations that are not part of the Departments of the Army, Navy, or Air Force. Instead, those defensewide organizations perform activities that support DoD as a whole. Such organizations employ some military personnel, but they do not directly fund those personnel, because all military personnel are part of one of the services.¹ However, they do employ and fund DoD civilian personnel—about 216,000, on average, over the 2017–2021 period, according to the DoD’s budget plans.

Defensewide organizations fall into three broad categories:

- Organizations that make up DoD’s highest levels of command and control—the Office of the Secretary of Defense, the Joint Staff (a headquarters staff at the Pentagon composed of personnel from all of the services that assists the Chairman of the Joint Chiefs of Staff), and the regional combatant commands (groups of personnel from multiple services that are responsible for U.S. military strategy in specific geographic areas, such as U.S. Africa Command and U.S. Pacific Command).
- Organizations that provide specialized military capabilities that are not specific to any one service—examples include Special Operations Command, the Missile Defense Agency, and the military intelligence agencies.
- Organizations that give administrative support to all of DoD—most notably, the Defense Health Program

(DHP), which provides health care to service members, retired military personnel, and their dependents. Other such organizations operate schools for military dependents, run commissaries and exchanges (stores for military families), take care of payroll and finance activities, and provide telecommunications and logistics services. This category accounts for the largest share of defensewide operation and support (O&S) funding,

For this analysis, the Congressional Budget Office largely combined the first two categories of defensewide organizations. Most information about military intelligence activities is classified, so CBO could not describe their portion of DoD’s budget in any detail.² The only organization from the first two categories whose budget CBO treated separately, for visibility, was Special Operations Command. All of the other organizations in those two categories were included either in the group “Classified Defensewide Funding” or in the group “Rest of the Defensewide Organizations.”

For the third category, CBO distributed the costs of organizations that provide administrative support for DoD as a whole to the various units that generate the workload for those organizations. For example, CBO assigned the largest single defensewide cost—that of the Defense Health Program—to major combat units according to their numbers of active- and reserve-component personnel and their respective costs. Thus, the costs shown in the previous chapters for a major combat unit (or its support units or overhead activities) include that unit’s portion of DHP costs. The DHP also funds health care for retired military personnel and their dependents, but CBO did not distribute that portion of the program’s

1. Military personnel who work in defensewide activities, such as members of the Joint Staff and combatant commanders, are funded by the military service to which they belong. When service members are assigned to a defensewide activity, the activity tracks the costs incurred for those personnel through a system of DoD internal accounting credits that show the amounts that the military services must contribute to defensewide personnel costs.

2. DoD provides some insight into the classified portion of defensewide O&S spending in its publicly available budget materials, but that information relates only to the year for which the budget request is being made, not to the full five years covered in DoD’s budget documents.

funding among units because it is not a cost of maintaining current units. Instead, that part of DHP funding is shown in a separate entry in this chapter.

Since the late 1970s, the share of its funding that DoD devotes to defensewide activities has been growing—not necessarily because the department is providing greater amounts of support (although in some cases, such as health care, it is) but generally because DoD is becoming a more fully integrated institution over time. Many of the functions now carried out by defensewide agencies were formerly performed by the individual services but have gradually been centralized. That trend is generally seen as positive and as especially appropriate for joint installations and activities. (There is no reason, for example, to believe that the Air Force is particularly well suited to operating commissaries for Air Force personnel in a way that another, more focused, organization would not be.)

One consequence of the growing share of funding devoted to defensewide activities is that the costs that a military department bears for sustaining its units do not reflect the full cost of those units because defensewide agencies incur some of those costs. Thus, simply looking at the Army's cost to sustain an infantry brigade combat team—without including the defensewide costs associated with such things as processing the unit's payroll, educating its dependents, or providing commissaries for its personnel—will understate the unit's true costs.

CBO included such defensewide support as part of the cost of every unit, so the total cost of a military department's units in this analysis reflects those additional costs. As a result, the total cost that CBO attributes to the Army, for example, to sustain all of its units exceeds the Army's total O&S budget, whereas the amount of purely defensewide costs not attributed to any military department is much smaller than the defensewide O&S budget.

The rest of this chapter presents CBO's analysis of the following major defensewide activities:

- Special operations; see page 111.
- The Defense Health Program; see page 114.
- All of the other units and activities that support DoD as a whole, presented together; see page 116.

This chapter also examines two topics of special concern to the Department of Defense:

- The structure of the U.S. military's nuclear forces; see page 117.
- The United States' missile defense capability; see page 120.

Major Element of the Force Structure

Special Operations

	Total	Direct	Indirect ^a	Overhead
Army Special-Operations Forces^b				
Total Military Personnel	45,100	32,370	0	12,730
Total Annual Cost (Millions of 2017 dollars)	7,210	3,190	0	4,020
Navy Special-Operations Forces^b				
Total Military Personnel	16,440	9,900	0	6,550
Total Annual Cost (Millions of 2017 dollars)	2,370	1,050	0	1,330
Marine Corps Special-Operations Forces^b				
Total Military Personnel	3,530	2,130	0	1,410
Total Annual Cost (Millions of 2017 dollars)	490	210	0	280
Air Force Special-Operations Forces^b				
Total Military Personnel	24,070	15,900	0	8,170
Total Annual Cost (Millions of 2017 dollars)	3,730	1,840	0	1,890
Special Operations Command^c				
Total Military Personnel	0	0	0	0
Total Annual Cost (Millions of 2017 dollars)	5,370	5,370	0	0

“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.

- In the analytic framework used for this report, special-operations units are considered to not have any units supporting them and thus to not have any indirect personnel or costs.
- Funding for the services’ special-operations units comes from each service’s budget, so these numbers appeared in previous chapters in the entries for “Other Units and Activities.” They are repeated here to provide a complete picture of the costs of the U.S. military’s special-operations forces.
- Funding for Special Operations Command (SOCOM) comes from the defensewide operation and maintenance budget. Like other defensewide organizations, SOCOM does not directly fund any military personnel of its own (because all military personnel are part of one of the services). No overhead costs are shown for SOCOM because such costs are apportioned on the basis of the number of military personnel in an activity.

The Department of Defense has traditionally distinguished between “special forces” (SF) and “special-operations forces” (SOF). Special forces are a fairly small set of units that perform direct-action missions (small, short-duration raids, ambushes, or assaults in hostile territory, such as the raid on Osama bin Laden’s compound in Pakistan). SF units include the units most commonly associated in the public’s mind with special operations,

such as the Army’s Green Berets and Rangers and the Navy’s Sea, Air, and Land forces (known as SEALs). Special-operations forces encompass a larger set of units that include not only SF units but also personnel responsible for psychological operations, civil affairs, and other specialized activities, all of which are overseen by Special Operations Command (SOCOM)—the organization within DoD responsible for special-operations forces.

Each military service recruits personnel for its special-operations units, provides their initial training, and pays their salaries. SOCOM provides those units with specialized training and equipment. SOCOM also develops doctrine and strategy for special-operations units and is responsible for ensuring that all U.S. special-operations forces can be used in a unified way by a combatant commander (as opposed to having separate special-operations communities in each service that operate in their own ways and focus on their own limited missions).

Current and Planned Structure. DoD's special-operations forces consist of a broad array of diverse units. In all, the department plans to field an average of about 60,000 special-operations direct personnel over the 2017–2021 period.

Purpose and Limitations. SOF are intended to be versatile forces, capable of conducting a wide range of missions, including those that other military units would not be suited for. Among their multiple roles, the most important are considered to be direct action, special reconnaissance, foreign internal defense, and security-force assistance. The last two activities involve helping friendly governments improve their military capabilities (often in order to defeat insurgencies hostile to the United States); those missions generally require the largest commitments of SOF personnel and time. Thus, special-operations forces could be described as an exceptionally well-trained and well-equipped set of trainers for foreign militaries—capable, when needed, of performing combat roles as well.

SOF have numerous limits on their use, which relate to the extremely difficult missions they are often assigned. For example, direct-action missions generally require very good intelligence, as well as a situation in which a small force, operating with the benefit of surprise, can achieve a highly valuable objective. Even so, direct-action missions have a mixed record of success—SOCOM was created in the 1980s largely in response to the failure of special forces to rescue U.S. hostages in Iran. Where the conditions for direct action are not present, SF can function as highly trained light infantry, although that role is often considered a waste because it does not capitalize on the unique capabilities of special forces. That role has also been associated with poor outcomes on some occasions, such as in Mogadishu, Somalia, in 1993 (when what was supposed to be a short raid turned into an overnight confrontation with local militiamen that resulted in

many SF casualties) and in Tora Bora, Afghanistan, in 2001 (when SF personnel failed in an attempt to capture Osama bin Laden).

When special-operations forces are performing their more common role of training foreign militaries, their effectiveness is limited by their host countries' willingness and ability to make use of that training. In general, it is difficult to assess how well a foreign country would combat an insurgency with or without the assistance of U.S. special-operations forces. Insurgencies are generally ended not through military force but through negotiated settlements; however, having a strong military often helps a government persuade insurgents to negotiate and strengthens the government's position during the negotiations. Another limitation associated with using SOF is that because they often assist countries that have relatively unstable or unpopular governments, their work risks associating the United States with the actions of those countries' militaries, as happened in El Salvador in the 1980s.

Past and Planned Use. Many of the missions for which special-operations forces are intended—as well as many of their past and current operations—are classified. A common complaint of both the SOF and intelligence communities is that because of the classified nature of their work, their failures are more visible than their successes, giving the public a distorted view of their value.

SOF have participated in all major U.S. combat operations since SOCOM was created. In most cases, their participation was not central to the outcome of those combat operations (largely because their role was limited to providing reconnaissance or carrying out small missions within the larger operation). However, in Operation Enduring Freedom in Afghanistan, SOF units played a leading role in the initial phases of ground combat by assisting Afghan rebel forces by calling in air strikes; conventional U.S. ground forces arrived only after the Taliban had lost control of much of the country. Since the invasion, SOF have been used extensively in and around Afghanistan, achieving a notable success with the direct-action mission of killing Osama bin Laden but experiencing more mixed results when employed as light infantry (as at Tora Bora).

SOF have also been widely used for activities other than major combat operations. Some of the largest commitments of U.S. special-operations forces for

foreign internal defense and security-force assistance have occurred in El Salvador, Colombia, Iraq, Afghanistan, the Philippines, and, more recently, the Horn of Africa and Trans-Saharan Africa. None of the foreign governments that received such assistance have been militarily overthrown by insurgents or terrorists, although some remain unstable. However, the government of Mali was overthrown by members of the country's military twice since U.S. assistance began, weakening the government in its fight against insurgents and exposing the United States to criticism about the effectiveness of its training. Some SOF commitments have also opened the United States to criticism because of the actions of the foreign militaries it has assisted (particularly those in Latin America).

SOCOM and other DoD sources frequently describe special-operations forces as crucial for antiterrorism missions. In essence, such missions are the same as traditional SOF missions except that the adversaries are terrorist groups rather than insurgents or other countries' militaries. Many of the SOF operations in countries mentioned above were antiterrorist missions. Special-operations forces have also participated in a wide variety of smaller missions, such as helping to evacuate noncombatants during a crisis or providing humanitarian assistance or disaster relief.

Major Element of the Force Structure

Defense Health Program

	Total	Direct	Indirect	Overhead
Defense Health Program for Retirees				
Total Military Personnel	0	0	0	0
Total Annual Cost (Millions of 2017 dollars)	14,720	14,720	0	0

“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 million; more detailed information is presented in Appendixes A and B.

Defensewide organizations do not directly fund any military personnel of their own (because all military personnel are part of one of the services). In addition, in the analytic framework used for this report, defensewide organizations are considered to not have any units supporting them and thus to not have any indirect personnel or costs. No overhead costs are shown for the defensewide organizations because such costs are apportioned on the basis of the number of military personnel in an activity.

The Department of Defense offers medical and dental care to more than 9 million service members, military retirees, and eligible family members through the Military Health System (MHS) at an estimated cost of about \$47 billion in 2016.³ The MHS exists to ensure that service members are fit for deployment and to care for them if they are sick, injured, or wounded. The system also provides care for military families and retirees.

Current and Planned Structure. The cost of the MHS is accounted for in three major blocks of DoD’s budget:

- The Defense Health Program—a defensewide activity that pays for nearly all of the civilian personnel associated with the MHS, as well as for contracts for private-sector care and purchases of medical supplies.⁴
- Funding for MHS military personnel—including the pay of service members associated with the MHS, which is funded by their military departments. (Together, those first two blocks make up the TRICARE system, which is responsible for providing care to active-duty service members and their families and military retirees and their families.)

- Accrual charges levied against the services for all military personnel—funds deducted from military personnel appropriations and credited to the Medicare-Eligible Retiree Health Care Fund, which reimburses military medical facilities for care provided to Medicare-eligible retirees and their family members and also covers most of the out-of-pocket costs of Medicare-eligible retirees and their family members who seek care from private-sector Medicare providers.

Although the Defense Health Program is the only portion of the Military Health System whose costs are included in the defensewide budget, the discussion below focuses on the MHS as a whole.

In the Congressional Budget Office’s analysis, the system’s costs for current service members and their families are included in the costs of the various elements of the force structure discussed in previous chapters, allocated in proportion to the number of military personnel employed by those elements. The \$14.7 billion shown here covers only health care for military retirees and their families. CBO did not divide that cost among various elements of the force structure because it is not a cost of current forces and it cannot be altered by decisions about the future force structure. Instead, that cost results from prior decisions about the force structure that produced the current pool of retirees and from the policies and laws that govern health care benefits for military retirees. Lawmakers could change those laws, but in the past, they have been extremely reluctant to do so.

3. See Congressional Budget Office, *Long-Term Implications of the 2016 Future Years Defense Program* (January 2016), pp. 22–25, www.cbo.gov/publication/51050.
4. For a fuller discussion of the MHS, see Congressional Budget Office, *Approaches to Reducing Federal Spending on Military Health Care* (January 2014), www.cbo.gov/publication/44993.

The MHS is separate from the health care system operated by the Department of Veterans Affairs (VA), which has its own funding. VA provides health care to veterans who have service-connected disabilities or who meet certain other criteria. (It also provides cash payments that compensate for service-connected disabilities and GI Bill benefits that reimburse some of the costs of higher education for veterans.) The Military Health System is available to the roughly 2 million people who served long enough to retire from the military—typically for at least 20 years—and to their eligible family members. VA benefits, by contrast, are potentially available to the 22 million veterans who received honorable or general discharges from the military, regardless of whether they served long enough to retire. Therefore, military retirees may be eligible for VA health benefits, but veterans who did not serve long enough to retire from the military are not eligible for MHS benefits after they leave the service.

Purpose and Limitations. Providing health care is considered an important military function for several reasons:

- It cares for personnel who are involved in ongoing military operations.
- It represents a substantial portion of the total compensation package that military personnel receive and is thus important for recruiting and retaining service members.
- It plays a key role in maintaining the readiness of units by making sure that military personnel are healthy.
- It helps lessen some of the challenges of military life because service members can generally be assured of receiving quality medical care for themselves and their families even when they are deployed for an operation or stationed in a foreign country.
- It is widely seen as a moral duty to care for people who may risk their lives while serving their country.

The MHS accounts for a large portion of DoD's budget—about a quarter of the total operation and support budget—and has been growing rapidly in recent years.⁵ Past analyses by CBO indicate that much of that cost growth has occurred for two reasons: Military retirees are increasingly choosing to use MHS services rather than to

rely on health insurance provided by a subsequent employer (or their spouse's employer), and MHS beneficiaries generally use medical care at relatively high rates. Those beneficiaries face very low premiums or copayments for their care, and people tend to use a service more when they pay less for it themselves. As a result, DoD takes in fairly small revenues from MHS beneficiaries while experiencing the high costs that stem from their intensive use of care. DoD has put forward a number of proposals in recent years to increase the amount of cost sharing for MHS beneficiaries in an effort to reduce the costs of the system. So far, however, lawmakers have not been receptive to such proposals.⁶

Past and Planned Use. The vast majority of the MHS's workload results from providing health care to service members, retirees, and their eligible family members during peacetime. That workload is not expected to change appreciably anytime soon.

The MHS also provides health care for personnel who are involved in ongoing military operations, and it is likely to keep doing so as long as such operations include any risk of casualties.⁷ Although that role is important, it requires less funding and creates less workload than the peacetime provision of health care.⁸ The main reason is that deployed service members make up only a small portion of the system's total beneficiaries—not all service members are deployed at a given time, and family members and retirees are not deployed. In addition, the MHS often takes part in humanitarian missions of various sorts, such as providing medical assistance in the aftermath of natural disasters.

5. See Figure 2-3 in Congressional Budget Office, *Long-Term Implications of the 2016 Future Years Defense Program* (January 2016), p. 24, www.cbo.gov/publication/51050.

6. For a brief legislative history of such cost-sharing proposals, see Congressional Budget Office, *Costs of Military Pay and Benefits in the Defense Budget* (November 2012), Appendix C, www.cbo.gov/publication/43574.

7. Even operations that do not involve combat generate a need for medical care. Casualties include diseases and nonbattle injuries, which in many cases require more medical attention than battle injuries (even during active combat operations).

8. For more discussion of the effects of recent combat operations, see Congressional Budget Office, *Approaches to Reducing Federal Spending on Military Health Care* (January 2014), pp. 16–19, www.cbo.gov/publication/44993.

Major Element of the Force Structure

Other Defensewide Units and Activities

	Total	Direct	Indirect	Overhead
Classified Defensewide Funding				
Total Military Personnel	0	0	0	0
Total Annual Cost (Millions of 2017 dollars)	14,540	14,540	0	0
Rest of the Defensewide Organizations				
Total Military Personnel	0	0	0	0
Total Annual Cost (Millions of 2017 dollars)	4,060	4,060	0	0

“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 million; more detailed information is presented in Appendixes A and B.

Defensewide organizations do not directly fund any military personnel of their own (because all military personnel are part of one of the services). In addition, in the analytic framework used for this report, defensewide organizations are considered to not have any units supporting them and thus to not have any indirect personnel or costs. No overhead costs are shown for the defensewide organizations because such costs are apportioned on the basis of the number of military personnel in an activity

The Department of Defense includes a wide variety of other defensewide activities and organizations. A significant portion of their funding is classified, however, which prevents the Congressional Budget Office from providing any detail other than the amount of classified operation and maintenance funding that DoD discloses in its publicly available budget documents.⁹ (Operation and maintenance funding is a subset of operation and support funding.)

The rest of the defensewide organizations, which represent a relatively small amount of DoD’s O&S budget, fall into two groups:

- High-level command-and-control functions, such as the Office of the Secretary of Defense, the Joint Staff, and the combatant commands. Although they are fairly small, those organizations include civilian and military personnel from multiple military departments and have responsibilities that affect significant portions of DoD’s mission.
- Miscellaneous activities that cannot be characterized as supporting any major combat units (and thus were not included in the costs for those units). Such activities include the Defense POW/MIA Office, which works to help U.S. prisoners of war and to locate personnel missing in action; the Defense Security Cooperation Agency, which works with foreign countries’ militaries and oversees military aid and arms sales to other nations; and the Office of Economic Adjustment, which helps state and local governments deal with the economic consequences of cutbacks in defense industries or closures or expansions of military bases.

9. DoD’s O-1 budget display presents the full amount of classified operation and maintenance funding for each military department and for defensewide activities, but only for a limited number of years and with no breakdown between intelligence and other classified activities or other details. See Office of the Under Secretary of Defense (Comptroller), *Department of Defense Budget, Fiscal Year 2017: Operation and Maintenance Programs (O-1), Revolving and Management Funds (RF-1)* (February 2016), <http://comptroller.defense.gov/BudgetMaterials.aspx>.

Special Topic

Nuclear Forces

	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
Minuteman III Missile Squadron^a				
Military Personnel per Unit	2,040	690	650	690
Annual Cost per Unit (Millions of 2017 dollars)	380	130	90	160
B-52 Bomber Aircraft Squadron^b				
Military Personnel per Unit	3,830	1,310	1,220	1,300
Annual Cost per Unit (Millions of 2017 dollars)	740	270	170	300
B-2 Bomber Aircraft Squadron^b				
Military Personnel per Unit	8,660	2,120	3,600	2,940
Annual Cost per Unit (Millions of 2017 dollars)	1,840	670	490	680

Funding for the services' nuclear forces comes from each service's budget, so these numbers appeared in previous chapters in the entries for "Other Units and Activities" or "Bomber Squadrons." They are repeated here to provide a complete picture of the costs of the U.S. military's nuclear forces. For additional details, see Congressional Budget Office, *Projected Costs of U.S. Nuclear Forces, 2015 to 2024* (January 2015), www.cbo.gov/publication/49870.

"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. Squadron of 50 Minuteman missiles.

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

The U.S. strategic nuclear force has traditionally been seen as a triad consisting of land-based intercontinental ballistic missiles (ICBMs), sea-based ballistic missile submarines (SSBNs), and airborne bomber aircraft. All of those platforms are capable of delivering nuclear weapons over long distances.

Current and Planned Structure. As part of the nuclear force structure, the Navy plans to field 14 SSBNs and 4 guided missile submarines (SSGNs) in 2017.¹⁰ It does not expect to change those numbers through 2021 (although the Department of Defense plans to reduce the number of active missile launch tubes on each SSBN from 20 to 16 by 2018 to comply with the New START

arms control treaty). The Air Force intends to field 450 Minuteman III ICBMs in 2017, but current plans call for it to reduce that number to 400 by 2018 to comply with the New START treaty. The Air Force's B-52 and B-2 bombers are also capable of delivering nuclear weapons, but unlike SSBNs and ICBMs, they spend most of their time performing their conventional (non-nuclear) role. DoD plans to remove the ability of some B-52s to deliver nuclear weapons by 2018 to comply with

10. The Navy's budget documents group the 14 SSBNs with the 4 SSGNs, which are former SSBNs that have been converted to launch Tomahawk cruise missiles and to support special operations.

the New START treaty.¹¹ The nuclear warheads that missiles are armed with are funded mainly through Department of Energy accounts, which are not included in this analysis.

For the past 40 years, the U.S. nuclear force structure has been affected by the outcomes of arms control negotiations (although the United States always has the option to change its nuclear force structure unilaterally and has sometimes done so).¹² The most recent arms control agreement, the New START treaty, has been in effect since 2011 and limits the total numbers of deployed strategic missiles and bombers (700), deployed strategic nuclear warheads (1,550), and deployed and non-deployed strategic missile launchers and bombers (800). The United States currently exceeds those limits, but it has until 2018 to comply with the treaty.

Purpose and Limitations. In practice, the fundamental role of U.S. nuclear forces is to deter any nuclear attack on the United States, its allies, or its partners through the threat of a devastating counterattack. However, at various points in history, U.S. policymakers have also considered the possibility of using nuclear forces to initiate an attack on a hostile state, to deter nonnuclear attacks on the United States, or to deter nonnuclear attacks on U.S. allies. (In particular, much debate during the Cold War focused on whether nuclear weapons could deter a possible Soviet invasion of Western Europe.)

As a deterrent, nuclear forces are intended to allow the United States to retaliate with so much firepower that no rational enemy could possibly view a nuclear attack on the United States as a reasonable option. Deterrence is a theoretical approach for understanding the decision-making process of opponents, and there are several variations on the core theory. However, almost all of them

agree that successful deterrence requires a credible commitment and capability to respond with overwhelming force to any nuclear attack. Some variations on the theory would add that there are no uses for nuclear forces other than deterrence—which suggests that the purpose of nuclear weapons is to not be used. If U.S. decisionmakers agree with such views, the main limitation of nuclear forces is that their only role is to provide a credible deterrent. Another limitation is that some nuclear-armed opponents might not be rational actors and thus might not be deterred by U.S. nuclear forces.¹³ Finally, the use of nuclear weapons is limited by the fact that such use is considered by many people to be unacceptable in most circumstances.

Each part (or “leg”) of the nuclear triad has unique strengths and weaknesses that complement those of the other legs, such that the full triad is generally considered much more powerful than a “pure” deterrent composed of only one type of system. Historically, most of the value of the triad lay in discouraging the Soviet Union from launching a nuclear first strike on the United States that would have destroyed the U.S. capability to respond with a second strike. In the present era, concerns about deterrence often focus more on smaller nuclear powers (such as North Korea) that have less sophisticated arsenals for delivering nuclear weapons. Those smaller powers cannot credibly threaten a first strike that would destroy the U.S. capability to respond. However, all recent U.S. nuclear policy statements have indicated a commitment to maintaining the full triad. Because each leg of the triad is aging, DoD has modernization programs in place for all three.

U.S. ICBMs and SSBN-launched missiles are armed only with nuclear warheads and cannot be used for any non-nuclear purpose. (Although DoD has considered arming those missiles with conventional warheads, it has not done so.) The bomber fleet, by contrast, has routinely been used in major conflicts to deliver conventional weapons. During the Cold War, bombers were seen mainly as a nuclear delivery platform, and the majority of the bomber fleet was usually on some form of standby, able to launch quickly in case it was needed to carry out nuclear strikes. In the post-Cold War era, bombers have

11. DoD also deploys short-range, smaller-yield nuclear weapons, known as tactical nuclear weapons. During the Cold War, all three military departments deployed such weapons, which numbered more than 10,000. They included bombs delivered by aircraft, artillery shells, torpedoes, land mines, sea-launched cruise missiles, and short-range surface-to-surface ballistic missiles. Today, only the Air Force deploys tactical nuclear weapons—bombs delivered by tactical aircraft. Those forces are not discussed here.

12. Recent arms control treaties have given the parties flexibility in meeting their obligations by specifying the total number of warheads or delivery systems allowed but letting each nation determine the mix of ICBMs, SSBNs, and bombers fielded.

13. That possibility is frequently raised in discussions of North Korea's and Iran's nuclear programs, as well as in hypothetical cases in which a terrorist group obtains a nuclear weapon.

been used extensively for conventional strikes, although the B-2 fleet and part of the B-52 fleet still routinely train for nuclear missions.

Past and Planned Use. The United States used two nuclear weapons against Japan in World War II but has not employed any nuclear weapons in combat since then. No other country has used nuclear weapons in combat.

Supporters of the theory of deterrence point to the lack of nuclear exchanges as evidence that nuclear deterrence has been extremely successful. Nevertheless, as with all counterfactual examples, there is no way to prove that the U.S. nuclear deterrent was directly responsible for preventing a nuclear attack by the Soviet Union during the Cold War.

Special Topic

Missile Defense

The United States is currently operating a number of systems to protect itself and its allies from missile strikes. Those systems are generally developed and purchased by the Missile Defense Agency (MDA), and their acquisition costs are paid through the defensewide portion of the Department of Defense's budget. Once purchased, however, missile defense systems are operated by the services, and most of their operation and support (O&S) costs are included in the budgets of the relevant military departments. In this report, all of a department's O&S costs for missile defense are included in its chapter's entry for "Other Units and Activities" (under "rest of" the department).

Several missile defense systems do not significantly add to their service's O&S costs. For example, the Army fields Patriot missile battalions as part of its normal air-defense force structure, and the Navy fields Aegis cruisers and destroyers as part of its normal surface combatant fleet. Equipping those battalions and ships with advanced missiles capable of performing missile defense does not result in substantial new O&S costs to the Army or the Navy because those units existed already. If, in the future, missile defense missions caused more Patriot units to be created or more ships to be purchased, those forces' O&S costs might be more directly attributable to missile defense.

Other missile defense systems, such as the Ground-Based Midcourse Defense system and the Terminal High Altitude Area Defense system, incur additional O&S costs. However, those costs are very small compared with the costs of other elements of the force structure.

Current and Planned Structure. DoD has four major missile defense systems, which are designed to intercept threatening missiles in midair:

- The Ground-Based Midcourse Defense (GMD) system, which the Army operates from various land bases (primarily Fort Greely, Alaska), is designed to protect the United States against long-range ballistic missiles. That system is intended to intercept missiles during the midcourse part of their flight (the phase after a missile's rocket motor has stopped burning and accelerating the missile but before air resistance from

reentry into the atmosphere has begun decelerating it). In that phase, missiles are at their maximum speed and are generally following predictable, parabolic paths.

- The Aegis Ballistic Missile Defense (BMD) system, a midcourse-phase interception system operated by the Navy from cruisers and destroyers, is designed to protect allies and U.S. forces from medium- and intermediate-range ballistic missiles.¹⁴ DoD is developing a land-based variant of the Aegis system, as well as an interceptor capable of targeting missiles during the terminal phase of their flight (when air resistance from reentry has begun decelerating them). Missiles in that phase are very close to their targets, which greatly reduces the time that missile defense systems have to react to them but also allows the use of relatively short-range and lower-cost interceptor missiles.
- The Terminal High Altitude Area Defense (THAAD) system, a terminal-phase interception system operated by the Army from mobile launchers, is designed to intercept short- and medium-range ballistic missiles as they near their targets.
- The Patriot Advanced Capability 3 (PAC-3) system, a terminal-phase interception system operated by the Army from mobile launchers, is similar to THAAD but is better suited to intercepting smaller short-range ballistic missiles. It can also intercept cruise missiles and aircraft.

The Missile Defense Agency has explored some other missile defense concepts and systems—and is likely to develop new systems in the future—but none of those other systems are deployed now or are likely to be deployed soon. MDA also invests heavily in command-and-control systems and sensors to support the missile defense mission. However, most of that spending comes from DoD's acquisition funding rather than from the O&S budget, so it is not included in this analysis.

14. Intermediate-range ballistic missiles have ranges between 3,000 and 5,500 kilometers; medium-range ballistic missiles, between 1,000 and 3,000 kilometers; and short-range ballistic missiles, fewer than 1,000 kilometers. Intercontinental ballistic missiles have ranges greater than 5,500 kilometers.

Purpose and Limitations. Missile defense systems are intended to defend against ballistic missiles fired at the United States, its allies, or its deployed forces. Ballistic missiles, which were developed during World War II, are initially powered by a rocket motor that boosts them high into the air; after that they coast on an arching (ballistic) trajectory, powered only by gravity as they fall to Earth toward their target. Ballistic missiles are very difficult to intercept once fired—their speed, high-altitude flight, and long range mean that developing weapon systems capable of destroying them in flight is extremely challenging. Those same characteristics have also made ballistic missiles a preferred delivery system for nuclear weapons (as discussed in the previous entry). The difficulty of defending against nuclear-armed ballistic missiles is one of the main reasons that the United States continues to rely heavily on deterrence to protect against nuclear attacks.

Intercontinental ballistic missiles (ICBMs) and the very similar submarine-launched ballistic missiles (SLBMs) present the greatest technical challenges to effective missile defense: Their very long range (between continents) requires extremely powerful engines, which accelerate them to very high speeds and loft them in very high ballistic arcs. Intermediate-range, medium-range, and short-range ballistic missiles are somewhat less challenging because they reach lower maximum speeds and usually fly at lower altitudes. In general, ICBMs and SLBMs are the most costly and difficult weapon systems to develop and are designed to deliver nuclear weapons, meaning that usually only the largest nuclear powers possess them. Short-range ballistic missiles are much less costly and difficult to develop, are fielded by many countries, and are generally armed with conventional explosive payloads rather than nuclear warheads. Medium-range ballistic missiles are more expensive and less plentiful than their short-range counterparts, and intermediate-range ballistic missiles are more costly and less common than medium-range missiles.

The first missile defense systems were developed by the United States and the Soviet Union in the 1960s and 1970s. They were designed to destroy a ballistic missile after its launch by detonating a nuclear warhead in its vicinity. However, because of the undesirability of using nuclear warheads, the United States began in the 1980s to extensively research ways to use conventional explosive or kinetic warheads to destroy ballistic missiles.¹⁵ The

initial Patriot missile system, which was fielded as an air-defense system in the 1980s, also possessed a limited ability to destroy short-range ballistic missiles. Since then, the United States has made significant technical progress in developing systems to destroy all types of ballistic missiles, and MDA now has systems capable of intercepting all of those types of ballistic missiles.

Effective missile defense remains highly challenging. As a result, analysts outside DoD have raised a number of concerns about the feasibility of missile defense in general and about the performance of current U.S. systems in particular—especially against an adversary that can field decoy warheads and other countermeasures to confuse defense systems. MDA has faced external criticism of its test programs and their results, and it is difficult to assess how effective the systems that DoD has fielded would be in an actual missile attack.

Even if all of its current systems perform as DoD plans, the GMD system intended to defend U.S. territory against missiles is designed to protect against attacks by very small numbers of long-range ballistic missiles—the sort of attack that might be launched by a so-called rogue state, such as North Korea or Iran. That system is not intended to defend the United States against attacks by large numbers of nuclear-armed missiles.

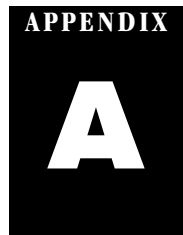
Past and Planned Use. During Operation Desert Storm in 1991, the Army used Patriot missiles to defend against Iraqi Scud missile attacks targeted at Saudi Arabia, Israel, and U.S. and coalition forces. The Army's missiles were early-model Patriots rather than the current PAC-3 design, and their effectiveness in actually shooting down Iraqi missiles has been the subject of debate. (Part of the difficulty in assessing their performance is that many engagements with Scud missiles ended up being near misses that may not have destroyed those missiles, resulting in an ambiguous operational record.) PAC-3 missiles were employed in 2003 during the invasion of Iraq with some success. None of the remaining systems in the current generation of U.S. missile defenses have been used in combat.

15. Unlike explosive weapons, kinetic weapons destroy their targets by hitting them at high speed. A kinetic warhead can be fairly small and thus easier to accelerate to high speed, but it requires much more accurate guidance than an explosive or nuclear warhead does.

Currently, two of the primary missions for U.S. missile defense systems are to protect the United States against a limited attack by North Korean nuclear-armed ICBMs (using the GMD system) and to protect U.S. forces and allies in Europe against an attack by Iranian nuclear-armed intermediate-range ballistic missiles (using ship- and land-based versions of the Aegis BMD system). Both of those missions involve countering a threat that has yet to emerge, because neither of those countries is currently believed to have effectively combined nuclear warheads and ballistic missiles, and neither has yet fielded missiles with sufficient range. It is also unclear whether missile defenses are required to counter those threats. U.S. nuclear forces may be sufficient to deter attacks, as they

were during the Cold War, although it is possible that a reliable missile defense system could enhance the effectiveness of the existing U.S. nuclear deterrent. (The effect of missile defenses on deterrence is an extremely controversial topic.)

The main intended mission for the THAAD and PAC-3 systems is to defend deployed U.S. forces or U.S. allies against attacks by intermediate-, medium-, or short-range ballistic missiles. Such a mission is not speculative: Short-range ballistic missiles have proliferated widely and were used against U.S. forces in Operations Desert Storm and Iraqi Freedom.



Size, Costs, and Number of U.S. Forces

This appendix shows, for quick reference, the total size and costs of each type of major combat unit in the Congressional Budget Office's analysis (see Table A-1). The table also shows how many of each type of unit the

Department of Defense plans to have in its force each year from 2017 to 2021 as reported in DoD's 2017 Future Years Defense Program.

Table A-1.

Size, Costs, and Number of U.S. Forces

	Military Personnel per Unit	Annual Cost per Unit (Millions of 2017 dollars)	Number of Units				
			2017	2018	2019	2020	2021
Department of the Army							
Active-Component Armored Brigade Combat Team	17,450	2,610	9	9	9	9	9
National Guard Armored Brigade Combat Team	14,440	820	5	5	5	5	5
Active-Component Stryker Brigade Combat Team	17,180	2,560	7	7	7	7	7
National Guard Stryker Brigade Combat Team	14,230	800	2	2	2	2	2
Active-Component Infantry Brigade Combat Team	16,250	2,410	14	14	14	14	14
National Guard Infantry Brigade Combat Team	12,720	700	19	19	19	19	19
Active-Component Aviation Brigade	4,300	890	11	11	10	10	10
Reserve-Component Aviation Brigade	2,750	200	11	12	12	12	12
Army Special-Operations Forces	45,100 ^a	7,210 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Rest of the Army	12,570 ^a	3,180 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Department of the Navy							
Aircraft Carrier	6,590	1,180	11	11	11	11	11
Carrier Air Wing	4,860	910	10	10	10	10	10
Arleigh Burke Class Destroyer (DDG-51)	720	140	66	67	69	72	74
Ticonderoga Class Cruiser (CG-47)	550	110	22	22	22	20	20
Littoral Combat Ship	430	100	14	18	22	24	28
Zumwalt Class Destroyer (DDG-1000)	500	100	2	2	3	3	3
Attack Submarine ^c	390	140	51	52	50	51	51
Amphibious Ship ^d	1,450	270	35 ^e	35 ^e	35 ^e	35 ^e	35 ^e
Active-Component Marine Corps Infantry Battalion	5,780	740	24	24	24	24	24
Reserve-Component Marine Corps Infantry Battalion	4,370	470	8	8	8	8	8
Marine Corps Aircraft Complement	2,750	520	24	24	24	24	24
Ballistic and Guided Missile Submarines	660	170	18	18	18	18	18

Continued

Table A-1.

Continued

Size, Costs, and Number of U.S. Forces

	Military	Annual Cost per Unit	Number of Units				
	Personnel per Unit	(Millions of 2017 dollars)	2017	2018	2019	2020	2021
Department of the Navy (Continued)							
P-3 and P-8 Maritime Patrol Aircraft Squadron ^f	1,890	330	8	8	8	8	8
Seabee Construction Engineers	14,200 ^a	1,860 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Navy Special-Operations Forces	16,440 ^a	2,370 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Marine Corps Special-Operations Forces	3,530 ^a	490 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Rest of the Navy	37,990 ^a	6,550 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Rest of the Marine Corps	770 ^a	230 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Department of the Air Force ^f							
A-10 Attack Aircraft Squadron	1,190	230	16	13	10	6	2
F-15 Fighter Aircraft Squadron	1,540	300	25	25	25	25	26
F-16 Fighter Aircraft Squadron	1,250	220	45	45	46	46	46
F-22 Fighter Aircraft Squadron	2,390	470	13	13	13	13	13
F-35 Fighter Aircraft Squadron ^g	2,940	570	3	5	7	10	14
B-52 Bomber Aircraft Squadron	3,830	740	4	4	4	4	4
B-1B Bomber Aircraft Squadron	3,980	810	4	4	4	4	4
B-2 Bomber Aircraft Squadron	8,660	1,840	1	1	1	1	1
C-130 Cargo Aircraft Squadron	2,120	360	24	24	23	24	24
C-5 Cargo Aircraft Squadron	2,430	430	3	3	3	3	3
C-17 Cargo Aircraft Squadron	1,390	270	14	15	16	16	16
KC-135 Tanker Aircraft Squadron	1,930	360	30	28	28	27	28
KC-10 Tanker Aircraft Squadron	3,140	580	5	5	4	3	2
KC-46 Tanker Aircraft Squadron ^g	1,070	180	1	3	4	5	6
MQ-1 "Predator" UAS Squadron	260	70	9	0	0	0	0
RQ-4 "Global Hawk" UAS Squadron	1,840	440	3	3	3	3	3
MQ-9 "Reaper" UAS Squadron	920	160	23	24	26	27	27
Minuteman III Missile Squadron ^h	2,040	380	9	9	9	9	9
RED HORSE Construction Engineers	19,340 ^a	2,170 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Air Force Special-Operations Forces	24,070 ^a	3,730 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Rest of the Air Force	49,010 ^a	10,000 ^b	n.a.	n.a.	n.a.	n.a.	n.a.

Continued

Table A-1.

Continued

Size, Costs, and Number of U.S. Forces

	Military Personnel per Unit	Annual Cost per Unit (Millions of 2017 dollars)	Number of Units				
			2017	2018	2019	2020	2021
Defensewide Activities							
Special Operations Command	0 ⁱ	5,370 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Defense Health Program for Retirees	0 ⁱ	14,720 ^b	n.a.	n.a.	n.a.	n.a.	n.a.
Classified Defensewide Funding	0 ⁱ	14,540 ^b					
Rest of the Defensewide Organizations	0 ⁱ	4,060 ^b	n.a.	n.a.	n.a.	n.a.	n.a.

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

n.a. = not applicable; UAS = unmanned air system.

a. Military personnel for these forces as a whole, rather than personnel per unit.

b. Annual cost for these forces as a whole, rather than cost per unit.

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

d. Because of data limitations, CBO 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).

e. Includes two command ships that are considered part of the amphibious fleet in the Department of Defense's budget documents.

f. Aircraft squadrons are notional squadrons of 12 aircraft (actual squadrons vary in size).

g. Because these aircraft 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.

h. Squadron of 50 Minuteman missiles.

i. Defensewide organizations do not directly fund any military personnel of their own (because all military personnel are part of one of the services).



Reconciling CBO's and DoD's Five-Year Tallies of Funding and Personnel

This appendix shows how the personnel numbers (see Table B-1) and costs (see Table B-2) for each type of major combat unit, as estimated by the Congressional Budget Office, sum to the totals for the Department of Defense's operation and support budget and military

personnel reported in DoD's 2017 Future Years Defense Program. Supplemental data for Table B-1 and Table B-2 are available on CBO's website (www.cbo.gov/publication/51535).

Table B-1.

Five-Year Tallies of Units' Military Personnel, 2017 to 2021

	Five-Year					Total Military Personnel Over the 2017–2021 Period			
	Total of Units	Military Personnel per Unit				(In thousands)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Department of the Army									
Active-Component Armored Brigade Combat Team	45	4,200	9,090	4,160	17,450	189	409	187	785
National Guard Armored Brigade Combat Team	25	4,140	9,090	1,210	14,440	104	227	30	361
Active-Component Stryker Brigade Combat Team	35	4,440	8,590	4,150	17,180	156	301	145	601
National Guard Stryker Brigade Combat Team	10	4,450	8,590	1,190	14,230	45	86	12	142
Active-Component Infantry Brigade Combat Team	70	4,230	8,090	3,920	16,250	296	566	275	1,137
National Guard Infantry Brigade Combat Team	95	3,560	8,090	1,060	12,720	338	769	101	1,208
Active-Component Aviation Brigade	52	3,020	0	1,280	4,300	157	0	67	224
Reserve-Component Aviation Brigade	59	2,520	0	230	2,750	148	0	14	162
Army Special-Operations Forces	n.a.	32,370 ^a	0	12,730 ^a	45,100 ^a	162	0	64	226
Rest of the Army	n.a.	8,860 ^a	0	3,710 ^a	12,570 ^a	44	0	19	63
Department of the Navy									
Aircraft Carrier	55	3,200	760	2,620	6,590	176	42	144	362
Carrier Air Wing	50	1,630	1,300	1,930	4,860	81	65	97	243
Arleigh Burke Class Destroyer (DDG-51)	348	340	100	290	720	118	33	100	251
Ticonderoga Class Cruiser (CG-47)	106	250	90	220	550	26	9	23	59
Littoral Combat Ship	106	190	70	170	430	20	8	18	46
Zumwalt Class Destroyer (DDG-1000)	13	220	80	200	500	3	1	3	7
Attack Submarine ^b	255	190	50	150	390	48	12	39	99
Amphibious Ship ^c	175 ^d	710	170	580	1,450	123	29	101	254
Active-Component Marine Corps Infantry Battalion	120	1,490	1,990	2,300	5,780	179	239	276	693
Reserve-Component Marine Corps Infantry Battalion	40	2,070	560	1,740	4,370	83	22	70	175
Marine Corps Aircraft Complement	120	760	890	1,090	2,750	92	107	131	330
Ballistic and Guided Missile Submarines	90	320	80	260	660	29	7	24	60

Continued

Table B-1.

Continued

Five-Year Tallies of Units' Military Personnel, 2017 to 2021

	Five-Year					Total Military Personnel Over the 2017–2021 Period			
	Total of Units	Military Personnel per Unit				(In thousands)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Department of the Navy (Continued)									
P-3 and P-8 Maritime Patrol Aircraft Squadron ^e	37	630	500	750	1,890	24	19	28	71
Seabee Construction Engineers	n.a.	8,550 ^a	0	5,650 ^a	14,200 ^a	43	0	28	71
Navy Special-Operations Forces	n.a.	9,900 ^a	0	6,550 ^a	16,440 ^a	49	0	33	82
Marine Corps Special-Operations Forces	n.a.	2,130 ^a	0	1,410 ^a	3,530 ^a	11	0	7	18
Rest of the Navy	n.a.	22,860 ^a	0	15,120 ^a	37,990 ^a	114	0	76	190
Rest of the Marine Corps	n.a.	460 ^a	0	310 ^a	770 ^a	2	0	2	4
Department of the Air Force ^e									
A-10 Attack Aircraft Squadron	46	350	440	400	1,190	16	20	19	55
F-15 Fighter Aircraft Squadron	124	430	590	520	1,540	53	73	65	191
F-16 Fighter Aircraft Squadron	226	450	370	420	1,250	102	85	96	282
F-22 Fighter Aircraft Squadron	65	430	1,150	810	2,390	28	75	53	156
F-35 Fighter Aircraft Squadron ^f	37	430	1,510	1,000	2,940	16	57	37	110
B-52 Bomber Aircraft Squadron	19	1,310	1,220	1,300	3,830	25	23	24	72
B-1B Bomber Aircraft Squadron	21	940	1,680	1,350	3,980	20	36	29	85
B-2 Bomber Aircraft Squadron	7	2,120	3,600	2,940	8,660	14	24	20	58
C-130 Cargo Aircraft Squadron	118	800	590	720	2,120	95	70	85	251
C-5 Cargo Aircraft Squadron	16	780	820	830	2,430	13	13	13	40
C-17 Cargo Aircraft Squadron	76	450	460	470	1,390	35	35	36	106
KC-135 Tanker Aircraft Squadron	141	610	660	650	1,930	87	93	92	272
KC-10 Tanker Aircraft Squadron	18	900	1,170	1,060	3,140	17	22	20	58
KC-46 Tanker Aircraft Squadron ^f	20	640	70	360	1,070	13	1	7	21
MQ-1 "Predator" UAS Squadron	9	90	80	90	260	1	1	1	2
RQ-4 "Global Hawk" UAS Squadron	15	470	750	630	1,840	7	11	9	28
MQ-9 "Reaper" UAS Squadron	128	340	270	310	920	44	34	40	118
Minuteman III Missile Squadron ^g	45	690	650	690	2,040	31	29	31	92
RED HORSE Construction Engineers	n.a.	12,780 ^a	0	6,560 ^a	19,340 ^a	64	0	33	97
Air Force Special-Operations Forces	n.a.	15,900 ^a	0	8,170 ^a	24,070 ^a	80	0	41	120
Rest of the Air Force	n.a.	32,370 ^a	0	16,630 ^a	49,010 ^a	162	0	83	245

Continued

Table B-1.

Continued

Five-Year Tallies of Units' Military Personnel, 2017 to 2021

	Five-Year Total of Units	Military Personnel per Unit				Total Military Personnel Over the 2017–2021 Period (In thousands)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Defensewide Activities ^h									
Special Operations Command	n.a.	0	0	0	0	0	0	0	0
Defense Health Program for Retirees	n.a.	0	0	0	0	0	0	0	0
Classified Defensewide Funding	n.a.	0	0	0	0	0	0	0	0
Rest of the Defensewide Organizations	n.a.	0	0	0	0	0	0	0	0
Five-Year Total						3,780	3,653	2,946	10,379
National Defense Budget Estimates for Fiscal Year 2017									10,379

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

"Direct" personnel are associated with a major combat unit, "indirect" personnel are associated with units that support the major combat unit, and "overhead" personnel are associated with the major combat unit's share of administrative or overhead activities. For more information, see Chapter 1.

Supplemental data for this table are available on CBO's website (www.cbo.gov/publication/51535).

n.a. = not applicable; UAS = unmanned air system.

- a. Military personnel for these forces as a whole, rather than personnel per unit.
- b. Because of data limitations, CBO could not estimate personnel numbers for different classes of attack submarines using the framework of this analysis.
- c. Because of data limitations, CBO could not estimate personnel numbers for different classes of amphibious ships using the framework of this analysis. The numbers shown here are average personnel of ships only (they do not include the personnel of the Marine units that would deploy on the ships).
- d. Includes two command ships that are considered part of the amphibious fleet in the Department of Defense's budget documents.
- e. Aircraft squadrons are notional squadrons of 12 aircraft (actual squadrons vary in size).
- f. Because these aircraft are not yet in full operational service, their actual personnel numbers may differ from the planned personnel numbers included in the Department of Defense's budget documents, on which these estimates are based.
- g. Squadron of 50 Minuteman missiles.
- h. Defensewide organizations do not directly fund any military personnel of their own (because all military personnel are part of one of the services). In addition, in the analytic framework used for this report, defensewide organizations are considered to not have any units supporting them and thus to not have any indirect personnel or costs. No overhead costs are shown for defensewide organizations because such costs are apportioned on the basis of the number of military personnel in an activity.

Table B-2.

Five-Year Tallies of Units' Costs, 2017 to 2021

	Five-Year Total of Units	Annual Cost per Unit (Millions of 2017 dollars)				Total Cost Over the 2017–2021 Period (Billions of 2017 dollars)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Department of the Army									
Active-Component Armored Brigade Combat Team	45	500	840	1,280	2,610	22.3	37.7	57.5	117.5
National Guard Armored Brigade Combat Team	25	180	390	240	820	4.6	9.8	6.1	20.5
Active-Component Stryker Brigade Combat Team	35	500	790	1,280	2,560	17.4	27.7	44.6	89.7
National Guard Stryker Brigade Combat Team	10	190	370	240	800	1.9	3.7	2.4	8.0
Active-Component Infantry Brigade Combat Team	70	450	750	1,210	2,410	31.8	52.2	84.6	168.5
National Guard Infantry Brigade Combat Team	95	140	350	220	700	13.2	33.1	20.5	66.7
Active-Component Aviation Brigade	52	490	0	410	890	25.3	0	21.2	46.5
Reserve-Component Aviation Brigade	59	160	0	50	200	9.3	0	2.7	12.0
Army Special-Operations Forces	n.a.	3,190 ^a	0	4,020 ^a	7,210 ^a	15.9	0	20.1	36.1
Rest of the Army	n.a.	2,000 ^a	0	1,180 ^a	3,180 ^a	10.0	0	5.9	15.9
Department of the Navy									
Aircraft Carrier	55	470	180	530	1,180	25.6	10.2	29.2	65.0
Carrier Air Wing	50	330	200	390	910	16.3	9.8	19.6	45.7
Arleigh Burke Class Destroyer (DDG-51)	348	60	20	60	140	19.8	8.2	20.2	48.3
Ticonderoga Class Cruiser (CG-47)	106	40	20	40	110	4.7	2.1	4.7	11.5
Littoral Combat Ship	106	40	20	30	100	4.7	2.1	3.7	10.5
Zumwalt Class Destroyer (DDG-1000)	13	40	20	40	100	0.5	0.2	0.5	1.3
Attack Submarine ^b	255	70	40	30	140	17.8	10.4	8.0	36.2
Amphibious Ship ^c	175 ^d	110	40	120	270	19.6	7.8	20.5	47.9
Active-Component Marine Corps Infantry Battalion	120	140	140	470	740	16.4	16.9	55.9	89.3
Reserve-Component Marine Corps Infantry Battalion	40	70	50	350	470	2.9	1.8	14.1	18.8
Marine Corps Aircraft Complement	120	160	140	220	520	19.7	16.5	26.6	62.9
Ballistic and Guided Missile Submarines	90	70	40	50	170	6.4	3.7	4.8	14.9

Continued

Table B-2.

Continued

Five-Year Tallies of Units' Costs, 2017 to 2021

	Five-Year Total of Units	Annual Cost per Unit (Millions of 2017 dollars)				Total Cost Over the 2017–2021 Period (Billions of 2017 dollars)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Department of the Navy (Continued)									
P-3 and P-8 Maritime Patrol Aircraft Squadron ^e	37	110	70	150	330	4.2	2.5	5.7	12.4
Seabee Construction Engineers	n.a.	720 ^a	0	1,150 ^a	1,860 ^a	3.6	0	5.7	9.3
Navy Special-Operations Forces	n.a.	1,050 ^a	0	1,330 ^a	2,370 ^a	5.2	0	6.6	11.9
Marine Corps Special-Operations Forces	n.a.	210 ^a	0	280 ^a	490 ^a	1.0	0	1.4	2.5
Rest of the Navy	n.a.	3,490 ^a	0	3,060 ^a	6,550 ^a	17.4	0	15.3	32.8
Rest of the Marine Corps	n.a.	160 ^a	0	60 ^a	230 ^a	0.8	0	0.3	1.1
Department of the Air Force ^e									
A-10 Attack Aircraft Squadron	46	80	60	90	230	3.5	2.7	4.3	10.5
F-15 Fighter Aircraft Squadron	124	100	80	120	300	12.6	10.0	15.0	37.6
F-16 Fighter Aircraft Squadron	226	70	50	100	220	15.4	11.5	22.1	49.1
F-22 Fighter Aircraft Squadron	65	120	160	190	470	8.0	10.3	12.2	30.5
F-35 Fighter Aircraft Squadron ^f	37	130	210	230	570	4.9	7.7	8.6	21.2
B-52 Bomber Aircraft Squadron	19	270	170	300	740	5.0	3.1	5.6	13.8
B-1B Bomber Aircraft Squadron	21	270	230	310	810	5.7	4.9	6.6	17.2
B-2 Bomber Aircraft Squadron	7	670	490	680	1,840	4.5	3.3	4.5	12.3
C-130 Cargo Aircraft Squadron	118	110	80	170	360	12.9	9.6	19.7	42.1
C-5 Cargo Aircraft Squadron	16	130	110	190	430	2.1	1.8	3.1	7.0
C-17 Cargo Aircraft Squadron	76	90	60	110	270	7.1	4.8	8.3	20.2
KC-135 Tanker Aircraft Squadron	141	110	90	150	360	16.1	12.7	21.3	50.1
KC-10 Tanker Aircraft Squadron	18	180	160	250	580	3.3	2.9	4.5	10.7
KC-46 Tanker Aircraft Squadron ^f	20	80	10	80	180	1.6	0.2	1.7	3.5
MQ-1 "Predator" UAS Squadron	9	40	10	20	70	0.3	0.1	0.2	0.6
RQ-4 "Global Hawk" UAS Squadron	15	190	100	140	440	2.9	1.5	2.2	6.6
MQ-9 "Reaper" UAS Squadron	128	50	40	70	160	7.0	4.7	9.3	20.9
Minuteman III Missile Squadron ^g	45	130	90	160	380	5.9	4.0	7.2	17.1
RED HORSE Construction Engineers	n.a.	660 ^a	0	1,520 ^a	2,170 ^a	3.3	0	7.6	10.9
Air Force Special-Operations Forces	n.a.	1,840 ^a	0	1,890 ^a	3,730 ^a	9.2	0	9.4	18.7
Rest of the Air Force	n.a.	6,160 ^a	0	3,840 ^a	10,000 ^a	30.8	0	19.2	50.0

Continued

Table B-2.

Continued

Five-Year Tallies of Units' Costs, 2017 to 2021

	Five-Year Total of Units	Annual Cost per Unit (Millions of 2017 dollars)				Total Cost Over the 2017–2021 Period (Billions of 2017 dollars)			
		Direct	Indirect	Overhead	Total	Direct	Indirect	Overhead	Total
Defensewide Activities									
Special Operations Command	n.a.	5,370 ^a	0	0	5,370 ^a	26.9	0	0	26.9
Defense Health Program for Retirees	n.a.	14,720 ^a	0	0	14,720 ^a	73.6	0	0	73.6
Classified Defense Funding	n.a.	14,540 ^a	0	0	14,540 ^a	72.7	0	0	72.7
Rest of the Defensewide Organizations	n.a.	4,060 ^a	0	0	4,060 ^a	20.3	0	0	20.3
Five-Year Total						694.2	352.6	701.3	1,748.1
National Defense Budget Estimates for Fiscal Year 2017									1,748.1

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

"Direct" costs are associated with a major combat unit, "indirect" costs are associated with units that support the major combat unit, and "overhead" costs are associated with the major combat unit's share of administrative or overhead activities. For more information, see Chapter 1.

Supplemental data for this table are available on CBO's website (www.cbo.gov/publication/51535).

n.a. = not applicable; UAS = unmanned air system.

a. Annual cost for these forces as a whole, rather than cost per unit.

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

c. Because of data limitations, CBO 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).

d. Includes two command ships that are considered part of the amphibious fleet in the Department of Defense's budget documents.

e. Aircraft squadrons are notional squadrons of 12 aircraft (actual squadrons vary in size).

f. Because these aircraft 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.

g. Squadron of 50 Minuteman missiles.

Military Operations and Planning Scenarios Referred to in This Report

In describing the past and planned use of various types of forces, this primer mentions a number of military operations that the United States has engaged in since World War II, as well as a number of scenarios that the Department of Defense (DoD) has used to plan for future conflicts. Those operations and planning scenarios are summarized below.

Military Operations

1950–1953: **Korean War.** U.S. forces defended South Korea (the Republic of Korea) from an invasion by North Korea (the Democratic People's Republic of Korea). North Korean forces initially came close to overrunning the entire Korean Peninsula before being pushed back. Later, military units from China (the People's Republic of China) intervened when U.S. forces approached the Chinese border. That intervention caused the conflict to devolve into a stalemate at the location of the current border between North and South Korea.

September 1950: **Inchon Landing.** U.S. marines led an amphibious assault on the South Korean port of Inchon. At the time, Inchon was well behind the North Korean military's lines, and the insertion of U.S. forces there contributed to the collapse and retreat of the North Korean invasion force.

1964–1975: **Vietnam War.** U.S. forces attempted to defend the government of South Vietnam (the Republic of Vietnam) from communist insurgents backed by North Vietnam (the People's Republic of Vietnam) and from military incursions by North Vietnam's ground forces. Ultimately, the United States withdrew ground forces from South Vietnam in 1973 and air support from the country in 1975. Subsequently, all of South Vietnam was conquered by North Vietnamese ground forces, uniting the two countries under a single government.

1965–1972, intermittently: **Bombing of North Vietnam.** Several U.S. bombing campaigns were conducted on the territory of North Vietnam during the war (as opposed to air operations in South Vietnam, which were essentially continuous in support of U.S. and South Vietnamese ground forces). The most notable campaigns included Operations Rolling Thunder, Linebacker, and Linebacker II.

1972: **Easter Offensive.** This offensive, launched by North Vietnamese ground forces, was largely defeated by South Vietnamese ground forces along with heavy air support from U.S. forces.

1975: **Spring Offensive.** This was the final offensive launched by North Vietnamese ground forces during the war. Unlike in the Easter Offensive, the United States did not provide air support to South Vietnamese ground forces, and North Vietnamese forces fully conquered South Vietnam.

1980: **Operation Eagle Claw.** U.S. special-operations forces attempted to rescue hostages held in Tehran in the wake of the Iranian revolution. The operation failed to meet any of its objectives.

1982: **Falklands War.** The United Kingdom recaptured the Falkland Islands from Argentina, which had occupied them. The campaign involved a U.K. naval task force that secured the seas around the Falklands prior to an amphibious assault by commandos and royal marines that retook the islands. The war included some of the few examples of modern naval combat since World War II: A U.K. nuclear submarine sank an Argentinian ship (the *ARA General Belgrano*), and Argentinian aircraft sank several U.K. ships (most notably, the *HMS Sheffield*) with bombs and cruise missiles.

1986: **Operation El Dorado Canyon.** Air Force and Navy aircraft bombed targets in Libya in response to terrorist attacks sponsored by the Libyan government.

1987: **USS *Stark* Incident.** During the Iran–Iraq War, an Iraqi fighter aircraft fired two cruise missiles at the USS *Stark*, a U.S. frigate on patrol in the Persian Gulf. Both missiles hit the *Stark*, causing casualties and damaging the ship.

1990–1991: **Operation Desert Shield.** U.S. forces were deployed to Saudi Arabia to protect that country from a potential invasion by Iraq in the aftermath of Iraq's August 1990 invasion of Kuwait. The first U.S. ground troops deployed were the 82nd Airborne Division, but the deployment ultimately involved a large enough force to invade Iraq and liberate Kuwait (see **Operation Desert Storm**, below). The U.S. military also enforced a naval blockade of Iraq. During that blockade, two U.S. warships, the USS *Princeton* and USS *Tripoli*, were damaged by Iraqi sea mines.

1991: **Operation Desert Storm.** During Operation Desert Shield, the United States' goals shifted from defending Saudi Arabia from an Iraqi attack to removing Iraqi forces from Kuwait. Operation Desert Storm was the operation to liberate Kuwait and destroy Iraqi ground forces. After an air campaign lasting 42 days, the United States launched a ground campaign that achieved its primary goals within 4 days. This conflict saw the first use of the Patriot missile system to defend against Iraqi Scud missiles fired at Saudi Arabia and Israel.

1991–2003: **Operations Northern Watch and Southern Watch.** This pair of operations was the U.S. effort to maintain northern and southern no-fly zones over Iraq (intended to protect Iraqi Kurds and Shiites, respectively) between Operation Desert Storm and Operation Iraqi Freedom.

1992–1993: **Operation Restore Hope.** This operation was the U.S. military component of the United Nations' effort to restore order in Somalia to allow for the distribution of humanitarian aid. During the October 1993 battle of Mogadishu, a U.S. special-operations force was pinned down and isolated in Somalia's capital by hostile militias and suffered several casualties—an incident featured in the book and film *Black Hawk Down*. That incident eventually led the United States to abandon the operation.

1994–1995: **Operation Uphold Democracy.** Initially planned as a U.S. invasion of Haiti to overthrow the Haitian government, this operation became a peace-keeping mission after a diplomatic settlement was reached in which the leaders of the Haitian government agreed to step down.

1998: **Operation Infinite Reach.** Navy ships launched a series of strikes with Tomahawk cruise missiles at targets in Sudan and Afghanistan in response to the bombings of the U.S. embassies in Kenya and Tanzania earlier that year.

1999: **Operation Noble Anvil.** This was the U.S. contribution to the North Atlantic Treaty Organization's (NATO's) operations against Serbia, intended to force Serbia's leadership to relinquish control of the province of Kosovo. The majority of the operation consisted of a three-month bombing campaign against targets in Serbia and against Serbian military units in Kosovo. A diplomatic settlement was ultimately reached in which the Serbian leadership agreed to NATO's demands.

1999: **Task Force Hawk.** A component of the U.S. campaign against Serbia, this Army task force was originally intended to deploy a battalion of AH-64 attack helicopters to Tirana, Albania. For a variety of reasons, the task force grew in size, was slow to deploy, and never participated in the campaign.

2000: **USS *Cole* Bombing.** In this incident, a small boat loaded with explosives was used to launch a suicide attack against the destroyer USS *Cole* while it was docked in the port of Aden, Yemen. The resulting explosion blew a large hole in the hull of the *Cole*, killed 17 sailors, and wounded several others.

2001: **Operation Enduring Freedom.** Although this name technically applied to a wide variety of operations (also referred to as the Global War on Terror), the main component of this operation was the invasion of Afghanistan to oust the Taliban government and apprehend Osama bin Laden after the September 11, 2001, terrorist attacks in the United States. Major portions of the offensive involved U.S. special forces supporting Afghan ground forces of the Northern Alliance and an air assault by U.S. Marines on the city of Kandahar.

December 2001: **Battle of Tora Bora.** U.S. special forces attempted to capture Osama bin Laden and other

elements of the Al Qaeda leadership in a mountainous region of Afghanistan. Despite U.S. confidence that bin Laden was present in the region, he was not found, although it is unclear whether that outcome occurred because he was not present or because of operational missteps.

2001–Present: Occupation/International Security Assistance Force. Since Operation Enduring Freedom, the United States has continuously maintained military forces in Afghanistan (often as part of a NATO security assistance force) in an effort to support the Afghan government against insurgents, warlords, a resurgent Taliban, and other destabilizing elements (since 2015, under the name **Operation Freedom's Sentinel**). For much of that time, U.S. forces in Afghanistan consisted of between one and three brigades of ground troops, but those forces were temporarily increased in 2009 as part of a surge.

2003: Operation Iraqi Freedom. U.S. forces invaded Iraq with the goal of destroying the government of Saddam Hussein. Army and Marine forces advancing from Kuwait formed the bulk of the U.S. offensive power, but U.S. Army and Kurdish forces in the north of Iraq and an extensive U.S. air campaign were also key parts of the operation. After three weeks, U.S. forces captured Baghdad, and Saddam Hussein's government disintegrated, although some pockets of resistance remained.

2003–2011: Occupation of Iraq. The United States maintained military forces in Iraq for eight years after Operation Iraqi Freedom in an effort to support the Iraqi government against insurgents, loyalists of the former regime, local militias, and other destabilizing elements, especially during the Iraqi civil war of 2006 and 2007. For much of that time, U.S. forces in Iraq consisted of between 15 and 18 brigades of ground forces, but those forces were temporarily increased in 2007 as part of a surge.

2011: Operation Neptune Spear. U.S. special forces raided a compound in Abbottabad, Pakistan, with the intent to capture or kill Osama bin Laden. The raid was a success, and bin Laden was killed in the action.

2011: Operation Odyssey Dawn. This was the U.S. contribution to NATO's operations against Libya, intended to enforce a no-fly zone against the government of Muammar Gaddafi. The operation included cruise

missile strikes and a naval blockade, but the majority of the campaign involved using tactical aviation to attack and destroy Libyan government military units. Libyan rebel groups captured and killed Gaddafi during the operation, ending his regime.

2014–Present: Operation Inherent Resolve. The United States is currently conducting air strikes against the Islamic State group (known variously as ISIS, ISIL, and Daesh) in Iraq and Syria. The United States has also committed a limited number of special forces to assist Kurdish groups fighting the Islamic State.

DoD Planning Scenarios

The Department of Defense uses scenarios for planning purposes to prepare for the types of conflicts that it considers especially relevant or challenging. Such scenarios are not war plans; they are descriptions of hypothetical conflicts that can be used in various types of analytic exercises rather than detailed plans that could be used in the event of an actual conflict. DoD's scenarios are not necessarily considered likely possibilities—some are useful as examples of worst-case planning, whereas others incorporate features that are considered important for understanding future developments in warfighting. Some of the scenarios that DoD uses involve the following areas:

North Korea. Scenarios for North Korea typically postulate an attack by that country's ground forces on South Korean territory that requires U.S. assistance to repel. North Korea is assumed to use ballistic missiles to try to complicate the U.S. response in various ways, such as by attacking ports and airfields in South Korea with chemical weapons to hinder the arrival of U.S. reinforcements or attacking the United States' allies in the region (such as Japan) to reduce diplomatic support for U.S. goals. Those scenarios allow DoD to consider a variety of issues, including how to provide missile defense to allies, how quickly U.S. forces can be deployed, and how to respond to the use of chemical weapons.

Strait of Hormuz. Scenarios for the Strait of Hormuz (the narrow waterway that connects the Persian Gulf to the Arabian Sea) typically postulate a conflict in which Iran attempts to use submarines, cruise missiles, and small boats to close the Persian Gulf to U.S. Navy warships and civilian shipping at the Strait of Hormuz. Those scenarios allow DoD to consider such factors as the difficulty of projecting naval power in coastal regions

(where defenders have many advantages), ways to counter nontraditional threats such as small boats, and other antiaccess challenges.

Taiwan. Scenarios for Taiwan typically postulate an attempt by China (the People's Republic of China) to force Taiwan (the Republic of China) to reunite with it or to prevent Taiwan from making a formal declaration of independence. China is assumed to use air strikes, cruise missiles, ballistic missiles, and possibly an amphibious attack against Taiwan, while attempting to use its air and naval forces to prevent the United States from defending Taiwan. Such scenarios allow DoD to plan for dealing with a powerful adversary that has a variety of advanced weapons, especially in a naval context. The naval angle is important because combat between modern warships has occurred only once since World War II (during the 1982 **Falklands War**), and the scarcity of such examples means that there is a great deal of uncertainty about what combat between warships might look like now.

South China Sea. Scenarios for the South China Sea typically postulate that the United States would respond to a request for military assistance from one or more of the countries that dispute the claims of sovereignty that China (the People's Republic of China) has made over several islands and their territorial waters in the South China Sea. In those scenarios, China is assumed to have used military force to resolve territorial disputes in its

favor, and U.S. air and naval forces would be required to do one or more of the following: defend the opposing countries against Chinese attacks, remove the Chinese military presence from disputed islands, or restore freedom of navigation in the South China Sea. For the purpose of force planning, such scenarios resemble Taiwan scenarios, requiring similar forces against the same opponent in almost the same theater of operations. But they suggest different forms of peacetime preparation, including establishing cooperative agreements with the governments of countries that border the South China Sea, such as the Philippines or Vietnam.

Two Major Regional Conflicts or Major Theater Wars.

In the 1990s, U.S. planners used a pair of scenarios (called major regional conflicts or, later, major theater wars) occurring at the same, or nearly the same, time as the formal benchmark for most planning decisions about the military's force structure. One scenario was the **North Korea** scenario described above. The other scenario was an Iraqi invasion of Kuwait and Saudi Arabia (essentially, a hypothetical variant of **Operations Desert Storm and Desert Shield** in which Iraq's offensive did not stop at the Saudi Arabia–Kuwait border). That pair of scenarios was DoD's planning framework, with some variations, for about a decade. It dominated the department's planning during the period between the collapse of the Soviet Union and the terrorist attacks of September 11, 2001.

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About This Document

This Congressional Budget Office report was prepared at the request of the former Ranking Member of the Senate Committee on the Budget. In keeping with CBO's mandate to provide objective, impartial analysis, it makes no recommendations.

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