U.S. Military Power
An Assessment of U.S. Military Power

America is a global power with global interests. Its military is meant first and foremost to defend America from attack. Beyond that, it is meant to protect Americans abroad, allies, and the freedom to use international sea, air, and space while retaining the ability to engage in more than one major contingency at a time. America must be able not only to defend itself and its interests, but also to deter enemies and opportunists from taking action that would challenge U.S. interests, a capability that includes preventing the destabilization of a region and guarding against threats to the peace and security of America’s friends.

As noted in the two preceding editions of the Index, however, the U.S. does not have the right force to meet a two-major regional contingency (two-MRC) requirement and is not ready to carry out its duties effectively. Consequently, as was seen during 2016, the U.S. risks seeing its interests increasingly challenged and the world order it has led since World War II undone.

How to Think About Sizing Military Power

Military power begins with the people and equipment used to conduct war: the weapons, tanks, ships, airplanes, and supporting tools such as communications systems that make it possible either for one group to impose its will on another or to prevent such an outcome from happening.

However, simply counting the number of people, tanks, or combat aircraft that the U.S. possesses would be irrelevant because it would lack context. For example, the U.S. Army might have 100 tanks, but to accomplish a specific military task, 1,000 or more tanks might be needed or none at all. It might be that the terrain on which a battle is fought is especially ill-suited to tanks or that the tanks one has are inferior to the enemy’s. The enemy could be quite adept at using tanks, or his tank operations might be integrated into a larger employment concept that leverages the supporting fires of infantry and airpower, whereas one’s own tanks are poorly maintained, the crews are ill-prepared, or one’s doctrine is irrelevant.

Success in war is partly a function of matching the tools of warfare to a specific task and employing those tools effectively in the conditions of the battle. Get these wrong—tools, objective, competency, or context—and you lose.

Another key element is the military’s capacity to conduct operations: how many of the right tools—people, tanks, planes, or ships—it has. One might have the right tools and know how to use them effectively but not have enough to win. Given that one cannot know with certainty beforehand just when, where, against whom, and for what reason a battle might be fought, determining how much capability is needed is an exercise of informed, but not certain, judgment.

Further, two different combatants can use the same set of tools in radically different ways to quite different effects. The concept of employment matters. Concepts are developed to account for numbers, capabilities, material readiness, and all sorts of other factors that enable or constrain one’s actions, such as whether one fights alone or alongside allies, on familiar or strange terrain, or with a
large, well-equipped force or a small, poorly equipped force.

All of these factors and a multitude of others bear upon the outcome of any military contest. Military planners attempt to account for them when devising requirements, developing training and exercise plans, formulating war plans, and providing advice to the President in his role as Commander in Chief of U.S. military forces.

Measuring hard combat power in terms of its adequacy in capability, capacity, and readiness to defend U.S. vital interests is hard, especially in such a limited space as this Index, but it is not impossible. Regardless of the difficulty of determining the adequacy of one’s military forces, the Secretary of Defense and the military services have to make decisions every year when the annual defense budget request is submitted to Congress.

The adequacy of hard power is affected most directly by the resources the nation is willing to invest. While that investment decision is informed to a significant degree by an appreciation of threats to U.S. interests and the ability of a given defense portfolio to protect U.S. interests against such threats, it is not informed solely by such considerations; hence the importance of clarity and honesty in determining just what is needed in hard power and the status of such power from year to year.

Administrations take various approaches in determining the type and amount of military power needed and, by extension, the amount of money and other resources to commit to it. After defining the national interests to be protected, the Department of Defense can use worst-case scenarios to determine the maximum challenges the U.S. military might have to overcome. Another way is to redefine what constitutes a threat. By taking a different view of whether major actors pose a meaningful threat and of the extent to which friends and allies have the ability to assist the U.S. in meeting security objectives, one can arrive at different conclusions about necessary military strength.

For example, one Administration might view China as a rising, belligerent power bent on dominating the Asia–Pacific. Another Administration might view China as an inherently peaceful, rising economic power, with the expansion of its military capabilities a natural occurrence commensurate with its strengthening status. The difference between these views can have a dramatic impact on how one thinks about U.S. defense requirements. So, too, can policymakers amplify or downplay risk to justify defense budget decisions.

There can also be strongly differing views on requirements for operational capacity.

- Does the country need enough for two major combat operations (MCOs) at roughly the same time or just enough for a single major operation plus some number of lesser cases?
- To what extent should “presence” tasks—the use of forces for routine engagement with partner countries or simply to be on hand in a region for crisis response—be additive to or a subset of a military force sized to handle two major regional conflicts?
- How much value should be assigned to advanced technologies as they are incorporated into the force?

Where to Start

There are references that one can use to help sort through the variables and arrive at a starting point for assessing the adequacy of today’s military posture: government studies and historical experience. The government occasionally conducts formal reviews meant to inform decisions on capabilities and capacities across the Joint Force relative to the threat environment (current and projected) and evolutions in operating conditions, the advancement of technologies, and aspects of U.S. interests that may call for one type of military response over another.

The 1993 Bottom-Up Review (BUR), conducted by then-Secretary of Defense Les
Aspin, is one such frequently cited example. Secretary Aspin recognized that “the dramatic changes that [had] occurred in the world as a result of the end of the Cold War and the dissolution of the Soviet Union” had “fundamentally altered America’s security needs” and were driving an imperative “to reassess all of our defense concepts, plans, and programs from the ground up.”

The BUR formally established the requirement that U.S. forces should be able “to achieve decisive victory in two nearly simultaneous major regional conflicts [MRCs] and to conduct combat operations characterized by rapid response and a high probability of success, while minimizing the risk of significant American casualties.” Thus was formalized the two-MRC standard.

Dr. Daniel Gouré, in his 2015 Index essay “Building the Right Military for a New Era: The Need for an Enduring Analytic Framework,” noted that various Administrations have redefined force requirements based on their perceptions of what was necessary to protect U.S. interests. In an attempt to formalize the process, and perhaps to have a mechanism by which to exert influence on the executive branch in such matters, Congress mandated that each incoming Administration must conduct a comprehensive strategic review of the global security environment, articulate a relevant strategy suited to protecting and promoting U.S. security interests, and recommend an associated military force posture.

The Quadrennial Defense Reviews (QDRs) have been conducted since 1997, accompanied in 1997, 2010, and 2014 by independent National Defense Panel (NDP) reports that have reviewed and commented on them. Both sets of documents purport to serve as key assessments, but analysts have come to minimize their value, regarding them as justifications for executive branch policy preferences (the QDR reports) or overly broad, generalized commentaries (the NDP reports) that lack substantive discussion about threats to U.S. interests, a credible strategy for dealing with them, and the actual ability of the U.S. military to meet national security requirements.

**Correlation of Forces as a Factor in Force Sizing**

During the Cold War, the U.S. used the Soviet threat as its primary reference in determining its hard-power needs. At that time, the correlation of forces—a comparison of one force against another to determine strengths and weaknesses—was highly symmetrical. U.S. planners compared tanks, aircraft, and ships against their direct counterparts in the opposing force. These comparative assessments drove the sizing, characteristics, and capabilities of fleets, armies, and air forces.

The evolution of guided, precision munitions and the rapid technological advancements in surveillance and targeting systems, however, have made comparing combat power more difficult. What was largely a platform v. platform model has shifted somewhat to a munitions v. target model.

The proliferation of precise weaponry increasingly means that each round, bomb, rocket, missile, and even individual bullet (in some instances) can hit its intended target, thus decreasing the number of munitions needed to prosecute an operation. It also means that the lethality of an operating environment increases significantly for the people and platforms involved. We are now at the point where one must consider how many “smart munitions” the enemy has when thinking about how many platforms and people are needed to win a combat engagement instead of focusing primarily on how many ships or airplanes the enemy can bring to bear against one’s own force.

In one sense, increased precision and the technological advances now being incorporated into U.S. weapons, platforms, and operating concepts make it possible to do far more with fewer assets than ever before. Platform signature reduction (stealth) makes it harder for the enemy to find and target them, while the increased precision of weapons makes it possible for fewer platforms to hit many more
targets. Additionally, the ability of the U.S. Joint Force to harness computers, modern telecommunications, space-based platforms—such as for surveillance, communications, positioning-navigation-timing (PNT) support from GPS satellites—and networked operations potentially means that smaller forces can have far greater effect in battle than at any other time in history. But these same advances also enable enemy forces, and certain military functions—such as seizing, holding, and occupying territory—may require a certain number of soldiers no matter how state-of-the-art their equipment may be.

With smaller forces, each individual element of the force represents a greater percentage of its combat power. Each casualty or equipment loss takes a larger toll on the ability of the force to sustain high-tempo, high-intensity combat operations over time, especially if the force is dispersed across a wide theater or across multiple theaters of operation.

As advanced technology has become more affordable, it has become more accessible for nearly any actor, whether state or non-state. Consequently, it may be that the outcomes of future wars will depend to a much greater degree on the skill of the forces and their capacity to sustain operations over time than they will on some great disparity in technology. If so, readiness and capacity will take on greater importance than absolute advances in capability.

All of this illustrates the difficulties of and need for exercising judgment in assessing the adequacy of America’s military power. Yet without such an assessment, all that we are left with are the quadrennial strategic reviews, which are subject to filtering and manipulation to suit policy interests; annual budget submissions, which typically favor desired military programs at presumed levels of affordability and are therefore necessarily budget-constrained; and leadership posture statements, which often simply align with executive branch policy priorities.

The U.S. Joint Force and the Art of War

This section of the Index, on military capabilities, assesses the adequacy of the United States’ defense posture as it pertains to a conventional understanding of “hard power,” defined as the ability of American military forces to engage and defeat an enemy’s forces in battle at a scale commensurate with the vital national interests of the U.S. While some hard truths in military affairs are appropriately addressed by math and science, others are not. Speed, range, probability of detection, and radar cross-section are examples of quantifiable characteristics that can be measured. Specific future instances in which U.S. military power will be needed, the competency of the enemy, the political will to sustain operations in the face of mounting deaths and destruction, and the absolute amount of strength needed to win are matters of judgment and experience, but they nevertheless affect how large and capable a force one might need.

In conducting the assessment, we accounted for both quantitative and qualitative aspects of military forces, informed by an experience-based understanding of military operations and the expertise of external reviewers.

Military effectiveness is as much an art as it is a science. Specific military capabilities represented in weapons, platforms, and military units can be used individually to some effect. Practitioners of war, however, have learned that combining the tools of war in various ways and orchestrating their tactical employment in series or simultaneously can dramatically amplify the effectiveness of the force committed to battle.

Employment concepts are exceedingly hard to measure in any quantitative way, but their value as critical contributors in the conduct of war is undeniable. How they are utilized is very much an art-of-war matter, learned through experience over time.

What Is Not Being Assessed

In assessing the current status of the military forces, this Index uses the primary
references used by the military services themselves when they discuss their ability to employ hard combat power. The Army’s unit of measure is the brigade combat team (BCT), while the Marine Corps structures itself by battalions. For the Navy, it is the number of ships in its combat fleet, and the most consistent reference for the Air Force is total number of aircraft, sometimes broken down into the two primary sub-types of fighters and bombers.

Obviously, this is not the totality of service capabilities, and it certainly is not everything needed for war, but these measures can be viewed as surrogate measures that subsume or represent the vast number of other things that make these “units of measure” possible and effective in battle. There is an element of proportionality or ratio related to these measures that drives other aspects of force sizing. For example:

• When planning air operations, the Air Force looks at the targets to be serviced and the nature of the general operation to be supported and then accounts for aircraft and munitions needed (type and quantity) and the availability and characteristics of airfields relevant to the operation. From this, they calculate sorties, distances, flight hours, fuel consumption, number of aircraft in a given piece of air space, and a host of other pieces of information to determine how many aerial refueling tankers will be needed.

• Joint Force detailed planning for operations determines how much equipment, manpower, and supplies need to be moved from one point to another and how much more will be needed to sustain operations: Logistics is a very quantitative business.

• U.S. Transportation Command (TRANS-COM) calculates the amount of lift required in cargo planes, sealift shipping, long-haul road movements, and trains.

• The Marine Corps thinks operationally in terms of Marine Air-Ground Task Forces (MAGTFs) that are composed of command, ground, air, and logistics elements. The size of a MAGTF varies depending on the mission to be accomplished, but the nucleus is normally (though not always) the ground combat element that typically ranges from a battalion to a division. The amount of airpower, logistics support, and transportation (amphibious, sealift, and airlift) required to execute the operation extends from there.

• The Navy thinks in terms of the number of surface combatants, the nature of operations, and proximity to ports to drive planning for all of the combat logistics force vessels that are needed to make it happen.

• The Army provides a host of “common user support” capabilities to the overall force that can include operating ports, theater-wide trucking and rail operations, large-scale fuel and ammunition storage and distribution, engineering and construction services, and general supply support.

• Institutional elements like recruiting are necessary to generate the force in the first place, as well as the multitude of installations at which units are based, training facilities, acquisition workforce, and the military’s medical infrastructure.

The point is that the military spear has a great deal of shaft that makes it possible for the tip to locate, close with, and destroy its target, and there is a rough proportionality between shaft and spear tip. Thus, in assessing the basic units of measure for combat power, one can get a sense of what is likely needed in the combat support, combat service support, and supporting establishment echelons. The scope of this Index does not extend to analysis of everything that makes hard power possible; it focuses on the status of the hard power itself.
This assessment also does not account for the Reserve and Guard components of the services; it focuses only on the Active component. Again, the element of proportion or ratio figures prominently. Each service determines the balance among its Active, Reserve, and National Guard elements (only the Army and Air Force have Guard elements; the Navy and Marine Corps do not) based on factors that include cost of the respective elements, availability for operational employment, time needed to respond to an emergent crisis, the allocation of roles between the elements, and political considerations. This assessment looks at the baseline requirement for a given amount of combat power that is readily available for use in a major combat operation—something that is usually associated with the Active components of each service.

The Defense Budget and Strategic Guidance

As for the defense budget, ample discussion of budget issues is scattered throughout (mainly as they pertain to acquisition programs), but the budget itself—whether for the military services individually, the Joint Force as a whole, or the totality of the defense establishment—is actually a reflection of the importance that the U.S. places on the modernity, capacity, and readiness of the force rather than a measure of the capability of the force itself. In other words, the budget itself does not tell us much about the posture of the U.S. military.

The baseline budget for defense in fiscal year (FY) 2016 was $548 billion, which paid for the forces (manpower, equipment, training); enabling capabilities (things like transportation, satellites, defense intelligence, and research and development); and institutional support (bases and stations, facilities, recruiting, and the like). The baseline budget does not pay for the cost of major ongoing overseas operations, which is captured in supplemental funding known as OCO (overseas contingency operations).

It is true that absent a significant threat to the survival of the country, the U.S. will always balance expenditures on defense with spending in all of the other areas of government activity that it thinks are necessary or desirable. Some have argued that a defense budget indexed to a percent of gross domestic product (GDP) is a reasonable reference, but a fixed percentage of GDP does not accurately reflect national security requirements per se any more than the size of the budget alone correlates to levels of capability. It is possible that a larger defense budget could be associated with less military capability if the money were allocated inappropriately or spent wastefully, and the fact that the economy changes over time does not necessarily mean that defense spending should increase or decrease in lockstep by default.

Ideally, defense requirements are determined by identifying national interests that might need to be protected with military power; assessing the nature of threats to those interests and what would be needed to defeat those threats (and how much that would cost); and then determining what the country can afford (or is willing) to spend. Any difference between assessed requirements and affordable levels of spending on defense would constitute risk to U.S. security interests.

This Index enthusiastically adopts this latter approach: interests, threats, requirements, resulting force, and associated budget. Spending less than the amount needed to maintain a two-MRC force results in policy debates about where to accept risk: force modernization, the capacity to conduct large-scale or multiple simultaneous operations, or force readiness.

The decision to fund national defense commensurate with interests and prevailing threats is a policy decision that reflects national priorities and acceptance of risk. This Index assesses the ability of the nation’s military forces to protect vital national security interests within the world as it is so that the debate about the level of funding for hard power is better informed.

In FY 2016, the debate about how much funding to allocate to defense was affected once again by a larger political debate that
pitted those who wanted to see an overall reduction in federal spending against those who pushed for higher levels of spending for defense and those who wanted to see any increase in defense spending matched by commensurate increases in domestic spending. In spite of each camp’s firmly held views, Congress as a whole, acknowledging problems in military readiness and the growing need to replace aging equipment, voted to modify the spending caps set by the Budget Control Act (BCA) by enacting the Bipartisan Budget Act of 2015 (BBA). The BBA increased the spending cap on the defense budget by $25 billion for FY 2016 and by $15 billion for FY 2017. It also provided an additional $8 billion for the base defense budget through the OCO account, which is not subject to spending caps as the normal defense budget is.

The combined base budget and OCO-for-base budget for FY 2016 was $556 billion. Adjusted for inflation, this was a 5 percent increase over FY 2015 levels but still below the President’s FY 2016 budget request of $561 billion. For comparison, President Barack Obama’s 2012 defense budget, the last under
former Secretary of Defense Robert Gates, proposed spending $638 billion on defense in FY 2016. A bipartisan consensus, as seen in the National Defense Panel report in 2014, has identified the so-called Gates budget as the minimum the United States should be spending on national defense. As seen in Chart 3, both the FY 2016 enacted budget and the FY 2017 budget proposal are well below this minimum.

The restrictions placed on defense spending by the BCA continue to be a major concern of the military service chiefs, who have consistently testified about the damage these restrictions are causing to readiness, modernization, and capacity for operations. As FY 2016 ended, the budget debates about FY 2017 had not been resolved, but it appears unlikely that any resolution will bring the national defense budget close to even the minimum levels proposed by the Gates budget.

Purpose as a Driver in Force Sizing

The Joint Force is used for a wide range of purposes, only one of which is major combat operations. Fortunately, such events have been rare, averaging roughly 15–20 years between occurrences. In between (and even during) such occurrences, the military is used in support of regional engagement, crisis response, strategic deterrence, and humanitarian assistance, as well as to provide support to civil authorities and U.S. diplomacy.

The U.S. Unified Combatant Commands, or COCOMS (EUCOM, CENTCOM, PACOM, SOUTHCOM, and AFRICOM), all have annual and long-term plans through which they engage with countries in their assigned regions. These engagements range from very small unit training events with the forces of a single partner country to larger bilateral and sometimes multinational military exercises. In 2015, these engagements included training and assisting Iraqi military forces and participating in joint training exercises with NATO members. Such events help to establish working relationships with other countries, acquire a more detailed understanding of regional political–military dynamics and on-the-ground conditions in areas of interest, and signal U.S. security interests to friends and competitors.

To support such COCOM efforts, the services provide forces that are based permanently in respective regions or that operate in them temporarily on a rotational basis. To make these regional rotations possible, the services must maintain a base force that is sufficiently large to train, deploy, support, receive back, and make ready again a stream of units ideally numerous enough to meet validated COCOM demand.

The ratio between time spent at home and time spent away on deployment for any given unit is known as OPTEMPO (operational tempo), and each service attempts to maintain a ratio that both gives units enough time to educate, train, and prepare their forces and allows the individuals in a unit to maintain some semblance of a healthy home and family life. This ensures that units are fully prepared for the next deployment cycle and that servicemembers do not become “burned out” or suffer adverse consequences in their personal lives because of excessive deployment time.

Experience has shown that a ratio of at least 3:1 is sustainable, meaning three periods of time at home for every period deployed. (If a unit is to be out for six months, it will be home for 18 months before deploying again.) Obviously, a service needs a sufficient number of people, units, ships, and planes to support such a ratio. If peacetime engagement were the primary focus for the Joint Force, the services could size their forces to support these forward-based and forward-deployed demands.

Thus, the size of the total force must necessarily be much larger than any sampling of its use at any point in time.

In contrast, sizing a force for major combat operations is an exercise informed by history—how much force was needed in previous wars—and then shaped and refined by analysis of current threats, a range of plausible scenarios, and expectations about what the
U.S. can do given training, equipment, employment concept, and other factors. The defense establishment must then balance “force sizing” between COCOM requirements for presence and engagement with the amount of military power (typically measured in terms of combat units and major combat platforms, which informs total end strength) thought necessary to win in likely war scenarios.

Inevitably, compromises are made that account for how much military the country is willing to buy. Generally speaking:

- The Army sizes to major warfighting requirements.
- The Marine Corps focuses on crisis response demands and the ability to contribute to one major war.
- The Air Force attempts to strike a balance that accounts for historically based demand across the spectrum because air assets are shifted fairly easily from one theater of operations to another (“easily” being a relative term when compared to the challenge of shifting large land forces), and any peacetime engagement typically requires some level of air support.
- The Navy is driven by global presence requirements. To meet COCOM requirements for a continuous fleet presence at sea, the Navy must have three to four ships in order to have one on station. To illustrate with a simplistic example, a commander who wants one U.S. warship stationed off the coast of a hostile country needs the use of four ships from the fleet: one on station, one that left station and is traveling home, one that just left home and is traveling to station, and one that fills in for one of the other ships when it needs maintenance or training time.

This report focuses on the forces required to win two major wars as the baseline force-sizing metric. The military’s effectiveness, both as a deterrent against opportunistic competitor states and as a valued training partner in the eyes of other countries, derives from its effectiveness (proven or presumed) in winning wars.

Our Approach

With this in mind, we assessed the state of military affairs for U.S. forces as it pertains to their ability to deliver hard power against an enemy in three areas:

- Capability,
- Capacity, and
- Readiness.

Capability. Examining the capability of a military force requires consideration of:

- The proper tools (material and conceptual) of sufficient design, performance characteristics, technological advancement, and suitability needed for it to perform its function against an enemy force successfully.
- The sufficiency of armored vehicles, ships, airplanes, and other equipment and weapons to win against the enemy.
- The appropriate variety of options to preclude strategic vulnerabilities in the force and give flexibilities to battlefield commanders.
- The degree to which elements of the force reinforce each other in covering potential vulnerabilities, maximizing strengths, and gaining greater effectiveness through synergies that are not possible in narrowly stovepiped, linear approaches to war.

The capability of the U.S. Joint Force was on ample display in its decisive conventional war victory over Iraq in liberating Kuwait in 1991 and later in the conventional military
operation to liberate Iraq in 2003. Aspects of its capability have also been seen in numerous other operations undertaken since the end of the Cold War. While the conventional combat aspect at the “pointy end of the spear” of power projection has been more moderate in places like Yugoslavia, Somalia, Bosnia and Serbia, and Kosovo, and even against the Taliban in Afghanistan in 2001, the fact that the U.S. military was able to conduct highly complex operations thousands of miles away in austere, hostile environments and sustain those operations as long as required is testament to the ability of U.S. forces to do things that the armed forces of few if any other countries can do.

A modern-day “major combat operation” along the lines of those upon which Pentagon planners base their requirements would feature a major opponent possessing modern integrated air defenses; naval power (surface and subsurface); advanced combat aircraft (to include bombers); a substantial inventory of short-range, medium-range, and long-range missiles; current-generation ground forces (tanks, armored vehicles, artillery, rockets, and anti-armor weaponry); cruise missiles; and (in some cases) nuclear weapons. Such a situation involving an actor capable of threatening vital national interests would present a challenge that is comprehensively different from the challenges that the U.S. Joint Force has faced in past decades.

2016 saw a continued shift in debate within military circles about the extent to which the U.S. military is ready for major conventional warfare, given its focus on counterinsurgency, stability, and advise-and-assist operations over the past decade. The Army in particular has noted the need to reengage in training and exercises that feature larger-scale combined arms maneuver operations, especially to ensure that its higher headquarters elements are up to the task. For example, Secretary of the Army Eric Fanning remarked in 2016 that “we’ve been fighting a certain way for 15 years” but “are [now] focused in the Army on getting back to full-spectrum training....” This Index ascertains the relevance and health of military service capabilities by looking at such factors as average age of equipment, generation of equipment relative to the current state of competitor efforts as reported by the services, and the status of replacement programs meant to introduce more updated systems as older equipment reaches the end of its programmed service life. While some of the information is quite quantitative, other factors could be considered judgment calls made by acknowledged experts in the relevant areas of interest or as addressed by senior service officials when providing testimony to Congress or addressing specific areas in other official statements.

It must be determined whether the services possess capabilities that are relevant to the modern combat environment.

**Capacity.** The U.S. military must have a sufficient quantity of the right capability or capabilities. There is a troubling but fairly consistent trend that characterizes the path from requirement to fielded capability within U.S. military acquisition. Along the way to acquiring the capability, several linked things happen that result in far less of a presumed “critical capability” than supposedly was required.

- The manufacturing sector attempts to satisfy the requirements articulated by the military.
- “Unexpected” technological hurdles arise that take longer and much more money to solve than anyone envisioned.
- Programs are lengthened, and cost overruns are addressed (usually with more money).
- Then the realization sets in that the country either cannot afford or is unwilling to pay the cost of acquiring the total number of platforms originally advocated. The acquisition goal is adjusted downward (if not canceled), and the military finally fields
fewer platforms (at higher unit cost) than it originally said it needed to be successful in combat.

As deliberations proceed toward a decision on whether to reduce planned procurement, they rarely focus on and quantify the increase in risk that accompanies the decrease in procurement.

Something similar happens with force structure size: the number of units and total number of personnel the services say they need to meet the objectives established by the Commander in Chief and the Secretary of Defense in their strategic guidance. The Marine Corps has stated that it needs 27 infantry battalions to fully satisfy the validated requirements of the regional Combatant Commanders, yet current funding for defense has the Corps at 23 on a path to 21. The Army was on a build toward 48 brigade combat teams, but funding reductions now have the number at 31—less than two-thirds the number that the Army originally thought necessary—if sequestration remains law.

Older equipment can be updated with new components to keep it relevant, and commanders can employ fewer units more expertly for longer periods of time in an operational theater to accomplish an objective. At some point, however, sheer numbers of updated, modern equipment and trained, fully manned units are likely necessary to win in battle against a credible opponent when the crisis is profound enough to threaten a vital interest.

Capacity (numbers) can be viewed in at least three ways: compared to a stated objective for each category by each service, compared to amounts required to complete various types of operations across a wide range of potential missions as measured against a potential adversary, and as measured against a set benchmark for total national capability. This Index employs the two-MRC metric as a benchmark.

The two-MRC benchmark for force sizing is the minimum standard for U.S. hard-power capacity because one will never be able to employ 100 percent of the force at the same time. Some percentage of the force will always be unavailable because of long-term maintenance overhaul (for Navy ships in particular); unit training cycles; employment in myriad engagement and small-crisis response tasks that continue even during major conflicts; and the need to keep some portion of the force uncommitted to serve as a strategic reserve.

The historical record shows that the U.S. Army commits 21 BCTs on average to a major conflict; thus, a two-MRC standard would require 42 BCTs available for actual use. But an Army built to field only 42 BCTs would also be an Army that could find itself entirely committed to war, leaving nothing back as a strategic reserve, to replace combat losses, or to handle other U.S. security interests. Again, this Index assesses only the Active component of the services, though with full awareness that the Army also has Reserve and National Guard components that together account for half of the total Army. The additional capacity needed to meet these “above two-MRC requirements” could be handled by these other components or mobilized to supplement Active-component commitments. In fact, this is how the Army thinks about meeting operational demands and is at the heart of the current debate within the total Army about the roles and contributions of the various Army components. A similar situation exists with the Air Force and Marine Corps.

The balance among Active, Reserve, and Guard elements is beyond the scope of this study. Our focus here is on establishing a minimum benchmark for the capacity needed to handle a two-MRC requirement.

We conducted a review of the major defense studies (1993 BUR, QDR reports, and independent panel critiques) that are publicly available, as well as modern historical instances of major wars (Korea, Vietnam, Gulf War, Operation Iraqi Freedom), to see whether there was any consistent trend in U.S. force allocation. The results of our review are presented in Table 6. To this we added 20
### TABLE 1

**Historical U.S. Force Allocation**

Troop figures are in thousands.

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<th>Vietnam War</th>
<th>Persian Gulf War</th>
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* Figures for engagements are numbers deployed; figures for documents are totals.

** Figures for Air Force bombers for Korean War, Vietnam War, Persian Gulf War, and Iraq are bomber squadrons. All other figures are bombers.

*** 2014 QDR prescribed nine heavy bomber squadrons, equaling 96 aircraft.
percent, both to account for forces and platforms likely to be unavailable and to provide a strategic reserve to guard against unforeseen demands. Summarizing the totals, this Index concluded that a Joint Force capable of dealing with two MRCs simultaneously or nearly simultaneously would consist of:

- Army: 50 BCTs.
- Navy: 346 ships and 624 strike aircraft.
- Air Force: 1,200 fighter/attack aircraft.
- Marine Corps: 36 battalions.

America’s security interests require the services to have the capacity to handle two major regional conflicts successfully.

**Readiness.** The consequences of the sharp reductions in funding mandated by sequestration have caused military service officials, senior DOD officials, and even Members of Congress to warn of the dangers of recreating the “hollow force” of the 1970s when units existed on paper but were staffed at reduced levels, minimally trained, and woefully ill-equipped. To avoid this, the services have traded quantity/capacity and modernization to ensure that what they do have is “ready” for employment.

As was the case in 2015, the service chiefs have stated that current and projected levels of funding continue to take a toll on the ability of units to maintain sufficient levels of readiness across the force. Some units have reduced manning. Though progress has been made in some areas due to funding provided by Congress in 2014 and 2015, the return of further cuts under the Budget Control Act of 2011 threaten to undo these gains. For example:

- General Mark Milley, Chief of Staff of the Army, and Acting Secretary of the Army Patrick J. Murphy testified in April 2016 that the Army can maintain only one-third of its force at acceptable levels of readiness to meet full-spectrum operations. They discussed the challenges posed by this crisis in stark terms: “The risk of deploying unready forces into combat is higher U.S. casualty rates and increased risk to mission success.”

- Air Force Chief of Staff General Mark A. Welsh and Secretary of the Air Force Deborah Lee James echoed the challenges expressed by General Milley and Acting Secretary Murphy, arguing that “the size of our force and state of our full-spectrum readiness are at or near all-time lows.”

- While the Navy has fared better in rebuilding its readiness over the past year, Admiral Michelle J. Howard, Vice Chief of Naval Operations, has testified that “[w]e are still paying down the readiness debt we accrued over the last decade but more slowly than we would prefer....” She further warned that “[w]e will only maintain our status as the world’s greatest navy with constant vigilance, dedication to restoring our readiness and a commitment to sustained forces around the globe.”

The Navy has preserved readiness over the past year through fastidious management of its resources and a resistance to overtaxing the fleet, but as demand for America’s global naval presence continues to remain high, this will stretch thin until the fleet grows to a healthy level.

It is one thing to have the right capabilities to defeat the enemy in battle. It is another thing to have a sufficient amount of those capabilities to sustain operations over time and many battles against an enemy, especially when attrition or dispersed operations are significant factors. But sufficient numbers of the right capabilities are rather meaningless if the force is unready to engage in the task.

**Scoring.** In our final assessments, we tried very hard not to convey a higher level of precision than we think is achievable using unclassified, open-source, publicly available documents; not to reach conclusions that could
be viewed as based solely on assertions or opinion; and not to rely solely on data and information that can be highly quantified, since simple numbers do not tell the whole story.

We believe the logic underlying our methodology is sound. This Index drew from a wealth of public testimony from senior government officials, from the work of recognized experts in the defense and national security analytic community, and from historical instances of conflict that seemed most appropriate to this project. This Index considered several questions, including:

- How does one place a value on the combat effectiveness of such concepts as Air-Sea Battle, Network-centric Operations, Global Strike, or Joint Operational Access?

- Is it entirely possible to assess accurately (1) how well a small number of newest-generation ships or aircraft will fare against a much larger number of currently modern counterparts when (2) U.S. forces are operating thousands of miles from home, (3) orchestrated with a particular operational concept, and (4) the enemy is leveraging a “home field advantage” that includes strategic depth and much shorter and perhaps better protected lines of communication and (5) might be pursuing much dearer national objectives than the U.S. such that the political will to conduct sustained operations in the face of mounting losses might differ dramatically?

This Index focused on the primary purpose of military power—to defeat an enemy in combat—and the historical record of major U.S. engagements for evidence of what the U.S. defense establishment has thought was necessary to execute a major conventional war successfully. To this we added the two-MRC benchmark, on-the-record assessments of what the services themselves are saying about their status relative to validated requirements, and the analysis and opinions of various experts in and out of government who have covered these issues for many years.

Taking it all together, we rejected scales that would imply extraordinary precision and settled on a scale that conveys broader characterizations of status that range from very weak to very strong. Ultimately, any such assessment is a judgment call informed by quantifiable data, qualitative assessments, thoughtful deliberation, and experience. We trust that our approach makes sense, is defensible, and is repeatable.

### U.S. Military Power

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Endnotes:


2. Ibid., p. 8.


5. The United States has not had to contend in combat with any credible air force since the Vietnam War, but U.S. Air Force planners are increasingly concerned about an enemy’s ground-based, anti-air missile capability. For naval planners, ship-based, air-based, and shore-based anti-ship cruise missiles are of much greater concern than is the number of conventional surface combatants armed with large-caliber guns that an enemy navy has. Likewise, ground force planners have to consider the numbers and types of guided anti-armor weapons that an enemy possesses and whether an opposing force has guided artillery, mortar, or rocket capabilities. Guided/precision weapons are less expensive (by orders of magnitude) than the platforms they target, which means that countries can produce far more guided munitions than primary weapons platforms. Some examples: Harpoon ASCM ($2 million)/DDG-51 *Arleigh Burke*-Class destroyer ($2 billion); AT4 anti-armor weapon ($1,500)/M1A1 Abrams main battle tank ($9 million); 120mm guided mortar round ($10,000) or 155mm guided artillery round ($100,000)/M198 155mm howitzer ($500,000); S-300 anti-air missile ($1 million)/F/A-18 Hornet ($60 million) or F-35A Lightning II ($180 million).

6. One example of balancing the forces is the Army’s Aviation Restructure Initiative, in which the active-duty force seeks to redistribute certain rotorcraft platforms among the active-duty Army and the National Guard, a plan that the Guard has contended will reduce the capabilities it has gained during recent combat engagements, such as its pilots’ proficiency flying Apache helicopters. For more on this issue, see U.S. Government Accountability Office, *Force Structure: Army’s Analyses of Aviation Alternatives*, GAO–15–430R, February 26, 2015 (updated April 27, 2015), http://www.gao.gov/assets/670/669857.pdf (accessed September 7, 2015).


8. Ibid.


11. Defense references to war have varied over the past few decades from “major combat operations” (MCO) and “major theater war” (MTW) to the current “major regional contingency” (MRC). Arguably, there is a supporting argument for such shifts as planners attempt to find the best words to describe the scope and scale of significant military efforts, but the terms are basically interchangeable.

The Department of Defense, through the Joint Staff and Geographic Combatant Commanders, manages a relatively small set of real-world operational plans (OPLANS) focused on specific situations where the U.S. feels it is most likely to go to war. These plans are reviewed and updated regularly to account for changes in the Joint Force or with the presumed enemy. They are highly detailed and account not only for the amount of force the U.S. expects it will need to defeat the enemy, but also for which specific units would deploy; how the force would actually flow into the theater (the sequencing of units); what ports and airfields it would use; how much ammunition, fuel, and other supplies it would need at the start; how much transportation or “lift” would be needed to get the force there (by air, sea, trucks, or rail); and the basic plan of attack. The Pentagon also routinely develops, explores, and refines various notional planning scenarios in order to better understand the implications of different sorts of contingencies, which approaches might be more effective, how much of what type of force might be needed, and the regional issue or issues for which there would have to be an accounting. These types of planning events inform service efforts to develop, equip, train, and field military forces that are up to the task of defending national security interests. All of these efforts and their products are classified national security information and therefore not available to the public.


U.S. Army

The U.S. Army is America’s primary land warfare component. Although it addresses all types of operations across the range of ground force employment, its chief value to the nation is its ability to defeat and destroy enemy land forces in battle.

As is the case with the other services, the U.S. Army has sought ways to absorb the budget cuts driven by the Budget Control Act (BCA) of 2011 while still meeting the missions outlined in the 2012 Defense Strategic Guidance (DSG). Fiscal challenges have strained the Army’s ability to meet the national security requirements outlined in the DSG even as it has worked to find a proper balance among readiness, modernization, and end strength. The Army has continued to reduce its end strength and accept greater risk to its modernization programs to preserve readiness levels—an even more challenging problem given that its proposed budget for fiscal year (FY) 2017 is $1.4 billion lower than FY 2016 enacted levels.

From a height of 566,000 in FY 2011, the Army’s active duty end strength has shrunk to nearly 475,000 in FY 2016 on a path to 460,000 by the end of FY 2017. These cuts are in line with the Army’s accelerated troop reduction plan to arrive at an end strength of 450,000 in FY 2018—the minimum outlined in the DSG. Although the Bipartisan Budget Act of 2015 provided a brief period of stability for the Department of Defense (DOD), funding levels continue to force the Army “to prioritize near-term operational requirements and readiness at the expense of end strength, sustainment and modernization.” If BCA-mandated budget caps return in FY 2018, reduced funding levels and continued unpredictability wrought by short-term funding fixes such as continuing resolutions will result in further reductions in end strength and delays in modernization, threatening both capacity and capability.

Operationally, the Army has approximately 190,000 soldiers forward stationed across 140 countries. This is a significant increase from the previous year’s level of 143,000 soldiers, a noteworthy contrast to the continued reduction in end strength signifying a smaller Army shouldering an increased workload. This includes authorization for up to 9,800 troops that will be stationed in Afghanistan through 2016. Despite past pledges to reduce troop levels in Afghanistan to 5,500 by the end of 2016, President Barack Obama recently announced that the U.S. will maintain 8,400 troops in Afghanistan into 2017. Of the total number of U.S. forces deployed globally, “[t]he Army currently provides 40% of planned forces committed to global operations and over 60% of forces for emerging demands from Combatant Commanders.”

Capacity

In FY 2016, total Army end strength was 1,030,000 soldiers: 483,000 Active soldiers, 200,000 in the Army Reserve, and 348,000 in the Army National Guard. In FY 2016, a portion of these personnel costs was paid through the Overseas Contingency Operations (OCO) budget function. This is unlike FY 2015, when all soldiers in the Active Component were paid for in the base budget.
The Army also refers to its size in terms of brigade combat teams (BCTs). BCTs are the basic “building blocks” for employment of Army combat forces. They are normally employed within a larger framework of U.S. land operations but are sufficiently equipped and organized so that they can conduct independent operations as circumstances demand. A BCT averages 4,500 soldiers in strength depending on its variant: Stryker, Armored, or Infantry. A Stryker BCT is a mechanized infantry force organized around the Stryker ground combat vehicle (GCV). Armored BCTs are the Army’s principal armored units and employ the Abrams main battle tank and the M2 Bradley fighting vehicle. An Infantry BCT is a highly maneuverable motorized unit.

The Army also has a separate air component organized into combat aviation brigades (CABs), which also can operate independently. CABs are made up of Army rotorcraft, such as the AH-64 Apache, and perform various roles including attack, reconnaissance, and lift.

CABs and Stryker, Infantry, and Armored BCTs make up the Army’s main combat force, but they do not make up the entirety of the Army. About 90,000 troops form the Institutional Army and provide support, such as preparing and training troops for deployments and overseeing military schools and Army educational institutions. The troops constituting the Institutional Army cannot be reduced at the same ratio as BCTs or CABs, and the Army plans to insulate these soldiers from drawdown and restructuring proposals in order to “retain a slightly more senior force in the Active Army to allow growth if needed.” According to Army assessments a minimum of 87,400 active component soldiers in these forces is necessary to maintain the proposed 980,000 end strength for the total force. In addition to the Institutional Army, a great number of functional or multi-functional support brigades (amounting to approximately 13 percent of the active component force based on historical averages) provide air defense, engineering, explosive ordnance disposal (EOD), military police, military intelligence, and medical support among other types of battlefield support for BCTs.

While end strength is a valuable metric in understanding Army capacity, counting BCTs is a more telling measure of actual hard-power capacity. In concert with the end strength reduction to approximately 475,000 soldiers, the Active Army underwent brigade restructuring that decreased the number of BCTs from 38 to 31 in April 2016. As a part of this reorganization, the Army also added a third maneuver battalion to its infantry and armored BCTs in FY 2015. Additionally, all BCTs received additional engineer and fire support capabilities (additional 105mm and/or 155mm howitzers). The FY 2017 budget will support the conversion of one Stryker BCT into an Infantry BCT.

The Department of the Army’s FY 2016 budget requests supported a drawdown to 30 BCTs by the end of the fiscal year. However, in February 2016, Army Chief of Staff General Mark Milley recommended delaying deactivation of the 4th Infantry BCT stationed in Alaska for at least one year in order to continue to provide rapid deployment capabilities and Arctic security.

The Army’s aviation units also face near-term reductions. In May 2015, the Active Army deactivated the first of three combat aviation brigades and converted the 12th CAB into a headquarters element, leaving only 11 CABs remaining in the active component. In the conversion process, the 12th CAB shed five of its seven battalions, intending to augment the remaining battalions with rotational units. The 3rd CAB is slated to be deactivated in FY 2019, which would leave only 10 in the Active Army.

It should be noted that the National Commission on the Future of the Army suggested in its 2016 report to Congress that maintaining an 11th CAB would leave the Army “better postured to retain a forward stationed aviation brigade in Korea” and would provide an advantage over rotational forces in maintaining aviation capability.
The reduction in end strength in the past year has continued to have a disproportionate effect on BCTs. The Active Army has been downsized from 45 BCTs (552,100 soldiers) in FY 2013 to 31 BCTs (475,000 soldiers) in FY 2016. Thus, a 14 percent reduction in troop numbers resulted in a 31 percent reduction in BCTs. The proposed elimination of the 4th BCT in Alaska by the end of FY 2016 would have resulted in a 33 percent reduction in Active Army BCTs even as “demand for Army forces across Combatant Commands has increased by 23 percent during the same period.” General Milley warned the Senate Armed Services Committee in March 2016 that at current end strength, “the Army risks consuming readiness as fast as we build it.”

Capability

The Army’s main combat platforms are ground vehicles and rotorcraft. The upgraded M1A2 Abrams and M2/M3 Bradley vehicles are primarily used in active component Armored BCTs, while reserve component ABCTs still rely on the earlier M1A1 variant. Stryker BCTs, as one would expect, are equipped with Stryker vehicles. Infantry BCTs rely on the inventory of M113 armored personnel carriers (APCs). CABs are made up of Army helicopters including AH-64 Apaches, UH-60 Black Hawks, and CH-47 Chinooks.

Overall, the Army’s equipment inventory is relatively healthy. While some equipment has been worn down by usage in Afghanistan and Iraq, the Army has undertaken a “reset” initiative that is discussed below in the readiness section. The bulk of Army vehicles are young because of recent remanufacture programs for the Abrams and Bradley that have extended the service life of both vehicles beyond FY 2028.

The Army has been methodically replacing the oldest variants of its rotorcraft and upgrading others that still have plenty of airframe service life. Today, the UH-60M, which is a newer version of the UH-60A, makes up approximately two-thirds of the total UH-60 inventory. Similarly, the CH-47F Chinook, a rebuilt variant of the Army’s CH-47D heavy lift helicopter, is expected to extend the platform’s service life at least through 2038. However, the current budget request for aircraft procurement stands at $2.3 billion less than FY 2016 enacted levels. The proposed budget will decelerate fleet modernization, potentially resulting in 24 fewer Black Hawks and nine fewer Apaches than previously planned for FY 2017.

In addition to the viability of today’s equipment, the military must ensure the health of future programs. While future modernizing programs are not current hard-power capabilities that can be applied against an enemy force, they are a significant indicator of a service’s overall fitness for sustained combat operations: The service may be able to engage an enemy but be forced to do so with aging equipment and no program in place to maintain viability or endurance in sustained operations.

The U.S. military services are continually assessing how best to stay a step ahead of competitors: whether to modernize the force today with currently available technology or wait to see what their investments in research and development produce years down the road. Technologies mature and proliferate, becoming more accessible to a wider array of actors over time. U.S. forces will be challenged by state and non-state competitors that will leverage the latest developments in matériel, computing, platform sciences, and designs.

The Army is currently undertaking several modernization programs to replace or improve its ground combat vehicles and current rotorcraft fleet. However, budget reductions levied in previous years have significantly affected modernization, with Research and Development, Acquisition, and Procurement accounts all experiencing 35 percent funding cuts between 2011 and 2015. In fact, “[s]ince 2011 the Army has ended 20 programs, delayed 125 and restructured 124.”

The Army’s most high-profile joint service Major Defense Acquisition Program (MDAP) is the Joint Light Tactical Vehicle (JLTV), a program shared with the Marine Corps.
Intended to combine the protection offered by Mine Resistant Ambush Protected Vehicles (MRAPs) with the mobility of the original unarmored High Mobility Multipurpose Wheeled Vehicle (HMMWV), the JLTV is a follow-on to the HMMWV (also known as the Humvee) and features design improvements that will increase its survivability against antiarmor weapons and improvised explosive device (IED) threats.

The Army plans to procure a total of 49,100 vehicles over the life of the program, replacing only a portion of the current HMMWV fleet. The program is heavily focused on vehicle survivability and is not intended as a one-for-one replacement of the HMMWV. In fact, the JLTV is intended to take on high-risk missions traditionally tasked to the HMMWV, to include scouting and troop transport in adverse environments, guerrilla ambushes, and artillery bombardment. Several issues, including changed requirements and some technical obstacles in the early development phases, delayed the program from its originally intended schedule by about one year. In August 2015, the Army awarded Oshkosh a low-rate initial production (LRIP) contract for the JLTV, with initial deliveries scheduled to begin in June 2016. For the final year of LRIP in FY 2017, the Army plans to procure 1,828 JLTVs, which would bring the Army’s JLTV order to a total of 2,690. A full-rate production decision is expected in FY 2018.

Other Army MDAPs of note in FY 2017 include the M1A2 Abrams, M2 Bradley, M109A6 Paladin 155mm Howitzers, and Stryker. These platforms will undergo various structural modifications and upgrades that are needed to keep them ready to meet future contingencies.

The M1A2 is currently being enhanced with Vehicle Health Management and Power Train Improvement & Integration Optimization in order to upgrade the tank’s reliability, durability, and fuel efficiency so that it can provide ground forces with superior battlefield firepower. Similarly, the M109A6 is being outfitted with the Paladin Integrated Management (PIM) program, which consists of a new drivetrain and suspension components, in order to sustain the platform’s utility in combat through 2050. Planned upgrades for the Stryker include improved survivability and lethality, and a major Engineering Change Proposal (ECP) aimed at improving mechanical and electrical power, an enhanced chassis, and electronics network.

The Army’s rotorcraft modernization programs do not include any new platform designs. Instead, the Army is upgrading current rotorcraft to account for more advanced systems.

The Army’s main modernization programs are not encumbered by any major problems, but there is concern about the future direction of Army capability. Fifteen years of sustained combat operations and limited resources has “limited the Army’s ability to modernize for future fights.” For example, cancellation of the Ground Combat Vehicle program raises the question of replacing the M2 Bradley. The Army awarded contracts to BAE Systems and General Dynamics Land Systems in May 2015 to begin work on design concepts for a Future Fighting Vehicle, a possible successor to the GCV. Contract work is due to be completed in November 2016 and will help to inform the Army’s decision to upgrade or entirely replace the Bradley. However, “[t]here are currently no ground combat vehicle developmental programs.” At current funding levels, this could mean that “the Bradley and Abrams will be in the Army inventory for 50–70 years.” Updating the capability that the Bradley Infantry Fighting Vehicle provides remains a priority, and the Army is currently “refining concepts, requirements, and key technologies” as part of a series of engineering change proposals, which will include suspension, engine, transmission, and lethality upgrades.

The Army is also continuing development efforts for the Armored Multi-Purpose Vehicle (AMPV) to replace its 1960s-vintage M113 Armored Personnel Carrier. The AMPV will
have five mission modules, including General Purpose, Medical Treatment, Medical Evacuation, Mortar Carrier, and Mission Command. Because it is still in development and is not expected to enter LRIP until FY 2020, the AMPV is not yet an MDAP and is not included in this year’s scoring.

Readiness

As a result of sequestration in FY 2013, the Army experienced a shortage in readiness funding that resulted in “significantly and rapidly degraded Army readiness,” which the Secretary of the Army and the Army Chief of Staff testified would “translate directly into FY 14 and beyond.” Although a higher level of funding in FY 2015 and FY 2016 provided two years of stability and modest budget relief, funding levels have not kept pace with the growing threat environment, including an FY 2017 base budget request that is $1.4 billion less than FY 2016 enacted levels. As a result, the Army has chosen to “protect current readiness at the expense of future modernization and end strength.” Army Vice Chief of Staff General Daniel Allyn explained that:

To build readiness...the Army reduced key installation services, individual training programs, and modernization to a level that impacts future readiness and quality of life. In addition to the effects on Soldier quality of life, these cuts force Commanders to divert Soldiers from training to perform life-support tasks.

Recognizing the risk that degraded readiness introduces into its ability to respond to an emergent threat, the Army continues to prioritize operational readiness over other expenditures for FY 2017. A return to “full spectrum combat readiness” will require sustained investment for a number of years. As a result of years of high operational tempos and sustained budget cuts, the Army is not expected to return to sufficient readiness levels until FY 2020.

This tiered readiness model employed by the Army has resulted in approximately one-third of the 31 Active BCTs being ready for contingency operations in FY 2016. This is an improvement from early in 2014 when 80 percent of the Army was considered to be “at a lower readiness level.” As stated, the Army had prioritized funding in readiness over capacity and modernization, allowing it to regain some of the readiness lost as a result of sequestration the prior year.

The Army uses Combat Training Centers (CTCs) to train its forces to desired levels of proficiency. Specifically, the mission of the CTC Program is to “provide realistic Joint and combined arms training” to approximate actual combat and increase “unit readiness for deployment and warfighting.” The Army financed 19 CTC rotations in FY 2016 and is expected to maintain the same number of rotations in FY 2017. Although utilizing CTCs continues to be a priority for the Army, resource constraints have limited investment in readiness.

The Army may already be experiencing the effect of reduced training hours. Army Aviation reported five major accidents in the first two quarters of FY 2016 that it determined to be a result of human error. While human error cannot be entirely eliminated, the Army has found that “[t]he most effective means of reducing human error is aggressive and realistic training that increases repetition and grows confidence and competence in the individual and collective team.” Aviation maintenance personnel are similarly starving for opportunities “to gain experience or maintain proficiency in their Military Occupational Specialty.” In order to stay within presidentially authorized end strengths in Afghanistan while at the same time maximizing combat capability, most maintenance personnel have been left behind as aircrew and aircraft have deployed. Instead, deployed forces have relied primarily on contractors to meet maintenance requirements, leaving Army maintenance personnel to perform only minor tasks.
In FY 2015, the Army supported the Army Contingency Force (ACF) initiative that is developing “a contingency response force which provides Combatant Commanders an initial response capability that can achieve early objectives for most contingency plans.”\(^8\) Under the ACF model, the Army maintains readiness for only 20 of the 60 total BCTs maintained by the Active, National Guard, and Reserve Components. Of those 20 that are considered ready, 11 are committed to ongoing missions, “leaving only nine to provide strategic flexibility for unforecasted contingencies.”\(^8\) The other 40 BCTs maintained by the Total Army are limited to “minimum Individual/Crew/Squad resourcing levels through sufficient Training Support Systems.”\(^8\) The aforementioned numbers can be misleading, as the Active Component maintains a total of only 31 BCTs and realistically maintains only about 30 percent of them at acceptable levels of combat readiness.\(^9\)

Another key factor in readiness is sustainment of equipment. At the most basic level, a unit’s equipment must work when the unit is deployed. As a result of extensive combat usage in Afghanistan and the lingering effects of nearly a decade of combat operations in Iraq, the Army has continued with its reset program to restore used equipment to desired capability or to replace worn-out equipment for use in future engagements. The Army estimates that it will require three years of reset funding “after the last piece of equipment has been retrograded from the combatant command theater of operations.”\(^8\) It also anticipates that the timeline for reset requirements will continue into FY 2020 for equipment retrograded from Afghanistan.\(^9\)

Reduced funding throughout FY 2013, a consequence of sequestration, forced the Army to postpone the reset of several pieces of equipment. Operations and maintenance funding for FY 2017 supports the repair and restoration of “30,000 battle damaged items including aircraft, aviation support equipment, artillery and missile, communication equipment, individual and crew served weapons, tactical wheeled vehicles, and general support equipment.”\(^9\) If the necessary funding is again reduced by the BCA, the Army’s efforts to recover from recent operations and prepare for the future will be further stymied.

**Scoring the U.S. Army**

**Capacity Score: Weak**

Historical evidence shows that, on average, the Army needs 21 brigade combat teams to fight one major regional conflict. Based on a conversion of roughly 3.5 BCTs per division, the Army deployed 21 BCTs in Korea, 25 in Vietnam, 14 in the Persian Gulf War, and around four in Operation Iraqi Freedom—an average of 16 BCTs (or 21 if the much smaller Operation Iraqi Freedom initial invasion operation is excluded). In the 2010 Quadrennial Defense Review, the Obama Administration recommended a force capable of deploying 45 active BCTs. Previous government force-sizing documents discuss Army force structure in terms of divisions; they consistently advocate for 10–11 divisions, which equates to roughly 37 active BCTs.

Considering the varying recommendations of 35–45 BCTs and the actual experience of nearly 21 BCTs deployed per major engagement, 42 BCTs would be needed to fight two MRCs.\(^9\) Taking into account the need for a strategic reserve, the Active Army force should also include an additional 20 percent of the 42 BCTs.

- **Two-MRC Benchmark**: 50 brigade combat teams.
- **Actual 2016 Level**: 31 brigade combat teams.

The Army’s current Active Component BCT capacity meets 64 percent of the two-MRC benchmark and thus is scored as “weak.”
Capability Score: Marginal

The Army’s aggregate capability score remains “marginal.” While the Army will continue to pursue a model of tiered readiness with the aim of improving, if only slightly, troop readiness levels in FY 2015 over the previous year, the service’s overall capability score remains static due to continued reductions in end strength that degrade capability. Additionally, in spite of progress with the JLTV and AMPV, budget reductions and continuing resolutions have led to inadequate and short-sighted funding for the development of future modernization programs, negatively affecting platform innovation and modernization. These subsequent reductions have set back the Army’s development of future capabilities needed to remain dominant in any operational environment.

This aggregate score is a result of “marginal” scores for “Age of Equipment,” “Size of Modernization Programs,” and “Health of Modernization Programs.” The Army scored “weak” for “Capability of Equipment.”

Readiness Score: Weak

Just over a third of Active BCTs were ready for action according to official Army testimony by the Chief of Staff in April 2016. The Army had 32 BCTs; therefore, roughly 11 of the Active Army BCTs were considered ready for combat. For that reason, this Index assesses Army readiness as “weak.” However, it should be noted that the Vice Chief of Staff also reported in March that of the BCTs fully trained for “decisive action operations,” the readiness of nine had been consumed in support of ongoing operations, which means that only three were uncommitted and ready for use. With this in mind, actual readiness is therefore likely dangerously close to nearing a state of “very weak.”

Overall U.S. Army Score: Weak

The Army’s overall score is calculated based on an unweighted average of its capacity, capability, and readiness scores. The average score was 2.3; thus, the overall Army score is “weak.” This was derived from the aggregate score for capacity (“weak”); capability (“marginal”); and readiness (“weak”). This score is the same as the score in the 2016 Index and indicates continued concerns for the Army, particularly when it comes to capacity in light of increased demand on the service around the globe.

U.S. Military Power: Army

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<tr>
<th></th>
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<th>MARGINAL</th>
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Endnotes:


2. Ibid.


10. Ibid., p. 1.


18. Ibid.


20. Ibid.

22. Ibid. The 13 percent estimate is based on a review of historical figures as referenced in the GAO report.


25. Ibid.


27. Horlander, Army FY 2017 Budget Overview, p. 10.


37. Ibid.


45. Ibid.


52. U.S. Army, “JLTV Enters Low Rate Production.”


54. Ibid., p. 3-5.

55. Ibid., p. 3-6.


60. Ibid.


62. Ibid.


66. Ibid.


68. Ibid.


73. Horlander, Army FY 2017 Budget Overview, p. 20.
81. Ibid.
82. Ibid.
83. Ibid.
87. Tan, “Big BCT Changes Mapped out for 2015.”
89. Ibid., p. 100.
91. Note that the first figures derive from an average BCT size of 4,500 and average division size of 15,000. The second set of numbers derives from the current average of around 3.5 BCTs per division and analysis of the structure of each Army division.
92. Congressional Quarterly transcript of Senate Armed Services Committee hearing, April 7, 2016.
Chief of Naval Operations (CNO) Admiral John M. Richardson, in the 2016 document *A Design for Maintaining Maritime Superiority*, describes the U.S. Navy’s mission as follows:

The United States Navy will be ready to conduct prompt and sustained combat incident to operations at sea. Our Navy will protect America from attack and preserve America’s strategic influence in key regions of the world. U.S. naval forces and operations—from the sea floor to space, from deep water to the littorals, and in the information domain—will deter aggression and enable peaceful resolution of crises on terms acceptable to the United States and our allies and partners. If deterrence fails, the Navy will conduct decisive combat operations to defeat any enemy.

As the military’s primary maritime arm, the Navy enables the United States to project military power in the maritime and air domains, a critical capability in war, crisis response, and peacetime engagement missions. Unlike land forces (or even, to a large extent, air forces), which are tethered to a set of fixed, larger-scale support bases, the Navy is able to shift its presence wherever needed so long as the world’s oceans and seas permit. In addition to the ability to project combat power rapidly anywhere in the world, the Navy’s peacetime forward presence supports missions that include securing sea lines of communication (SLOC) for the free flow of goods and services, assuring U.S. allies and friends, deterring adversaries, and providing a timely response to crises short of war.

A few key documents inform the Navy as to the level of its day-to-day fleet requirements: the 2012 Defense Strategic Guidance (DSG); the Global Force Management Allocation Plan (GFMAP); the 2015 update to “A Cooperative Strategy for 21st Century Seapower”; and the *Design for Maintaining Maritime Superiority*. The 2012 DSG issued by the Secretary of Defense describes 10 primary missions for the Navy and the other branches of the U.S. military. In addition, the U.S. Navy must meet forward presence requirements laid out in the fiscal year (FY) 2016 GFMAP, which states the force presence needed around the world as determined by the combatant commanders (COCOMs) and the Secretary of Defense.

While Admiral Richardson acknowledged in his March 2016 posture statement that the 2015 Bipartisan Budget Act provided some relief from funding shortfalls, he argued that recent years’ cuts and unstable budgets have caused the Navy to “modify our behaviors with a host of inefficient practices” and that “budget constraints are forcing choices that limit our naval capability in the face of growing and rising threats.”

**Capacity**

For the Navy, capacity is measured by the number of ships rather than the number of sailors, and not all ships are counted equally. The Navy focuses mainly on the size of its “battle force,” which is composed of ships considered to be directly related to its combat missions.

In 2015, the Navy increased its battle force requirement to 308 ships, two more than the
Navy Requirements and Current Inventory

This chart compares the Navy’s stated fleet requirement from its January 2015 report to Congress with their battle force ship capacity in 2016 as reported in the Naval Vessel Register.

<table>
<thead>
<tr>
<th>Ship Type</th>
<th>FY 2015 Inventory</th>
<th>FY 2015 Requirement</th>
<th>FY 2016 Inventory</th>
<th>2016 Difference: Inventory Minus Requirement</th>
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<td>Combat Logistics Force</td>
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<td>1</td>
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<tr>
<td>Support Ships</td>
<td>28</td>
<td>34</td>
<td>30</td>
<td>-4</td>
</tr>
<tr>
<td>Total</td>
<td>271</td>
<td>308</td>
<td>272</td>
<td>-36</td>
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</table>


previous year. The additional two ships in the fleet requirement are an LPD-17 amphibious ship and a Mobile Landing Platform vessel. Congress added funding for the amphibious ship in FY 2013 and FY 2015; it had not been requested by the Navy. While this may seem excessive since the Navy did not officially request a 12th LPD-17 ship, the Navy’s amphibious fleet is currently well below the Navy and Marine Corps program of record requirement (34 hulls) as well as this Index’s assessment (50); therefore, the addition of an unrequested LPD-17 contributes to the Navy’s broader amphibious vessel and overall fleet needs.

In both FY 2016 and FY 2017 budget materials, the Navy maintained its force structure goal of 308 ships. A new Force Structure Assessment (FSA) released by the Navy on July 12, 2016, also “supports a battle force requirement of 308 ships, but notes the force structure assessment under way for the fiscal 2018 budget submission will determine a new force level that will affect the shipbuilding plan.”

The Navy currently sails 274 vessels as part of its battle force fleet, up from 271 the previous year but still well below both the Navy’s fleet goal as well as a level sufficient to uphold a two-MRC (major regional contingency) construct. The Navy requested seven ships to be procured in FY 2017. This figure is below the number that the Congressional Budget Office (CBO) finds is necessary, on average annually, for the Navy to reach its fleet goal of 308 ships.

The largest proportional shortfall in the Navy fleet assessed in the 2017 Index is the same as in the past two editions: small surface combatants. This includes Littoral Combat Ships and Mine Countermeasure Ships and
previously included Frigates. All Oliver Hazard Perry-class frigates were decommissioned by the end of 2015.\textsuperscript{15} There are currently 11 mine countermeasure (MCM) vessels and six LCS vessels for a total of 17 small surface combatants in the fleet, far below the objective requirements established by the Navy (52).

The aircraft carrier fleet currently suffers a capacity shortfall of three hulls: 10 are currently in the fleet, while the two-MRC construct requires 13. This also falls below a legal minimum of 11 carriers in the fleet, which is currently waived.\textsuperscript{16} The carrier gap resulted from the delayed delivery of the first-of-its-kind Ford-class carrier, which was supposed to enter the fleet as the USS Enterprise was decommissioned in 2012. The Congressional Research Service reported in May 2016 that “The Gerald R. Ford (CVN-78), the lead ship in the CVN-78 class, is scheduled to be delivered to the Navy in late August or early September 2016” and “will likely be commissioned some months after that, returning the Navy’s carrier force to a total of 11 ships.”\textsuperscript{17} These and other shortfalls are partly due to underinvestment in the Shipbuilding and Conversion, Navy (SCN) budget to procure new hulls quickly enough to increase the size of the Navy.\textsuperscript{18}

In October 2015, the CBO calculated that the Navy’s 308-ship fleet goal would cost $20.2 billion in shipbuilding funds annually, well above the historical average of $15.7 billion per year.\textsuperscript{19} The Navy’s SCN request for FY 2017 totaled over $18 billion, much closer to the figure the CBO has assessed is necessary to reach fleet goals.\textsuperscript{20} However, as noted, this only includes funding for seven battle force ships to be procured in this fiscal year, which will make it difficult to increase the fleet size. The mismatch between higher funding but not more hulls is due in part to the fact that a large portion of this funding is dedicated to advanced procurement of the next-generation ballistic missile submarine program (SSBN(X) Columbia-class) as well as non-battle force requirements such as a training ship.\textsuperscript{21}

Without significant funding increases in procuring more vessels across ship types each year, it appears unlikely that the Navy will reach its own capacity goals for the foreseeable future.\textsuperscript{22} Due to expected funding shortfalls relative to fleet goals:

[T]he Navy projects that the fleet would experience a shortfall in large surface combatants (i.e., cruisers and destroyers) from FY2034 through FY2037, and from FY2041 through at least FY2046; a shortfall in small surface combatants (i.e., LCSs and frigates) for the entire 30-year period; a shortfall in attack submarines from FY2025 through FY2036; and a shortfall in amphibious ships from FY2017 through FY2021, in FY2040, and from FY2042 through at least FY2046.\textsuperscript{23}

By the publication of the 2016 Index, small surface combatants were projected to experience a shortfall solely between FY 2016 and FY 2027; but according to the 2016 Force Structure Assessment for FY 2017, the Secretary of Defense’s 2015 decision to reduce the LCS/Frigate program from 52 ships to 40 ships has upped the small surface combatant shortfall projection to a 30-year duration.\textsuperscript{24}

As important as the total fleet size is, the Navy must also consider the number of ships that are forward deployed to meet operational demands. Not all ships in the battle force are at sea at the same time. The majority of ships are based in the continental U.S. (CONUS) to undergo routine maintenance and training, as well as to limit deployment time for sailors. However, given the COCOMs’ requirements for naval power presence in each of their regions, there is an impetus to have as many ships forward deployed as possible. Striking a balance between deploying ships to meet operational demands and keeping them in port to perform needed maintenance and provide relief to sailors is a constant challenge.

Today, the Navy has 94 ships deployed globally—35 percent of the total available fleet and roughly on par with the 2016 level of 95 ships.\textsuperscript{25} While the Navy remains committed to deploying roughly a third of its fleet at all times, it should be noted that this is nevertheless an insufficient global presence because
the total fleet falls well below necessary levels both for the Navy’s stated presence needs and for a fleet capable of projecting power at the two-MRC level. The Navy has tried to increase forward presence by emphasizing non-rotational deployments: having a ship “home-ported” overseas or keeping the ship forward stationed:26

- **Home-ported:** The ships, crew, and their families are stationed at the port or based abroad.
- **Forward Stationed:** Only the ships will be based abroad while crews are rotated out to the ship.27

Both of these non-rotational deployment options require cooperation from friends and allies to permit the Navy’s use of their facilities as well as investment in additional facilities abroad. However, these options allow one ship to provide a greater level of presence than four ships based in CONUS and in rotational deployment since they offset the time necessary to deploy ships to distant theaters.28 A key example of the use of this practice is the Navy’s constant home porting of an aircraft carrier at the U.S. naval base in Yokosuka, Japan. In May 2015, the USS George Washington (CVN-73) departed this base with the USS Ronald Reagan sailing there to replace it.29 The George Washington, stationed at Yokosuka since 2008, left to undergo its midlife refueling and complex overhaul (RCOH).

The Navy maintains that it currently will be able to meet GFMAP requirements and the 10 missions outlined in the DSG. However, as noted, Admiral Richardson has indicated that the fleet will continue to be stretched to meet demand.

**Capability**

Scoring the U.S. Navy’s overall ability to protect U.S. interests globally is not just a matter of counting the fleet. The quality of the battle force is also important in determining the strength of the Navy.

A comprehensive measure of platform capability would involve a comparison of each ship and its weapons systems relative to the military capabilities of other nations. For example, a complete measure of naval capabilities would have to assess not only how U.S. platforms would match up against an enemy’s weapons, but also whether operational concepts like the often discussed Air-Sea Battle would be effective in a conflict. This assessment would then have to be replicated for each potential conflict. While this is a necessary exercise and one in which the military currently engages, it is beyond the scope of this *Index* because such details and analysis are routinely classified.

Capability can be usefully assessed based on the age of ships, the modernity of the platform, and whether or not modernization programs will maintain the fighting edge of the fleet. The Navy has several classes of ships that are nearing the end of their lifespan, and this will precipitate a consolidation of ship classes in the battle force.

As noted, the Navy retired its entire fleet of Oliver Hazard Perry-class guided missile frigates by the end of 2015. The Perry-class is being replaced by the Littoral Combat Ship (LCS), but some naval analysts have suggested that the LCS lacks the firepower of the frigate.30 In 2015, the Navy modified its LCS program to add more firepower to future hulls, and it will be referring to these upgunned LCSs as frigates beginning in FY 2019.31 This modification resulted from a restructuring of the LCS program initiated in 2014 by Secretary of Defense Chuck Hagel. The upgrades that the Navy says will give this future block of LCS/frigates capabilities closer to those of the Perry-class frigates include “[o]ver-the-horizon surface to surface missile and additional weapon systems and combat system upgrades” and “increased survivability [through] incorporating additional self-defense capabilities and increased hardening of vital systems and vital spaces.”32

The FY 2017 Future Years Defense Program (FYDP) includes funding for the
The construction of seven Littoral Combat Ships through FY 2021. Currently, the Navy projects that 10 LCSs will be in the deployable force by the end of FY 2016—double the five commissioned in FY 2015—and 14 by the end of FY 2017 if the funding requested for the construction of four additional LCSs is approved this summer.\(^\text{33}\) However, this is still well below the fleet size of small surface combatants necessary to fulfill the Navy’s global responsibilities (52) even when combined with the remaining mine countermeasure vessels in the fleet (11). Noting the age of these legacy vessels and LCS delays, the U.S. Congress mandated in the FY 2016 National Defense Authorization Act (NDAA) that the Department of Defense (DOD) produce a “Mine countermeasures master plan and report” that would assess the “capabilities, capacities, and readiness levels of the defensive capabilities of the Navy for MCM” and “ensur[e] the operational effectiveness of the MCM vessels, including the decommissioned MCM-1 and MCM-2 ships and the potential of such ships for reserve operational status.”\(^\text{34}\) This report is due in winter 2016.

The Navy is attempting to put the remaining **Ticonderoga**-class cruiser fleet into temporary layup status in order to extend this class’s fleet service time into the 2030s, even though these ships are younger than their expected service lives. The Navy’s FY 2017 budget request renewed its cruiser phased modernization plan as an alternative to a continuation of the 2-4-6 directive passed by Congress in 2015.\(^\text{35}\) This meant that “two cruisers would enter in a modernization cycle each year, [and] no cruisers will remain in layup for more than four years with no more than six cruisers out of service at one time,” according to Rear Admiral William Lescher, Deputy Assistant Secretary of the Navy for Budget.\(^\text{36}\) Driven by budget shortfalls, this plan (like the previous year’s) is an attempt to keep 11 of the 22 commissioned cruisers in service at all times through 2034.\(^\text{37}\)

In early 2016, Rear Admiral Lescher advocated for an alternative to the current 2-4-6, which has already put the USS **Cowpens** (CG-63) and the USS **Gettysburg** (CG-64) into modernization periods in FY 2015 with two to follow in the summer of 2016. The alternative phased modernization plan in the FY 2017 budget request asks Congress to allow the Navy to put the remaining seven unmodernized cruisers into maintenance in FY 2017, arguing that it saves $3 billion in operating costs over the FYDP. There is currently no program to replace the **Ticonderoga**-class cruisers; a program initiated in FY 2001, called CG(X), was to yield a replacement cruiser vessel, but it was canceled in FY 2011 after it was deemed too expensive.\(^\text{38}\)

The Navy’s two current dock landing ships (LSD), the **Whidbey Island**-class and **Harpers Ferry**-class amphibious vessels, are reaching the end of their service lives in the 2025 time frame and are to be replaced by the next-generation LX(R) program. The Navy requested $6.4 million for this program, dedicated to research and development, in FY 2017 following FY 2016 funding of $325.5 million (of which $250 million was advanced procurement funding) added by Congress. LX(R) was initially to begin procurement in FY 2017 but has since been delayed until FY 2020.\(^\text{39}\)

Many of the other ships that the Navy sails are also legacy platforms. Of the 18 classes of ships in the Navy, only seven are currently in production. For example, 72 percent of the Navy’s attack submarines are **Los Angeles**-class submarines, an older platform that is being replaced with a more modern and capable **Virginia**-class.\(^\text{40}\) This will shift as the Navy continues to purchase more ships.

The procurement of ships is critical to meeting Navy capacity requirements, maintaining ship capabilities, and maintaining the industrial capacity to build any warships. The Navy plans to procure 38 ships between FY 2017 and FY 2021, including seven battle force ships in FY 2017 alone.\(^\text{41}\) Compared to the FY 2016 plan to procure 48 new ships between FY 2016 and FY 2020, the FY 2017–FY 2021 plan projects a 10-ship reduction to 38 ships to account for the reduced annual
procurement rate for the Littoral Combat Ship (LCS)/Frigate program (52 ships to 40 ships) initiated by the Secretary of Defense in December 2015. This plan also directs the Navy to reduce planned annual procurement quantities of LCSs during the FY 2017–FY 2021 shipbuilding plan and downselect to one variant of the ship class.\textsuperscript{42}

Modernization programs supplement procurement plans and are intended to replace current platforms as they reach the end of their planned service lives, build up forces to meet capacity requirements, and introduce new technologies to the operating forces. Ship modernization programs as they currently stand are problematic because they do not “keep pace to deal with high-end adversary weapons systems by 2020.”\textsuperscript{43} The CBO has reported both in 2014 and most recently in October 2015 that to reach its procurement goals for the FY 2016 NDAA, the Navy would need to increase spending on shipbuilding by one-third over what it has spent per year during the past 30 years.\textsuperscript{44} It is worth noting that this assessment was for the Navy’s goal of a 308-ship Navy, maintaining the FY 2015 aim of 308 through FY 2016 and now in FY 2017 but still well below this Index’s prescribed fleet size of 346 ships.

Because ships take such a long time to build and only a few shipyards are capable of building them, and because shipbuilding programs require carefully orchestrated, long-lead-time planning to account for sequencing in the shipyards, supply chain and workforce management, and multi-year funding, the Navy publishes a 30-year plan as its top-level document that captures objectives by class and sequencing of replacements as older ships reach the end of their service lives.\textsuperscript{45} According to the current 30-year plan, the Navy will reach its 308-ship requirement by FY 2021.\textsuperscript{46}

However, the 30-year shipbuilding plan is not limited to programs of record and assumes procurement programs that have yet to materialize. For that reason, it is often considered overly optimistic. For example, the goal of 308 ships stated in the Navy’s most recent 30-year plan includes an objective for 12 SSBN(X) Columbia-class submarines to replace the legacy Ohio-class, which will require a significant portion of the SCN account when it goes into production if the overall budget is not increased. The Navy’s FY 2013 budget deferred the procurement of the lead boat from FY 2019 to FY 2021, projecting a shortfall of 11 or 10 SSBN boats for the period FY 2029 to FY 2041.\textsuperscript{47} This is something that the Navy will continue to have difficulty maintaining as it struggles to sustain, overhaul, modernize, and eventually retire the remainder of its legacy SSBN fleet. The Navy allocated over $773 million in its FY 2017 request, or 4 percent of its total shipbuilding budget, to advanced procurement funding for the Columbia-class.\textsuperscript{48}

The service is planning to acquire the first Columbia-class SSBN(X) in FY 2021.\textsuperscript{49} In March 2016, the Government Accountability Office (GAO) reported that total program acquisition costs will be about $97 billion, including $12 billion for research and development and $85.1 billion for procurement.\textsuperscript{50} According to the Congressional Research Service, “The Navy in January 2015 estimated the average procurement cost of boats 2 through 12 in the Ohio replacement program at about $5.2 billion each in FY2010 dollars.”\textsuperscript{51} Based on the historical average, the Navy will have to spend more than a third of its shipbuilding budget on one Columbia hull each year that it procures one.\textsuperscript{52} This Index therefore relies on budget and programmatic data from programs of record to determine the state of Navy modernization.

The most glaring problem with the Navy’s current modernization program has to do with how many ships it plans to purchase. While the Navy has stated its intent to purchase additional attack submarines, the current Virginia-class program of record is slated to produce a total of 30 submarines. Under the Navy’s FY 2017 30-year plan, the SSN force would reach a minimum of 41 boats in FY 2029 and stay below 48 boats through FY 2036. The Navy has stated that it will attempt to lengthen deployments...
and possibly perform service life extensions on some of the existing attack submarines to account for this shortfall. Similarly, the Navy plans to replace the 14 aging Ohio-class SSBNs with 12 Columbia-class hulls.

All remaining Oliver Hazard Perry-class frigates were retired in 2015, so the Littoral Combat Ship will increasingly assume the entire small surface combatant fleet requirement. As noted, the LCS and its follow-on, which will be called a frigate, are intended to make up this shortfall with a procurement of 52 total projected LCS/frigates. Timing for the small surface combatants will be another issue. While the LCS/frigate procurement has been scheduled, ship delivery will not be rapid enough to fill all small surface combatant requirements. The 2015 plan and the 2016 plan therefore do not expect to reach a count of 52 small surface combatants until the year 2028—again, a rosier projection than that determined by the CBO’s shipbuilding budget analysis.

Of the seven classes of ships the Navy is building, some have been relatively successful, whereas others are more problematic. Both the Virginia-class submarines and Arleigh Burke-class destroyers have a steady production rate and are being considered for upgrades to improve their respective capabilities. The newer Arleigh Burke-class Flight III design will be able to support a new and larger Air and Missile Defense Radar (AMDR). The Navy also intends to build some Virginia-class hulls with extended lengths through the Virginia Payload Module starting in FY 2019 to provide space for additional missiles or torpedoes and has requested continued research and development funding in FY 2017 for this program. The San Antonio-class LPD-17 program procured its 12th ship in FY 2016 but is not likely to continue procurement beyond this. As noted, the LX(R) is to replace these vessels, but its initial procurement year has been delayed a number of times. On the other hand, the Ford-class aircraft carrier, America-class amphibious ship, Zumwalt-class (DDG-1000) destroyer, and LCS have experienced varying degrees of difficulty in cost overruns and reductions in intended fleet size. The Zumwalt class was essentially relegated to an experimental order, having been reduced from a projected fleet of 32 hulls to just three. Despite obstacles in experimentation and funding, however, the lead Zumwalt-class guided missile destroyer DDG-1000, the USS Zumwalt, was commissioned on May 20, 2016, and will enable the Navy to test new and developing capabilities such as smaller crewing, an electric-drive propulsion system, and even possibly rail gun weapon technology.

The delivery of CVN-78, the first of the new Gerald R. Ford class of aircraft carriers, was significantly delayed, causing a shortfall in the number of aircraft carriers (down to 10) in the U.S. fleet. The Navy is currently confident that it will commission the USS Ford in Fall 2016 as 97 percent of the ship is completed. Both the America-class amphibious ship and the LCS also face delays and adjustments of requirements. The America class will produce only two ships of the current design, and the survivability and strike requirements for the LCS continue to be questioned. All four programs have experienced cost growth, with the Zumwalt-class, Ford-class, and America-class ships incurring cost breaches under the Nunn-McCurdy Act. In December 2015, Secretary of Defense Ashton Carter directed the Navy to reduce the number of LCS hulls that it will procure from 52 to 40. However, the Navy has somewhat defiantly maintained its program of record for a requirement of 52 small surface combatants (though not necessarily all of them LCSs). Despite these difficulties, the Navy regards its fleet as capable of handling today’s threats, albeit with increased risk.

The Navy’s long-range strike capability derives from its ability to launch various missiles and combat aircraft. Of the two, naval aircraft are much more expensive and difficult to modernize as a class. Not long ago, the Navy operated several models of strike aircraft that included the F-14 Tomcat, A-6 Intruder, A-4 Skyhawk, and F/A-18 Hornet. Over the past 20 years, this variety has been winnowed to a single model: the F/A-18. While the F/A-18
A–D variants were first introduced in 1983 and already have undergone service life extensions, the Navy flies a significant number of F/A-18 E/F Super Hornets that are not only newer, but also considered to be extremely capable. The Navy is implementing efforts to extend the life of some of the older variants but plans to have a mix of the F-35C and F/A-18 E/F Super Hornets.

The F-35C is the Navy’s largest aviation modernization program. It is a fifth-generation fighter (all F/A-18 variants are considered fourth-generation) that will have greater stealth capabilities and state-of-the-art electronic systems, allowing it to communicate with multiple other platforms. The Navy plans to purchase 260 F-35Cs (along with 80 F-35Bs for the Marine Corps, discussed in the section on that service) to replace a current inventory of 457 F/A-18 A–Ds and EA-18G Growler electronic attack aircraft. The F-35 is supposed to be a more capable aircraft relative to the F/A-18, but at 260 aircraft, it will not be enough to make up for the Hornets that the Navy will need to replace.

In addition, like the other F-35 variants, the F-35C has faced development problems. The system has been grounded because of engine problems, and software development issues have threatened further delay. The aircraft also has grown more expensive through the development process. The Navy's FY 2017 budget request indicates that it plans to buy four additional F-35Cs in 2017 and 64 between FY 2017 and FY 2021.

The F-35C is expected to reach initial operating capability (IOC) by August 2018. This is later than the previous expectation of IOC by FY 2015. Moreover, Deputy CNO for Warfare Systems Rear Admiral Michael C. Manazir conceded during congressional questioning that “there is some risk to that date.” Former CNO Admiral Jonathan Greenert stated in 2015 that this delay, combined with unforeseen higher operational tempo (OPTEMPO) on the existing fighter fleet caused by strikes against ISIS, is leading to a possible fighter shortfall of 36 aircraft. At least six years behind schedule as of 2016, the Navy is looking at a possible shortfall of as many as 138 aircraft by the 2020s. This shortfall and delayed development have led the Navy to extend the service lives of its legacy F/A-18 C/D Hornet aircraft. The Navy requested two additional F/A-18E/Fs in FY 2017 through OCO funding and intends to procure an additional 14 in FY 2018.

The Navy’s other aircraft programs, EA-18G Growler and E-2D Advanced Hawkeye, have been relatively successful. The EA-18G program, which had completed its previously planned procurement of 135 aircraft in FY 2014, added 15 aircraft in FY 2015 and 10 aircraft in FY 2016 that it had sought through that fiscal year’s “unfunded priorities” list.

The Navy included 12 F/A-18F Super Hornets in its FY 2016 list of unfunded priorities that the service explained could be “built...to be converted to EA-18G Growler electronic attack aircraft if necessary.” DOD has also established an Electronic Warfare (EW) Executive Committee that is currently assessing, among other issues, the potential necessity of additional Growlers in the future. However, the FY 2017 Navy budget request did not seek additional Growlers. The E-2D program is on a steady procurement schedule, with the Navy having successfully procured its requested level of five aircraft each in FY 2015 and FY 2016. The Navy requested an additional six in FY 2017 and intends to procure 23 over the FY 2017 FYDP.

In FY 2017, the Navy requested the authority to eliminate a carrier air wing, which would bring the total to nine. This decision was driven partly by the fact that the Navy has consistently fielded only 10 aircraft carriers for a number of years, with the service’s practice being one carrier air wing less than the number of carriers in the fleet based on the assumption that one carrier at any time will be effectively out of commission for its RCOH. This deactivation of one air wing is scheduled to take place in the fall of 2016.

This *Index* rejects this assumption and assumes that there should be an equal number
of air wings and aircraft carriers. The number of air wings is also well below the capacity required to field a two-MRC force by either count, as such a force requires 13 carriers. Therefore, if the Navy were to continue its one-less-air wing assumption, 12 would actually be necessary today. This Index assesses that 13 are actually necessary to provide enough aviation assets for every carrier at any given time.

It should be noted that this divestment of one carrier air wing (the aircraft and associated assets are being diverted to other wings) was driven largely by a mismatch between demand for naval aviation assets and the supply of ready air wings. As the Navy has experienced a higher-than-expected OPTEMPO in recent years, each air wing has been strained for available aircraft while performing necessary maintenance work, so the decision to draw down one wing was made to supplant the demand of those that were active in U.S. engagements.\(^8\)

Readiness

Although the Navy states that it can still deploy forces in accordance with GFMAP requirements, various factors indicate a continued decline in readiness over the past year. Admiral Michelle Howard, Vice Chief of Naval Operations, has reported that:

We have not yet recovered from the readiness impacts resulting from a decade of combat operations. The cumulative effect of budget reductions, complicated by four consecutive years of continuing resolutions, continues to impact maintenance, afloat and ashore. The secondary effects of these challenges impact material readiness of the force, and the quality of life of our Sailors and their families.\(^8\)

As a result of the inconsistent and insufficient funding experienced by the Navy in recent years:

Full recovery of the material readiness of the Fleet is likely to extend beyond 2020. Stable funding, improvement in on-time execution of ship and aviation depot maintenance, and steady state operations are required to meet our Fleet readiness goals. To mitigate impacts ashore, Navy has made difficult decisions and focused on shore items directly tied to our primary missions.\(^8\)

Like the other services, the Navy has had to dedicate readiness funding to its immediate needs of various engagements around the globe, which means that maintenance and training for those ships and sailors not deployed has not been prioritized.

The Navy’s undersized fleet has contributed greatly to the readiness challenges it faces. For example, carrier strike groups (CSGs) have experienced the following problems in recent years, according to the GAO:

- [C]arrier strike group deployment lengths have increased from an average of 6.4 months between 2008–2011 and 8.2 months between 2012–2014, to 9 months for three carrier strike groups in 2015.

- Increased deployment lengths have resulted in declining ship conditions and materiel readiness, and in a maintenance backlog that has not been fully identified or resourced, according to Navy officials.

- The declining condition of ships has increased the duration of time that ships spend undergoing maintenance in the shipyards, which in turn compresses the time available in the schedule for training and operations.\(^8\)

According to Congressman J. Randy Forbes, chairman of the Subcommittee on Seapower and Projection Forces of the House Committee on Armed Services:

[W]e have received data showing that [at current funding levels], next year, around the world, we will only be able to fulfill:

- 56% of our commanders’ requests for carriers,
• 54% of the requests for amphibious groups,
• 42% of the requests for submarines, and
• 39% of the requests for cruisers and destroyers.

To support fleet readiness, the Navy has synchronized maintenance and modernization with the fleet training required to achieve GFMAP objectives utilizing the Optimized Fleet Response Plan (O-FRP). This plan was implemented only because of years of a shrinking fleet and deferred maintenance. According to the Navy, O-FRP’s “aim is to produce a more comprehensively manned and completely trained Naval force that is ready to deploy on a more predictable schedule” given suboptimal capacity or readiness funding.

A GAO analysis of O-FRP’s performance since its implementation in 2014 compared to naval readiness of the recent past yielded mixed results. The GAO found that in the period from 2011 to the implementation of O-FRP, the Navy’s deployment and maintenance schedules were in poor condition. However, the three aircraft carriers that have implemented O-FRP “have not completed maintenance tasks on time, a benchmark that is crucial to meeting the Navy’s employability goals. Further, of the 83 cruisers and destroyers, only 15 have completed a maintenance availability under OFRP.”

The GAO found that these rates were better than before O-FRP was implemented, but only slightly.

Admiral Philip S. Davidson, Commander of U.S. Fleet Forces Command, testified on behalf of a group of commanding officers of ships and aircraft squadrons in May 2016, detailing a number of ways that budget shortfalls would strain naval readiness. The impacts of these shortfalls included restricting flying hours for a carrier air wing and deferring ship maintenance across the fleet. Admiral Davidson further testified that “the $848 million shortfall will have no impact to our forces currently deployed, but deferring depot and continuous maintenance availabilities would likely delay a number of deployments,” echoing the readiness challenges of the other services experiencing higher-than-expected OPTEMPO.

The Navy’s aviation readiness is also suffering as a result of years of deferred maintenance work and cuts in training budgets. Admiral Manazir testified in July 2016 that:

Navy aviation readiness is in a precarious position today as we continue to meet deployed readiness requirements, albeit at the expense of non-deployed force training.... [W]e continue to face challenges associated with increased costs and effort in sustaining legacy aircraft [that are] being demanded more than anticipated and retained longer than planned, while some of their intended replacements have not yet arrived. Furthermore, fiscal constraints force difficult trades in capacity and readiness for capability improvements. Simply, the Navy is challenged to modernize our fleet while also sustaining an aging force.

While Admiral Manazir’s assessment of Navy aviation readiness was more positive over the past year than the assessments of his counterparts in the other services, he warned that the continued high OPTEMPO could strain his service’s readiness if not paired with additional funding to maintain aircraft and train pilots that are not deployed. Commenting on the extension of the USS Harry Truman’s deployment by a month, Admiral Manazir said, “The particular impact is more readiness dollars to keep the carrier strike group out there for an additional month...that caused some impacts to training—the forces in training down the road.”

According to Admiral Manazir, the delays in IOC for the F-35C also have caused a number of readiness challenges, as the Navy has had to retain older F/A-18A–D aircraft longer than expected:

[W]e didn’t plan to do that maintenance and when we opened those airplanes up they had significant corrosion that we did not plan for.... [T]he second effect it had was we were over flying our F-18s, Super Hornets, Es and Fs. We
didn’t plan to fly them this much nor this early in their life. So it’s accelerating the life used on the F-18 Es and Fs.\textsuperscript{92}

Admiral Manazir added that the CNO’s primary priority that was not covered by the President’s FY 2017 budget request is the funding to bridge the gap between the older F/A-18s and the F-35C.\textsuperscript{93}

The Navy also has stated its readiness challenges in terms of maintenance work being performed. According to Admiral Howard:

Resetting our surface ships and aircraft carriers after more than a decade of war led to significant growth in public and private shipyard workload. The Navy baseline [FY 2017] request funds 70% of the ship maintenance requirements across the force.\textellipsis OCO funding provides the remaining 30%\textellipsis The Aviation Depot Maintenance program is funded to 76% in baseline and 85% with OCO for new work to be inducted in FY17.\textsuperscript{94}

Admiral Howard, however, rated facilities sustainment poorly as in the past few years, stating that:

\textquote[O]ur FY17 facilities sustainment account is resourced at 70\%\textellipsis which falls short of DOD’s goal of 90\% for the sixth year in a row. Navy’s FY17 request for restoration and modernization funding is roughly half of FY16 levels. This is only enough to address the most critical deficiencies for the naval shipyards\textellipsis By deferring less-critical repairs, we are increasing risk of greater requirements in the outyears and acknowledge that our overall facilities maintenance backlog will increase.\textsuperscript{95}

It is worth noting again that the Navy’s own readiness assessments are based on the ability to execute a strategy that assumes a force sizing construct that is smaller than the one prescribed by this Index.

Scoring the U.S. Navy

**Capacity Score: Marginal**

The Navy is unusual relative to the other services in that its capacity requirements must meet two separate objectives. First, during peacetime, the Navy must maintain a global forward presence. This ongoing peacetime requirement to be present around the world is the driving force behind ship count requirements: a set total number to ensure that the required number of ships is actually available to provide the necessary global presence.

On the other hand, the Navy also must be able to fight and win wars. In this case, the expectation is to be able to fight and win two simultaneous or nearly simultaneous MRCs. When thinking about naval combat power in this way, the defining metric is not necessarily a total ship count, but rather the carrier strike groups, amphibious ships, and submarines deemed necessary to win both the naval component of a war and the larger war effort by means of strike missions inland or cutting off the enemy’s maritime access to sources of supply.

An accurate assessment of Navy capacity takes into account both sets of requirements and scores to the larger requirement.

It should be noted that the scoring in this Index includes the Navy’s fleet of ballistic-missile and fast attack submarines to the extent that they contribute to the overall size of the battle fleet and with general comment on the status of their respective modernization programs. Because of their unique characteristics and the missions they perform, their detailed readiness rates and actual use in peacetime and planned use in war are classified. Nevertheless, the various references consulted are fairly consistent, both with respect to the numbers recommended for the overall fleet and with respect to the Navy’s shipbuilding plan.

The role of SSBNs (fleet ballistic missile submarines) as one leg of America’s nuclear triad capability is well known; perhaps less well known are the day-to-day tasks undertaken by the SSN force, which can include
collection, surveillance, and support to the special operations community and whose operations often take place apart from the operations of the surface Navy.

**Two-MRC Requirement.** The primary elements of naval combat power during a major regional contingency operation derive from carrier strike groups (which include squadrons of strike aircraft and support ships) and amphibious assault capacity. Since the Navy is constantly deployed around the globe during peacetime, many of its fleet requirements are beyond the scope of the two-MRC construct. However, it is important to observe the historical context of naval deployments during a major theater war.

**13 Deployable Carrier Strike Groups.** The average number of aircraft carriers deployed in the Korean War, Vietnam War, Persian Gulf War, and Operation Iraqi Freedom was between five and six. This correlates with the figures recommended in the 1993 Bottom-Up Review (BUR) and subsequent government force-sizing documents, each of which recommended at least 11 aircraft carriers. Assuming that 11 aircraft carriers are needed to engage simultaneously in two MRCs, and assuming that the Navy ideally should have a 20 percent strategic reserve in order to avoid having to commit 100 percent of its carrier groups and account for scheduled maintenance, the Navy should have 13 CSGs.

The aircraft carrier is the centerpiece of a CSG, composed of one guided missile cruiser, two guided missile destroyers, one attack submarine, and a supply ship in addition to the carrier itself. Therefore, based on the requirement for 13 aircraft carriers, the following numbers of ships are necessary for 13 deployable CSGs:

- 13 aircraft carriers,
- 13 cruisers,
- 26 destroyers, and
- 13 attack submarines.

**13 Carrier Air Wings.** Each carrier deployed for combat operations was equipped with a carrier air wing, meaning that five to six air wings were necessary for each of those four major contingencies listed. The strategic documents differ slightly in this regard because each document suggests one less carrier air wing than the number of aircraft carriers.

A carrier air wing usually includes four strike fighter squadrons. Twelve aircraft typically comprise one Navy strike fighter squadron, so at least 48 strike fighter craft are required for each carrier air wing. To support 13 carrier air wings, the Navy therefore needs a minimum of 624 strike fighter aircraft.

**50 Amphibious Ships.** The 1993 BUR recommended a fleet of 45 large amphibious vessels to support the operations of 2.5 Marine Expeditionary Brigades (MEBs). Since then, the Marine Corps has expressed a need to be able to perform two MEB-level operations simultaneously, with a resulting fleet of 38 amphibious vessels required. The 1996 and 2001 QDRs each recommended 12 “amphibious ready groups” (ARGs). One ARG typically includes one amphibious assault ship (LHA/LHD); one amphibious transport dock ship (LPD); and one dock landing ship (LSD). Therefore, the 12-ARG recommendation equates to 36 amphibious vessels.

The number of amphibious vessels required in combat operations has declined since the Korean War, in which 34 amphibious vessels were used; 26 were deployed in Vietnam, 21 in the Persian Gulf War, and only seven in Operation Iraqi Freedom (which did not require as large a sea-based expeditionary force). The Persian Gulf War is the most pertinent example for today because similar vessels were used, and modern requirements for an MEB most closely resemble this engagement.

While the Marine Corps has consistently advocated a fleet of 38 amphibious vessels to execute its two-MEB strategy, it is more prudent to field a fleet of at least 42 such vessels based on the Persian Gulf engagement. Similarly, if the USMC is to have a strategic reserve of 20 percent, the ideal number of amphibious ships would be 50.
**Total Ship Requirement.** The bulk of the Navy’s battle force ships are not directly tied to a carrier strike group. Some surface vessels and attack submarines are deployed independently, which is often why their requirements exceed those of a CSG. The same can be said of the ballistic missile submarine (nuclear missiles) and guided missile submarine (conventional cruise missiles), which operate independently of an aircraft carrier.

This *Index* uses the benchmark set by previous government reports, mainly the 1993 BUR, which was one of the most comprehensive reviews of military requirements. Similar Navy fleet size requirements have been echoed in follow-on reports.

The numerical values used in the score column refer to the five-grade scale explained earlier in this section, where 1 is “very weak” and 5 is “very strong.” Taking the full Navy requirement of 346 ships as the benchmark, the Navy’s current battle forces fleet capacity of 274 ships retains a score of “marginal,” as was the case in the 2016 Index. Given the CBO’s assessment that the Navy will continue to underfund its shipbuilding programs, and in view of the impending need for a ballistic missile submarine replacement that could cost nearly half of the current shipbuilding budget per hull, the Navy’s capacity score could fall to “weak” in the near future.

**Capability Score: Weak**

The overall capability score for the Navy is “weak.” This was consistent across all four components of the capability score: “Age of Equipment,” “Capability of Equipment,” “Size of Modernization Program,” and “Health of
Modernization Programs.” Given the number of programs, ship classes, and types of aircraft involved, the details that informed the capability assessment are more easily presented in a tabular format as shown in the Appendix.

This Index does not include an assessment of future programs such as the Columbia-Class SSBN(X); unmanned carrier-launched aircraft; and LX(R) because these are not yet categorized by the government as MDAPs.

Readiness Score: Strong

The Navy’s readiness score has returned to the original edition’s assessment of “strong,” up from the 2016 Index’s score of “marginal.” This assessment combines two major elements of naval readiness: the ability to consistently provide the required levels of presence around the globe and surge capacity. As elaborated below, the Navy’s ability to maintain required presence in key regions is “strong,” but its ability to surge to meet combat requirements ranges from “weak” to “very weak” depending on how one defines the requirement. In both cases—presence and surge—the Navy is sacrificing long-term readiness to meet current demand.

The Navy has reported that it continues to meet GFMAP goals but at the cost of future readiness. The GAO reported in May 2016 that “[t]o meet heavy operational demands over the past decade, the Navy has increased ship deployment lengths and has reduced or deferred ship maintenance.” The GAO has further found that as the Navy seeks to provide the same amount of forward presence with an undersized fleet, this “resulted in declining ship conditions across the fleet” and has “increased the amount of time that ships require to complete maintenance in the shipyards.”

Though the Navy has been able to maintain a third of its fleet globally deployed, and although the O-FRP has preserved readiness for individual hulls by restricting deployment increases, demand still exceeds the supply of ready ships to meet requirements sustainably. As Admiral Howard testified in March 2016:

We generate forces that are fully prepared to do the full spectrum of operations. And so for us, it’s as if we have this team of assets, but like every good team, we have a bench. And that bench are the assets that are the next ready to go or the assets we have if we ever have to get into a war fight. We refer to that bench as our surge capability. So we invest to make sure that as people are required to do their daily operations, they’re ready. Where we’ve made choices, our ability to surge, that bench has become smaller. We have lowered the readiness of those assets and, in some cases, the readiness was lowered because we consumed that readiness.

The Navy’s readiness as it pertains to providing global presence is rated as “strong.” The level of COCOM demand for naval presence and the fleet’s ability to meet that demand is similar to that of 2015. The Navy maintains its ability to forward deploy a third of its fleet and has been able to stave off immediate readiness challenges through the O-FRP. However, without further recapitalization and without more hulls entering the fleet, this level of readiness will likely not be sustainable.

Another element of naval readiness is the ability to surge forces to respond to a major contingency. The Navy’s goal is the ability to surge three CSGs and three ARGs for a contingency operation, but at current ship-count levels, it falls short of meeting this goal. Responding to questions about this issue, Admiral Manazir stated that the Navy is “currently...resourced to deploy two amphibi-ous readiness groups and two carrier strike groups. It will take us to about the end of this future year defense plan, 2020 to 2022, to be able to resource a third deployed amphibious readiness group.” It should be noted that this was reported only during questioning in a congressional hearing, a departure from previous years when this information was provided in prepared testimony by naval officials. This is consistent with this Index’s analysis of the other armed services, where elements of readiness typically reported each year were either omitted or altered in prepared statements.
Nevertheless, Navy readiness in 2016 is an improvement over the past few years, where the Navy could only generate a surge capacity of one ARG and one CSG. This yields a surge capacity score of “marginal,” up from “weak” in the 2016 Index.

Since the Index of U.S. Military Strength uses the two-MRC construct as its benchmark level of necessary military force, the Navy would actually need to be able to surge forces to a level higher than three CSGs and three ARGs. However, doubling the Navy’s surge capacity requirement to account for this is an oversimplification, as not enough public information exists to assess how much surge capacity the Navy would require to engage in a second contingency. Therefore, this Index notes that the Navy must be able to surge remaining forces if the U.S. finds itself responding to a second MRC but does not attempt to determine or count this additional level in its scoring.

**Overall U.S. Navy Score: Marginal**

The Navy’s overall score for the 2017 Index is “marginal,” the same as for the previous year. This was derived by aggregating the scores for capacity (“marginal”); capability (“weak”); and readiness (“strong”). However, given the continued upward trends in OPTEMPO that have not been matched by similar increases in capacity or readiness funding, the Navy’s overall score could degrade in the near future if the service does not more robustly recapitalize and maintain the health of its fleet.

### U.S. Military Power: Navy

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Endnotes:
9. Ibid.
17. Ibid.
19. Ibid.
21. Ibid.
22. Eleven cruisers will also be placed in “Reduced Operating Status” but will be included in the ship count as they are not being retired.
24. Ibid., p. 12.
26. Rotational deployments involve a ship sailing to a location for a set amount of time and returning to the United States.
28. On average, rotational deployments require four ships for one ship being forward deployed. This is because one ship is sailing out to location, one is at location, one is sailing back to the CONUS, and one is in the CONUS for maintenance.
32. Ibid., p. 16.
37. Ibid.
40. This is based on a calculation of the total number of attack submarines (which includes three different classes), which was 54 as of publication, and the number of Los Angeles-class submarines, which was 39 as of publication.
42. O’Rourke, “Navy Littoral Combat Ship (LCS)/Frigate Program.”
43. Ibid.
44. Congressional Budget Office, *An Analysis of the Navy’s Fiscal Year 2016 Shipbuilding Plan*, p. 3.
45. There are four shipbuilders and seven shipyard locations that build major naval vessels. The four shipbuilders are General Dynamics, Huntington Ingalls, Austal USA, and Marinette Marine Corporation. General Dynamics has three shipyards, Huntington Ingalls has two, and the remaining two shipbuilders have one each.
49. O’Rourke, “Navy Columbia Class (Ohio Replacement) Ballistic Missile Submarine (SSBN[X]) Program.”


51. O’Rourke, “Navy Columbia Class (Ohio Replacement) Ballistic Missile Submarine (SSBN[X]) Program,” Summary.

52. This is based on a Congressional Budget Office analysis of historical shipbuilding funding, which the CBO calculates as $13.9 billion annually. See Congressional Budget Office, "An Analysis of the Navy’s Fiscal Year 2016 Shipbuilding Plan," p. 3.


64. Ibid.

65. Staff writer, “Navy Aircraft,” Military Factory, last updated March 5, 2014, http://www.militaryfactory.com/aircraft/navy-carrieraircraft.asp (accessed August 26, 2014). The last of each of these aircraft were retired in 1997 (A-6); 2003 (A-4); and 2006 (F-14).


77. Ibid.

78. “A carrier air wing consists of one fully staffed headquarters, four strike fighter squadrons (VFA or VMFA; 44 F/A-18A/C/E/F aircraft), one airborne early warning squadron (VAW; four E-2C or five E-2D aircraft), one electronic warfare squadron (VAQ; five or six EA-18G aircraft), one helicopter sea combat squadron (HSC; eight MH-60S aircraft), one helicopter maritime strike squadron (HSM; 11 MH-60R aircraft), one carrier onboard delivery detachment (VRC; two C-2A aircraft).” O’Rourke, “Navy Ford (CVN-78) Class Aircraft Carrier Program,” p. 13.

79. “A carrier air wing consists of one fully staffed headquarters, four strike fighter squadrons (VFA or VMFA; 44 F/A-18A/C/E/F aircraft), one airborne early warning squadron (VAW; four E-2C or five E-2D aircraft), one electronic warfare squadron (VAQ; five or six EA-18G aircraft), one helicopter sea combat squadron (HSC; eight MH-60S aircraft), one helicopter maritime strike squadron (HSM; 11 MH-60R aircraft), one carrier onboard delivery detachment (VRC; two C-2A aircraft).” O’Rourke, “Navy Ford (CVN-78) Class Aircraft Carrier Program,” p. 13.

80. Ibid.


82. Ibid., p. 2.


86. Ibid.


89. Ibid., p. 5.


92. Ibid.
93. Ibid.
94. Statement of Howard, Cullom, and Aquilino, pp. 5–6.
95. Ibid., p. 7.
96. This requirement is derived from the BUR's requirement for four–five carrier strike groups per MRC; however, this Index finds that number low by historical accounts and recommends one additional carrier per MRC.
99. The full array of aircraft actually embarked on a carrier is more than just the strike aircraft counted here and includes E-2 Hawkeye early warning, C-2 Greyhound cargo, and various helicopter aircraft, among others, that are fielded in a ratio that is roughly proportional to the number of aircraft carriers in the fleet.
101. The size and capability of amphibious ships also have grown over time, with smaller amphibs like the old LST replaced by the much larger LSD and LPD classes. Consequently, fewer ships are needed to lift the same or an even larger amphibious force.
105. Ibid., p. 8.
U.S. Air Force

The U.S. Air Force (USAF) provides military dominance in the domains of air and space, enabling the Joint Force to project power quickly anywhere in the world at any time. Successful Operation Plan (OPLAN) execution relies on this service being able to rapidly respond to contingencies across the world, to guarantee the global freedom of movement and access that Americans have come to expect, and to project our nation’s power, influence, and reach.1

To support and defend America’s global interests along with the Joint Force, the Air Force focuses on five main missions:

- Air and space superiority;
- Intelligence, surveillance, and reconnaissance (ISR);
- Mobility and lift;
- Global strike; and
- Command and control (C2).

The Air Force has used the 2012 Defense Strategic Guidance (DSG) as its framework for determining investment priorities and posture. As a result of the DSG and fiscal constraints, the Air Force has “traded size for quality” by aiming to be a “smaller, but superb, force that maintains the agility, flexibility, and readiness to engage a full range of contingencies and threats.”2 In light of recent budget cuts, the Air Force has characterized this as a key year for the future of the service’s readiness and capabilities:

The FY 2017 budget request represents a “pivot point” for the Air Force to continue the recovery to “balance the force” for today’s readiness and the readiness needed 10 to 20 years from now. However FY 2017 could simply represent a pause to the devastating effects of sequestration level funding that will return in FY 2018.3

But while the Air Force’s fleet has been cut intentionally to maintain capability, continued cuts in capacity will result in a loss of that capability:

Americans have invested in airpower for well over 60 years to ensure the fight is never fair. But today—after many years of continual operations and a few fiscal upheavals—the Nation is at a crossroads, with a fundamental disconnect between its airpower expectations and its airpower capability.

There was a time when the Air Force could trade some capacity in order to retain capability. But we have reached the point where the two are inextricable; lose any more capacity, and the capability will cease to exist.4

Capacity

Due to the constrained fiscal environment of the past few years, the Air Force continues to prioritize capability over capacity. Air Force leadership has also made it clear that near-term reductions will be made in lift, command and control, and fourth-generation fighter aircraft to ensure that its top three modernization programs—the F-35A, Long-Range Strike Bomber (LRS-B), and KC-46A—are preserved.5 The USAF is now the oldest
and smallest in its history, and as the demand for air power continues to increase, the problem of capacity limiting capability will continue to grow. Unlike some of the other services, the Air Force did not grow during the post-9/11 buildup. Rather, it got smaller as older aircraft were retired and replacement programs, such as the F-35, experienced successive delays in bringing new aircraft into the fleet.

The Air Force’s capacity in terms of number of aircraft has been on a constant downward slope since 1952. As Air Force officials testified in 2016:

Prior to 1992, the Air Force procured an average of 200 fighter aircraft per year. In the two and a half decades since, curtailed modernization has resulted in the procurement of less than an average of 25 fighters yearly. In short, the technology and capability gaps between America and our adversaries are closing dangerously fast.

This reduction in capacity is expected to continue because of ongoing budgetary pressure. Under BCA-mandated spending caps, the Air Force would shrink to 39 total active duty fighter squadrons, of which only 26 would be combat-coded. This is a far cry from the 70 active duty fighter squadrons within the Air Force during Operation Desert Storm (1991).

This Index assesses the Air Force’s fleet of tactical aircraft based on a 2011 Air Force assessment that a force of 1,200 fighter aircraft was required to execute a two-MRC strategy. More recently, the service acknowledged that it could reduce the requirement by 100 fighters by assuming more risk. Of the 5,456 manned and unmanned aircraft in the USAF’s inventory, 1,303 are fighters, 1,159 of which are combat-coded aircraft (not associated with operational testing, evaluation, or training of replacement pilots). The continuation of constrained funding levels will deepen the shortage of fighters and readiness levels, degrading vital air operations as well as operational testing and training expertise.

**Capability**

Reductions in funding brought about by the Budget Control Act of 2011 and other budget constraints have forced the Air Force to prioritize future capability over capacity. This strategy centers on the idea of developing and maintaining a capable force that can win against advanced fighters and surface-to-air missile systems that are being developed by top-tier potential adversaries like China and Russia. The only way the Air Force can sustain that technological edge in the current budget environment is by reducing its fleet of aircraft that are moving toward obsolescence.

The state of aircraft capability includes not only the incorporation of advanced technologies, but also the overall health of the inventory. Most aircraft have programmed life spans of 20 to 30 years, based on a programmed level of annual flying hours. The bending and flexing of airframes over time in the air generates predictable levels of stress and metal fatigue. The average age of Air Force aircraft is 27 years, and some fleets, such as the B-52 bomber, are much older. Although service life extension programs can lengthen the useful life of airframes, their dated systems become increasingly expensive to maintain. That added expense consumes available funding and reduces the amount available to invest in modernization, which is critical to ensuring future capability.

The average age of the F-15C fleet is over 32 years, leaving less than 10 percent of its useful service life remaining. That same fleet comprises 42 percent of USAF air superiority platforms. The fleet of F-16Cs are, on average, 25 years old, and the service has used up nearly 80 percent of its expected life span. KC-135s comprise 87 percent of the Air Force’s tankers and are over 54 years old on average.

The Air Force’s ISR and lift capabilities face similar problems in specific areas that affect both capability and capacity. The bulk of the Air Force’s ISR aircraft (339 of 482) are now unmanned aerial vehicles (UAVs), which are relatively young and less expensive.
to procure, operate, and maintain.\textsuperscript{24} The RQ-4 Global Hawk is certainly one of the more reliable of those platforms, but gross weight restrictions limit the number of sensors that it can carry, and the warfighter still needs the capability of the U-2, which is now (on average) 33 years old.\textsuperscript{25} The E-8 Joint Surveillance Target Attack Radar System (Joint-STARS) and the RC-135 Rivet Joint are critical ISR platforms, and each was built on the Boeing 707 platform, the last one of which was constructed in 1979. The reliability of the Air Force fleet is at risk because of the challenges linked to aircraft age and flight hours, and the fleet needs to be modernized.

A service’s investment in modernization ensures that future capability remains healthy. Investment programs aim not only to procure enough to fill current capacity requirements, but also to advance future capabilities with advanced technology. In fiscal year (FY) 2016, the Air Force structured its budget to preserve funding for its three top acquisition priorities: the F-35A Joint Strike Fighter, the KC-46A Pegasus refueling aircraft, and the Long Range Strike-Bomber.\textsuperscript{26}

The Air Force’s number one priority remains the F-35A. It is the next-generation fighter scheduled to replace all legacy A-10, F-15, and F-16 aircraft. The Air Force’s program of record is for 1,763 aircraft, replacing all F-16, all A-10, and possibly all F-15 aircraft currently in the inventory. The Air Force has not explicitly stated the rationale for purchasing 1,763 F-35s to replace 1,303 fighters currently in its inventory,\textsuperscript{27} and this has led to speculation that they may partially offset the Defense Department’s reduction of the Air Force’s original plan to purchase 750 F-22As\textsuperscript{28} to a final program of record of just 187.\textsuperscript{29}

The Active Air Force currently has 268 F-15Cs, and there are concerns about what platform will fill this gap when the F-15C is eventually retired. Even with their superior technology, 159 combat-coded F-22As would be hard-pressed to fulfill the wartime requirement for air superiority fighters for a single major regional contingency (MRC).\textsuperscript{30} The F-22A is world’s most dominant air-to-air fighter and was designed to shoulder the air superiority mission for the Air Force, but with only 187 of a planned 750, this becomes a challenging burden for the F-22 community to carry on its own. The F-35A’s multirole design favors the air-to-ground mission, but its fifth-generation faculties extend well into the air-to-air role,\textsuperscript{31} which will allow it to augment the F-22A in many scenarios.\textsuperscript{32}

Fulfilling the operational need for fighters will be further strained in the near term because the F-22 retrofit—a mix of structural alterations to 162 aircraft needed for the airframe to reach its promised service life—has been forecasted to run through 2021, a year later than previously predicted.\textsuperscript{33} As a result of the retrofit, only 62 percent (99 of 169) of the mission fleet of F-22As are currently available.\textsuperscript{34}

Like the F-35B and F-35C (the Marine Corps and Navy variants, respectively), the F-35A has experienced a host of problems including technological and production delays, cost overruns, and purchase reductions caused by budget cuts. As a result, the initial operating capability (IOC) date was pushed from 2013 to 2016. This system of systems relies heavily on software, and the currently fielded version 3I (IOC software) offers approximately 89 percent of the code required to deliver full warfighting capability. It is expected that 3F, the software that will enable full operating capability (FOC), will be fielded in mid-2017, half a year later than planned.\textsuperscript{35} Given the age of the aircraft that the F-35A will be replacing, every slip in the Lightning II’s program will necessarily affect the warfighting capability of the United States.

A second top priority for the USAF is the KC-46A air refueling tanker aircraft. The Air Force has stated that replacing the KC-135 (now over 50 years old) “remains one of the Air Force’s top three acquisition priorities.”\textsuperscript{36} Though the KC-46 has experienced a series of delays, it reached a milestone in August 2016
that enabled low-rate initial production. The Air Force awarded the contract for 19 initial aircraft in August 2016 toward Pegasus's program of record for 179 aircraft. As it stands now, this system will replace less than half of the current tanker inventory of 391 aircraft. The current program calls for the delivery of 70 aircraft by FY 2020.

The third major priority for the USAF from an acquisition perspective is the B-21 bomber, formerly called the Long-Range Strike Bomber. The USAF awarded Northrop Grumman the B-21 contract to build the Engineering and Manufacturing Development (EMD) phase, which includes associated training and support systems and initial production lots. The B-21 is the service’s next-generation deep-strike platform, intended to begin replacing a total of 119 B-52 Stratofortresses and B-1B Lancers by the mid-2020s. The Air Force has 20 B-2s that apparently will remain in the fleet with an average age of 21 years. The B-21, still in the development phase, will constitute the Air Force’s capability to penetrate highly contested environments defended by the most advanced air defense systems.

The current plan for procurement includes the acquisition of 100 new bombers at an average cost of $564 million per plane. One potential future concern for this program is that with a 100-airframe B-21 purchase, the Air Force’s bomber fleet will fall from 159 aircraft to 120 aircraft.

The Air Force’s strategy of capability over capacity is encumbered by the requirement to sustain ongoing combat operations in Afghanistan, Iraq, and Syria. In a budget-constrained environment, the need to sustain those ongoing efforts while modernizing an outdated fleet of aircraft for operations in contested environments means that funding has to be pulled from other areas, adversely affecting readiness.

Readiness

Air Force Director of Current Operations Major General Scott West testified to the House Armed Services Committee in July 2016 on his force’s aviation readiness,

The Air Force must be ready to conduct full spectrum operations. That includes the continued conduct of nuclear deterrence operations, continued support of counter terror operations (CT), and readiness for potential conflict with a near-peer competitor. While we are able to conduct nuclear deterrence operations and support CT operations, operations against a near-peer competitor would require a significant amount of training. In sum, our readiness is imbalanced at a time when the Air Force is small, old, and heavily tasked.

Air Force readiness relies on weapon systems availability (sustainment); training; wartime readiness materials (WRM); facilities; and installations. While each of the four is important, weapon systems sustainment and WRM are the most critical. Reduced levels of funding, coupled with more than 13 years of continual air campaigns in the Middle East, have taken a significant toll on aircraft, pilot, and maintenance personnel availability.

Munitions are being used faster than they can be replaced. Air-to-surface weapons that offer stand-off, direct attack, and penetrators are short of current inventory objectives, and the concurrent shortage of air-to-air weapons could lead to an increase in the time needed to gain and maintain air superiority in future environments, particularly highly contested ones.

According to the Air Force, readiness has been declining since 2003. In FY 2013, flying hours were reduced by 18 percent, and 18 of 36 active duty, combat-coded squadrons (50 percent) were temporarily stood down. In FY 2014, the Air Force prioritized funding for readiness, but not at a rate to make up completely for cuts in FY 2013, and the shortfalls in readiness have persisted into FY 2016.

Parts inventory shortfalls and a shortage of aircraft maintenance personnel (maintainers) have reduced flying hours to the point where fighter pilots who once averaged over 200 hours a year struggled to get
120 hours in 2014. In 2015, the average rose to 150 hours through combat deployments, in which the vast majority of a fighter pilot’s time is spent patrolling or loitering (holding), over Iraq, Afghanistan, and Syria, where few sorties actually call for employment and no training is allowed. When they return home, those same pilots often average less than one sortie a week.

To put this into context, in the 1980s and 1990s, the demands on a “full spectrum capable” Air Force fighter pilot required, on average, 200 hours per year, or roughly four hours (or sorties) a week. All of that time was spent in the cockpit conducting combat-relevant missions (something other than flying in circles waiting for a call to action). This amount of flying enabled pilots not only to gain proficiency in a broad range of critical air-to-surface and air-to-air engagements, including low-altitude maneuvering, but also to improve those skills over time. At three hours per week (150 hours per year), a pilot might be able to sustain minimal levels of proficiency, but the Air Force typically would consider an inexperienced pilot (one having less than 500 hours of flying time) with that level of proficiency non-deployable for combat operations.

At two hours (or two sorties) or less per week (100 hours per year), a pilot’s skills drop precipitously. With most pilots now receiving 150 hours or less a year, it is hard to fathom which 50 percent of the fighter force is ready for full-spectrum combat. Thirteen continual years of deployment have taken a toll. The Air Force now has a shortfall of 4,000 maintenance personnel and 700 pilots. While the service may be able to devise a plan to fill maintenance and pilot billets, it will take years to regain the experience lost through this flight of talent.

During his confirmation hearing for the position of Chief of Staff of the Air Force, General David Goldfein stated that at current readiness levels, the Air Force cannot muster a surge capacity for major OPLAN contingencies and meet all of the global demand with ready combat forces. In order to meet those contingencies, the Air Force must have 80 percent or more of its combat forces at full-spectrum readiness. Less than 50 percent of combat units are at that level, and while the Air Force could surge forces to meet combatant commander requirements, their lack of readiness would affect its ability to conduct all assigned mission-essential tasks. It would also put those pilots at risk.

The Air Force has stated that it lacks the capacity to absorb additional cuts in manpower without also reducing capability. If requirements continue to increase, the Air Force “will have to make difficult decisions on mission priorities and dilute coverage across the board.” Even with sufficient funding, recovering from its current status would take no small amount of time. For example, standing down a unit for 60 days results in a degraded (unfit for combat) unit. To return the unit to desired levels of proficiency takes six months to a year. As General Goldfein explained, “Bottom line—when an Air Force does not fly, readiness atrophies across the enterprise with impacts that cannot be reversed in the time it took to lose it.” The Air Force’s FY 2017 budget submission seeks to strike a balance among capability, capacity, and readiness with the goal of achieving full-spectrum readiness by 2023.
Scoring the U.S. Air Force

Capacity Score: Strong

One of the key elements of combat power in the U.S. Air Force is its fleet of fighter aircraft. In responding to major combat engagements since World War II, the Air Force has deployed an average of 28 fighter squadrons, based on an average of 18 aircraft per fighter squadron. That equates to a requirement of 500 active component fighter aircraft to execute one MRC. Based on government force-sizing documents that count fighter aircraft, squadrons, or wings, an average of 55 squadrons (990 aircraft) is required to field a two-MRC–capable force (rounded up to 1,000 fighter aircraft to simplify the numbers). This Index looks for 1,200 active fighter aircraft to account for the 20 percent reserve necessary when considering availability for deployment and the risk of employing 100 percent of fighters at any one time.

- **Two-MRC Level:** 1,200 fighter aircraft.
- **Actual 2016 Level:** 1,159 fighter aircraft.

Based on a pure count of combat-coded fighter/attack platforms that have at least IOC, the USAF currently is only slightly below the two-MRC benchmark. However, this figure should be taken with a few caveats. The F-35 will become a highly advanced and capable multirole platform, but the 75 aircraft that have entered the USAF inventory to date are only nearing IOC and do not yet field many of the capabilities that would constitute full-spectrum readiness.

While the 1,159 figure would normally yield a capacity level of “very strong,” aircraft require pilots to fly them and maintainers to launch, recover, and fix them. With a fighter pilot shortage of 700 and a maintenance shortfall of 4,000 personnel, the ability of the Air Force to meet the wartime manning requirements for fighter cockpits or sufficient maintenance personnel to continually repair, refuel, and rearm aircraft rapidly to meet wartime sortie requirements has been significantly reduced. Those factors, coupled with the lack of funding for a sufficient supply of spare parts, has reduced the capacity for employment from “very strong” in the 2016 Index to a 2017 Index assessment of “strong.”

Capability Score: Marginal

The Air Force’s capability score is “marginal,” a result of being scored “strong” in “Size of Modernization Program,” “marginal” for “Age of Equipment” and “Health of Modernization Programs,” but “weak” for “Capability of Equipment.” These scores have not changed from the 2016 Index’s assessment. However, continued concern with the F-35 program’s progress toward effective replacement of legacy aircraft could cause the USAF’s capability score to decline in future years.

Readiness Score: Marginal

The Air Force scores “marginal” in readiness in the 2017 Index, the same as it scored in the 2016 Index. This is based primarily on the Air Force’s reporting that 50 percent of its combat air forces met full-spectrum readiness requirements in 2016. The Air Force should be prepared to respond quickly to an emergent crisis and retain full readiness of its combat airpower, but it has been suffering from degraded readiness since 2003, and implementation of BCA-imposed budget cuts in FY 2013 has only exacerbated the problem. Similar to the other services, the Air Force was able to make up some of its readiness shortfalls under the FY 2015 budget, but given its poor readiness assessment, much more improvement is required.

The Air Force’s current deficits in both pilot and maintainer manpower are also very troubling indicators for readiness. They will strain the service in the immediate term and, if not reversed, could lead to broader readiness challenges in the future.
Overall U.S. Air Force Score: Marginal

The Air Force is scored as “marginal” overall. This is an unweighted average of its capacity score of “strong,” capability score of “marginal,” and readiness score of “marginal.” While the overall score remains the same as the previous year’s, the accumulating shortage of pilots and maintainers has begun to affect the ability of the Air Force to generate the amount of combat air power that would be needed to meet wartime requirements.

### U.S. Military Power: Air Force

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Endnotes:
5. Ibid., p. 18.
14. Ibid.
15. International Institute for Strategic Studies, The Military Balance 2016: The Annual Assessment of Global Military Capabilities and Defence Economics (London: Routledge, 2016). Summed totals of Air Force Fighter Aircraft (1,303) and the subtracted seven AETC fighter squadrons and one ACC fighter squadron (8 x 18 = 144) that are RTU (non-combat-coded) squadrons.

16. Ibid., pp. 8–9.


18. Ibid., p. 7.


22. Ibid.

23. International Institute for Strategic Studies, The Military Balance 2016, p. 47. This reference is missing 31 MC-12s (see “The Air Force in Facts and Figures,” May 2016, p. 37) that were added to reach a total of 482.


34. Ibid.


47. Ibid., p. 17.


52. Ibid.


60. This number represents total active component fighters. This *Index* considers requirements, such as aircraft, that are needed to perform Operation Noble Eagle (ONE), an ongoing mission to defend American airspace. Details regarding ONE are limited and largely unavailable to the public. Because the exact number of active component fighter aircraft participating in ONE is unknown, those fighters that may be tasked with the ONE mission are not counted in this total.

The U.S. Marine Corps

The U.S. Marine Corps (USMC) is the nation’s expeditionary armed force, positioned and ready to respond to crises around the world. Marine units assigned aboard ships (“soldiers of the sea”) or at bases abroad stand ready to project U.S. power into crisis areas. Marines also serve in a range of unique missions, from combat defense of U.S. embassies abroad under attack to operating the President’s helicopter fleet.

Although Marines have a wide variety of individual assignments, the focus of every Marine is on combat: Every Marine is first a rifleman. The USMC has positioned itself for crisis response and has evolved its concepts to leverage its equipment more effectively to support operations in a heavily contested maritime environment such as the one found in the Western Pacific. Worldwide, over 35,000 Marines are forward deployed and engaged. Despite the drawdown of forces, in 2015, “Marines executed approximately 100 operations, 20 of them amphibious, 140 security cooperation activities with our partners and allies, and 160 major exercises” in addition to providing embassy security and short-term reinforcement of posts.2

Pursuant to the Defense Strategic Guidance (DSG), maintaining the Corps’ crisis response capability is critical. Thus, given the fiscal constraints imposed, the Marines have prioritized “near-term readiness” at the expense of other areas, such as capacity, capability, modernization, home station readiness, and infrastructure.3 This trade-off is a short-term fix to meet immediate needs: Over the longer term, the degradation of investment in equipment will lead to lowered readiness.

Capacity

The Marine Corps has managed the reduction in funding by cutting capacity. The Corps’ measures of capacity are similar to the Army’s: end strength and units (battalions for the Marines and brigades for the Army). End strength has been decreased from a force of 202,100 Active personnel in fiscal year (FY) 20124 to roughly 184,000 in FY 2016.5 In FY 2016, the Marine Corps requested a pause in capacity cuts (to remain at an end strength of 184,000) in order to reduce the “impact on deployment to dwell ratios” and “assess the impact of its four[-]year drawdown.”6 The drawdown will resume in FY 2017, to reach an “enduring” end strength of 182,000 Active personnel funded entirely from the base budget.7 Although the Bipartisan Budget Act gave the military partial, temporary relief from budget cuts, according to Secretary of Defense Ashton Carter, a return to BCA spending caps in FY 2018 remains the “greatest risk to the Department of Defense.”8 The DOD estimated in 2014 that if sequestration-level cuts occurred in FY 2016, Marine Corps end strength would be cut further to 175,000 by FY 2017.9 With a force of that size, the USMC would be unable to meet the requirements of the DSG and according to General Joseph Dunford, recently Commandant of the Marine Corps, a new strategy would need to be developed.10

The Marine Corps organizes itself in infantry battalions, which are its basic combat unit. A battalion has about 900 Marines and
includes three rifle companies, a weapons company, and a headquarters and service company. The Marine Corps maintained 23 Active infantry battalions in FY 2016,\textsuperscript{11} down from 25 in FY 2014 and 27 in FY 2012.\textsuperscript{12} Funding at the requested levels for FY 2017 supports an increase to 24 Active infantry battalions after a one-year delay from the FY 2016 force structure plan.\textsuperscript{13} However, under full sequestration, USMC end strength would be able to support only 21 infantry battalions,\textsuperscript{14} which, according to General Dunford, would leave the Corps “with fewer active duty battalions and squadrons than would be required for a single major contingency.”\textsuperscript{15} It should be noted that the service was able to field only 23 battalions in 2016, although funding was to have been sufficient for 24.

Marine Aviation units have been particularly stressed by insufficient funding. Although operational requirements have not decreased, fewer Marine aircraft are available for tasking or training. For example, the number of active component squadrons (including both fixed-wing and rotary wing aircraft) decreased from 58 in 2003 to 55 in 2015.\textsuperscript{16} Another way to look at this decline is through tactical air squadrons, which include the strike fighter and close air support aircraft in the USMC inventory. In July 2016, USMC Deputy Commandant for Aviation Lieutenant General Jon M. Davis explained, “right now, we’re at 20 [tactical] air squadrons and we, like the Air Force, came down after Desert Storm.”\textsuperscript{17} General Davis added that the USMC had around 28 tactical air squadrons during that military engagement.

The number of available aircraft continues to decline as procurement of the F-35B and MV-22 struggles to keep pace with the decommissioning of aging aircraft squadrons, high operational temps, and maintenance backlogs that have limited the number of Ready Basic Aircraft (RBA) for training and operational requirements.\textsuperscript{18} The MV-22 has not yet been delivered in sufficient quantities to offset the retirement of the CH-46, resulting in a temporary reduction in vertical lift capacity.\textsuperscript{19} Two additional MV-22 squadrons are planned for procurement in FY 2017.\textsuperscript{20} Moreover, “shortages in aircraft availability due to increased wear on aging aircraft and modernization delays”\textsuperscript{21} have led the Marine Corps to reduce the requirement of aircraft per squadron for the F/A-18, CH-53E, and AV-8B temporarily in order to provide additional aircraft for home station training.\textsuperscript{22} Approximately 80 percent of Marine Corps aviation units are experiencing shortages below the minimum number of RBA required for training.\textsuperscript{23} Any reduction in Marine aviation capability has a direct effect on overall Corps combat capability, as the Corps usually fights with its ground and aviation forces integrated as Marine Air-Ground Task Forces (MAGTFs).

Additionally, the current inventory of non-commissioned officers and staff non-commissioned officers does not meet USMC force structure requirements. This will pose readiness challenges for the Corps as the shortage of “small unit leaders with the right grade, experience, technical skills and leadership qualifications” grows.\textsuperscript{24}

In 2010, the USMC determined that its ideal force size would be 186,800 in light of the requirements of the President’s National Security Strategy.\textsuperscript{25} However, given the budget pressures from the Budget Control Act (BCA) of 2011 and the newer 2012 DSG, the Corps decided that a force size of “182,100 active component Marines could still be afforded with reduced modernization and infrastructure support.”\textsuperscript{26}

One impact of reduced capacity is a reduction in dwell time. The stated ideal deployment-to-dwell (D2D) time ratio is 1:3 (seven months deployed for every 21 months at home), which is possible with 186,000 troops.\textsuperscript{27} The “fundamental difference” between that optimal force size and an active end strength of 182,000 is a lower D2D ratio of 1:2, which translates to roughly seven-month deployments separated by stretches of 14 months at home.\textsuperscript{28} Under current budget constraints, some individuals and even whole units with critical skills “are operating in excess of a 1:2
(D2D) ratio.” A return to BCA-level budget caps in FY 2018 could reduce capacity even further, and the dwell ratio for the Marine Corps could fall to 1:1. This increase in deployment frequency would exacerbate the degradation of readiness, as people and equipment would be used more frequently with less time to recover between deployments.

**Capability**

The nature of the Marine Corps’ crisis response role requires capabilities that span all domains. The USMC ship requirement is managed by the Navy and is covered in the Navy’s section of the Index. The Marine Corps is focusing on “essential modernization” and emphasizing programs that “underpin our core competencies,” making the Amphibious Combat Vehicle (ACV) and the F-35 Joint Strike Fighter (JSF) programs its top two priorities.

Of the Marine Corps’ current fleet of vehicles, its amphibious vehicles—specifically, the Assault Amphibious Vehicle (AAV-7A1) and Light Armored Vehicle (LAV)—are the oldest, with the AAV-7A1 averaging over 40 years old and the LAV averaging 25 years old. The AAV-7A1 is currently undergoing survivability upgrades, with the first round of upgrades (AAV SU) delivered to U.S. Marine Corps Base Quantico on March 4. These upgrades will help to bridge the capability gap until the fielding of the ACV. Comparative-ly, the Corps’ M1A1 Abrams inventory is 26 years old with an estimated 33-year life span, and its fleet of light tactical vehicles such as HMMWVs (“Humvees”) is relatively young, averaging seven years old.

The Corps’ main combat vehicles all entered service in the 1970s and 1980s, and while service life extensions, upgrades, and new generations of designs have allowed the platforms to remain in service, these vehicles are quickly becoming ill-suited to the changing threat environment. For example, with the advent of improvised explosive devices (IEDs), the flat-bottom hulls found on most legacy vehicles are ineffective compared to the more blast-resistant V-shaped hulls incorporated in modern designs. Furthermore, the cost of maintaining these legacy systems diverts funding from innovation and modernization.

The Corps’ aircraft have age profiles similar to the Navy’s. As of February 2016, the USMC had 262 F/A-18 A–Ds (including one reserve squadron) and 27 EA-6Bs in its primary mission aircraft inventory, and both aircraft have already surpassed their originally intended life spans. The Marine Corps began to retire its EA-6B squadrons in FY 2016 with the decommissioning of Marine Tactical Electronic Warfare Squadron 1 and will continue to decommission the remaining three at a rate of one per year through FY 2019. The 2016 Marine Aviation Plan projects that a total of 18 Prowlers will remain in the active and reserve components in FY 2017. Unlike the Navy, the Corps did not acquire the newer F/A-18 E/F Super Hornets; thus, the older F/A-18 Hornets are going through a service life extension program to extend their life span to 10,000 flight hours from the original 6,000 hours. This was intended to bridge the gap to when the F-35Bs and F-35Cs enter service to replace the Harriers and most of the Hornets. However, delays in the service life extension program and “increased wear on aging aircraft” have further limited availability of the F/A-18 A-D and AV-8B. The AV-8B Harrier, designed to take off from the LHA and LHD amphibious assault ships, will be retired from Marine Corps service in 2026. The AV-8B received near-term capability upgrades in 2015 that will continue in 2017 in order to maintain its lethality and interoperability until the F-35 transition is complete. The Corps declared its first F-35B squadron operationally capable on July 31, 2015, after it passed an “Operational Readiness Inspection” test. However, problems with the aircraft’s software continue to generate concern, with the potential for performance and schedule delays to accumulate between $20 billion and $100 billion in additional costs. On June 30, 2016,
the Marine Corps stood up its second F-35B squadron, transitioning from an AV-8B Marine Attack Squadron to a Marine Fighter Attack Squadron.50

The Marine Corps has two Major Defense Acquisition (MDAP) vehicle programs: the Joint Light Tactical Vehicle (JLTV) and Amphibious Combat Vehicle (ACV).51 The JLTV is a joint program with the Army to acquire a more survivable light tactical vehicle to replace a percentage of the older HMMWV fleet, originally introduced in 1985. The Army retains overall responsibility for JLTV development through its Joint Program Office.52 The Marines intend to purchase 5,500 vehicles (10 percent of a total of 54,599),53 and acquisition of the JLTVs should be completed by FY 2023. However, the FY 2017 USMC budget request funds only 192 vehicles, 77 fewer JLTVs than originally requested, in order to prioritize funding for ACV and GATOR.54 The program is still in development and has experienced delays in the past due to a change in requirements, a contract award protest, and concerns regarding technical maturity.55 In 2014, the Corps cancelled the HMMWV Sustainment Modification Initiative, which would have upgraded 13,000 vehicles,56 in order to prioritize JLTV funding.57 Although the Marine Corps has indicated that the JLTV will not be a one-for-one replacement of the HMMWV,58 there are concerns that reduced procurement will create a battlefield mobility gap for some units.59

Following FY 2015 plans for the JLTV, the program awarded a low-rate initial production (LRIP) contract, which includes a future option of producing JLTVs for the Marine Corps, to defense contractor Oshkosh.60 The Corps procured 130 JLTVs across FY 2015 and FY 2016.61 The lack of operational detail in the Army’s updated Tactical Wheeled Vehicle Strategy could be an issue for future USMC JLTV procurement and modernization plans.62 Nevertheless, the USMC expects the JLTV program, consisting of “one infantry battalion fully fielded with the JLTV plus a training element,” to reach initial operational capability (IOC) in the fourth quarter of 2018.63

The Marine Corps plans to replace the AAV-7A1 with the ACV, which completed its Milestone B requirements in November 201564 and will move into the engineering, manufacture, and development phase in FY 2017.65 The ACV, which took the place of the Expeditionary Fighting Vehicle (EFV), “has been structured to provide a phased, incremental capability.”66 The AAV-7A1 was to be replaced by the EFV, a follow-on to the cancelled Advanced AAV, but the EFV was also cancelled in 2011 due to technical obstacles and cost overruns. Similarly, the Corps planned to replace the LAV inventory with the Marine Personnel Carrier (MPC), which would serve as a Light Armored Vehicle with modest amphibious capabilities but would be designed primarily to provide enhanced survivability and mobility once ashore.67 However, budgetary constraints led the Corps to shelve the program, leaving open the possibility that it may be resumed in the future.

After restructuring its ground modernization portfolio, the Marine Corps determined that it would combine its efforts by upgrading 392 of its legacy AAVs and continuing development of the ACV in order to replace part of the existing fleet and complement the upgraded AAVs.68 This would help the Corps to meet its requirement of armored lift for 10 battalions of infantry.69 The USMC’s acquisition objective for the ACV is 204 vehicles for the first increment.70 Brigadier General Joseph Shrader confirmed that this ACV 1.1 increment would not replace the AAV, but rather would serve to “enhance that capability.”71

The ACV 1.1 platform is notable in that it will be an amphibious wheeled vehicle instead of a tracked vehicle, capable of traversing open water only with the assistance of Navy shore connectors such as Landing Craft, Air Cushion Vehicles (LCAC). The ACV 1.2 platform is being planned as a fully amphibious, tracked version.72 Development and procurement of the ACV program will be phased so that the new platforms can be fielded incrementally
alongside a number of modernized AAVs. Plans call for a program of record of 694 vehicles, with the first battalion to reach IOC in FY 2020 and for modernizing enough of the current AAV fleet to outfit four additional battalions, which would allow the Corps to meet its armored lift requirement for 10 battalions. In addition, the Corps will purchase new vehicles based on the MPC concept.

The F-35B remains the Marine Corps’ largest investment program in FY 2017. The Corps announced IOC of the F-35B variant in July 2015. The service’s total procurement will consist of 420 F-35s (357 F-35Bs and 63 F-35Cs). The AV-8Bs and F/A-18A-Ds will continue to receive interoperability and lethality enhancements in order to extend their useful service lives during the transition to the F-35.

As the F-35 enters into service and legacy platforms reach the end of their service life, the Marine Corps expects a near-term inventory challenge. Specifically, this is due to a combination of reduced JSF procurement, increasing tactical aircraft utilization rates, and shortfalls in F/A-18A-D and AV-8B depot facility production. In March 2016, General Robert Neller, Commandant of the Marine Corps, assessed that “[i]f these squadrons [in the F/A-18 community] were called on to fight today they would be forced to execute with 86 less jets than they need.” Like the F-35A, the F-35B and F-35C variants are subject to development delays, cost overruns, budget cuts, and production problems. The F-35B in particular was placed on probation in 2011 because of its technical challenges. Probation has since been lifted, and the Corps declared IOC with its first F-35B squadron, VMFA-121, on July 31, 2015.

Today, the USMC MV-22 program is operating with few problems and nearing completion of the full acquisition objective of 360 aircraft. As of April 2016, the Marine Corps had received 269 of the 360 aircraft included in the program of record. Following deactivation of the final CH-46 squadron in April 2015, the Osprey has replaced the Sea Knight as the USMC’s primary medium lift platform. However, new Osprey squadrons were not commissioned fast enough to replace the retiring CH-46 squadrons. Currently, there are 14 fully operational capability squadrons to meet these needs, and two additional squadrons are forming. The MV-22’s capabilities are in high demand from the Combatant Commanders (COCOMs), and the Corps is adding capabilities such as fuel delivery and use of precision-guided munitions to the MV-22 to enhance its value to the COCOMs.

The USMC heavy lift replacement program, the CH-53K, conducted its first flight on October 27, 2015. The CH-53K will replace the Corps’ CH-53E, which entered service in 1980. However, “unexpected redesigns to critical components have delayed aircraft assembly and testing and have slowed delivery of test aircraft” pushing the expected LRIP decision into 2017. The helicopter is now predicted to reach IOC in 2019, almost four years later than initially anticipated. This is of increasing concern as the Marine Corps maintains only 146 CH-53Es, only 47 of which are considered flyable. Although the Marine Corps began a reset of the CH-53E in 2016 to bridge the procurement gap, it will not have enough helicopters to meet its heavy-lift requirement without the transition to the CH-53K. The FY 2017 request asks for continued Research, Development, Test and Evaluation (RDT&E) funding, along with $437 million for an initial procurement quantity of two CH-53Ks, and retains the current program of record of 200 CH-53Ks.

### Readiness

The Marine Corps’ first priority is to be the crisis response force for the military, which is why investment in readiness has been prioritized over capacity and capability. However, in order to invest in readiness in a time of downward fiscal pressure, the Corps has
been forced to reduce end strength and delay investment in modernization. Even though funding for near-term readiness has been relatively protected from cuts, future readiness is threatened by underinvestment in long-term modernization and infrastructure. As General Dunford has explained, extended or long-term imbalance among the USMC “pillars” of readiness, which address both operational and foundational readiness, “will hollow the force and create unacceptable risk for our national defense.”

In FY 2016, according to Marine Corps Assistant Commandant General John M. Paxton, Jr., “approximately half of our non-deployed units are suffering from some degree of personnel, equipment, or training shortfalls.” Personnel and equipment shortages, lower end strength, shorter dwell times, and a scarcity of prepositioned ships have inhibited sufficient training for home-station units and have “degraded full spectrum capability across the Service.”

Marine aviation in particular is experiencing significant readiness shortfalls. With a smaller force structure and fewer aircraft available for training, aviation units are having difficulty keeping up with demanding operational requirements. All of the Marine Corps’ fixed-wing and tiltrotor aircraft are operating in excess of a 1:2 D2D ratio. High operational tempos, coupled with a 5.6 percent reduction in operations and maintenance funding from FY 2015 to FY 2016, put increasing stress on depots. This stress is increased by reduced procurement and workforce cuts, which contribute to readiness problems and leave fewer aircraft available for training or operations.

Only 43 percent of the Marine Corps’ total aircraft inventory is currently considered flyable, which “leaves the Corps shy of being able to meet our wartime commitments” and reduces the aircraft available for training. As a result, average flight hours have reached “historic lows.” According to General Paxton, the Marine Corps is concerned about these conditions and the possible correlation to “an increasing number of aircraft mishaps and accidents,” acknowledging that “if you fly less and maintain slower there’s a higher likelihood of accidents.”

In order to achieve the minimum readiness goal, squadrons must be qualified to perform 70 percent of their Mission Essential Tasks. However, nearly half of the last 27 deployed squadrons failed to meet the necessary “training and readiness levels to be safe and meet the minimum for tactical proficiency.” In FY 2017, the Marine Corps will prioritize readiness funding for deployed and pre-deployment units. This decision comes at the expense of non-deployed forces. According to General Paxton, “[b]y degrading the readiness of these bench forces to support those forward deployed, we are forced to accept increased risk in our ability to respond to further contingencies, our ability to assure we are the most ready when the nation is least ready.”

The Marines’ Ground Equipment Reset Strategy has been progressing and is anticipated to be completed by the end of FY 2017. All of the equipment in Afghanistan was withdrawn by February 2015. As of March 2016, 78 percent of ground equipment had been reset, and the Marine Corps expects to complete its total reset requirement by 2019. Reconstituting equipment and ensuring that the Corps’ inventory can meet operational requirements are critical aspects of readiness.

Scoring the U.S. Marine Corps

**Capacity Score: Weak**

Based on the deployment of Marines across major engagements since the Korean War, the Corps requires roughly 15 battalions for one MRC. Therefore, it would need a force of around 30 battalions to fight two
MRCs simultaneously. The government force-sizing documents that discuss Marine Corps composition support this. Though the documents that make such a recommendations count the Marines by divisions, not battalions, they are consistent in arguing for three Active Marine Corps divisions, which in turn requires roughly 30 battalions. With a 20 percent strategic reserve, the ideal USMC capacity for a two-MRC force-sizing construct is 36 battalions.

More than 33,000 Marines were deployed in Korea, and over 44,000 were deployed in Vietnam. In the Persian Gulf, one of the largest Marine Corps missions in U.S. history, some 90,000 Marines were deployed, and around 66,000 were deployed for Operation Iraqi Freedom. As the Persian Gulf War is the most pertinent example for this construct, a force of 180,000 Marines is a reasonable benchmark for a two-MRC force, not counting Marines that would be unavailable for deployment (assigned to institutional portions of the Corps) or that are deployed elsewhere. This is supported by government documents that have advocated for a force as low as 174,000 (1993 Bottom-Up Review) and as high as 202,000 (2010 Quadrennial Defense Review), with an average end strength of 185,000 being recommended.

- **Two-MRC Level:** 36 battalions.
- **Actual 2016 Level:** 23 battalions.

The Corps is operating with slightly less than 64 percent of the number of battalions relative to the two-MRC benchmark. This is the same capacity level as measured in the 2016 Index, and the Corps’ capacity is therefore scored as “weak” again in 2017.

**Capability Score: Marginal**

The Corps receives scores of “weak” for “Capability of Equipment,” “marginal” for “Age of Equipment” and “Health of Modernization Programs,” but “strong” for “Size of Modernization Program.” Therefore, the aggregate score for Marine Corps capability is “marginal.” Excluded from the scoring are various ground vehicle programs that have been cancelled and are now being reprogrammed. This includes redesign of the MPC.

**Readiness Score: Marginal**

In FY 2016, approximately half of USMC units experienced degraded readiness. As the nation’s crisis response force, the Corps requires that all units, whether deployed or non-deployed, be ready. Thus, this Index scores the Corps’ readiness as “marginal” because the USMC is meeting only half of its readiness requirement. Last year, the USMC reported more specifically that 42 percent of units experienced degraded readiness, leaving 58 percent ready. Since the reporting was more vague this year, this Index assumes that the level is nearly the same, although it could be lower given that half would literally mean 50 percent ready, 8 percent lower than the reported 58 percent measured in the 2016 Index.

**Overall U.S. Marine Corps Score: Marginal**

The Marine Corps is scored as “marginal” overall in the 2017 Index. This is the same as the assessment in the previous Index. However, the Corps is at the lower end of this category, and the possibility of further declines in both capacity and readiness signals that this score could drop to “weak” in the near future given continued high demand and OPTEMPO on this service and the need to preserve immediate readiness concerns at the expense of the future force.
### U.S. Military Power: Marine Corps

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Endnotes:


4. Ibid., p. 11.


7. Ibid.


15. Dunford statement, January 28, 2015, p. 32.


18. International Institute for Strategic Studies, *The Military Balance 2016: The Annual Assessment of Global Military Capabilities and Defence Economics* (London: Routledge, 2016), pp. 44–45. The prior year figure was not repeated in recent testimony. Since publication of the 2016 IISS *Military Balance*, one Prowler squadron has been decommissioned, and one harrier squadron has been transitioned to an F-35B squadron. Factoring in these changes to the IISS *Military Balance*, there are 60 total squadrons in the Marine Corps active component, including all fixed-wing and rotary aircraft squadrons, training and transport squadrons, and one combat search and rescue squadron (does not include the “VIP” transport squadron). Using the same metrics, the total for 2015 based on the IISS *Military Balance* would have been 64.


22. Ibid.


32. Ibid., p. 11.


43. Ibid., p. 39.


47. Grosklags, Davis, and Manazir, “Department of the Navy’s Aviation Programs,” April 20, 2016, p. 3.


66. Ibid.


69. In regard to this overall requirement—armored lift for 10 battalions of infantry—the AAV Survivability Upgrade Program would provide for four battalions, and ACV 1.1 and ACV 1.2 would account for six battalions. Ibid., pp. 27–28.


72. Feickert, “Marine Corps Amphibious Combat Vehicle (ACV) and Marine Personnel Carrier (MPC).”

73. Dunford statement on Marine Corps readiness, February 26, 2015, p. 28.


77. Ibid, p. 3.

78. Vice Admiral Paul Grosklags, Principal Military Deputy, Assistant Secretary of the Navy (Research, Development and Acquisition); Rear Admiral Michael C. Manazir, Director, Air Warfare; and Lieutenant General Jon Davis, Deputy Commandant for Aviation, “Department of the Navy’s Aviation Programs,” statement before the Subcommittee on Seapower, Committee on Armed Services, U.S. Senate, March 25, 2015, p. 10, http://www.armed-services.senate.gov/imo/media/doc/Grosklags_Manazir_Davis_03-25-15.pdf (accessed August 30, 2016).


86. Grosklags, Manazir, and Davis, “Department of the Navy’s Aviation Programs,” March 25, 2015, p. 16.

87. Ibid.


90. Ibid., p. 93.
92. Ibid., p. 10.
95. Ibid.
99. Ibid., pp. 6 and 9.
100. Ibid., p.
102. Ibid., p. [3].
107. Ibid., p. 13.
108. This count is based on an average number of 1.5 divisions deployed to major wars (see Table 6, p. 226) and an average of 10–11 battalions per division.
U.S. Nuclear Weapons Capability

Assessing the state of U.S. nuclear weapons capabilities presents several challenges.

First, the U.S. has elected to maintain nuclear warheads—based on designs from the 1960s and 1970s—that were in the stockpile when the Cold War ended rather than take advantage of technological developments to field new warheads that could be designed to be safer and more secure and could give the United States improved options for guaranteeing a credible deterrent.

Second, the lack of detailed publicly available data about the readiness of nuclear forces, their capabilities, and weapon reliability makes analysis difficult.

Third, the U.S. nuclear enterprise is composed of many components, some of which are also involved in supporting conventional missions. For example, dual-capable bombers do not fly airborne alert with nuclear weapons today, although they did so routinely during the 1960s (and are capable of doing so again if the decision should ever be made to resume this practice). Additionally, the national security laboratories do not focus solely on the nuclear weapons mission; they also perform a variety of functions related to nuclear non-proliferation, medical research, threat reduction, and countering nuclear terrorism, including nuclear detection.

Thus, assessing the extent to which any one piece of the nuclear enterprise is sufficiently funded, focused, and effective with regard to the nuclear mission is problematic.

In today’s rapidly changing world, the U.S. nuclear weapons enterprise should be flexible and resilient to underpin the U.S. nuclear deterrent. If the U.S. detects a game-changing nuclear weapons development in another country, the ability of the U.S. nuclear weapons complex to provide a timely response is important.

The U.S. maintains an inactive stockpile that includes near-term hedge warheads that can be put back into operational status within six to 24 months. Extended hedge warheads are said to be ready within 24 to 60 months. The U.S. preserves significant upload capability on its strategic delivery vehicles, which means that the nation can increase the number of nuclear warheads on each type of its delivery vehicles if contingencies warrant. For example, the U.S. Minuteman III intercontinental ballistic missile (ICBM) can carry up to three nuclear warheads, though it is currently deployed with only one.

Presidential Decision Directive-15 (PDD-15) requires the U.S. to maintain the ability to conduct a nuclear test within 24 to 36 months of a presidential decision to do so. However, successive governmental reports have noted the continued deterioration of technical and diagnostics equipment and the inability to fill technical positions supporting nuclear testing readiness. A lack of congressional support for improving technical readiness further undermines efforts by the National Nuclear Security Administration (NNSA) to comply with the directive.

The weapons labs are beset by demographic challenges of their own. Thomas D’Agostino, former Under Secretary of Energy for Nuclear Security and Administrator of the NNSA, has stated that it is quite plausible...
that by 2017, the United States will not have a single active engineer who had “a key hand in the design of a warhead that’s in the existing stockpile and who was responsible for that particular design when it was tested back in the early 1990s.” This is a significant problem because for the first time since the dawn of the nuclear age, the U.S. will have to rely on the scientific judgment of people who were not directly involved in nuclear tests of weapons that they designed, developed, and are certifying.

Not all of the existing inactive stockpile will go through the life-extension program. Hence, our ability to respond to contingencies by uploading weapons kept in an inactive status could decline with the passage of time.

The shift of focus away from the nuclear mission after the end of the Cold War caused the NNSA laboratories to lose their sense of purpose and to feel compelled to reorient and broaden their mission focus. According to a number of studies, their relationship with the government also evolved in ways that reduce output and increase costs. The NNSA was supposed to address these problems but has largely failed in this task, partly because “the relationship with the NNSA and the National security labs appears to be broken.”

In 1999, the Commission on Maintaining U.S. Nuclear Weapons Expertise concluded that 34 percent of the employees supplying critical skills to the weapons program were more than 50 years old. The number increased to 40 percent in 2009. The U.S. high-technology industry, on average, has a more balanced employee age distribution. In 2012, a number of the Los Alamos National Laboratory’s employees were laid off in anticipation of a $300 million shortfall.

Both the lack of resources and the lack of sound consistent policy guidance have undermined the morale of the workforce. The Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise recommended fundamental changes in the nuclear weapons enterprise’s culture, business practices, project management, and organization.

Others proposed moving the NNSA to the Department of Defense.

Another important indication of the health of the overall force is the readiness of forces that actually operate U.S. nuclear systems. In 2006, the Air Force mistakenly shipped non-nuclear warhead components to Taiwan. A year later, the Air Force transported nuclear-armed cruise missiles across the U.S. without authorization (or apparently even awareness that it was doing so, mistaking them for conventional cruise missiles). These serious incidents led to the establishment of a Task Force on DOD Nuclear Weapons Management, which found that “there has been an unambiguous, dramatic, and unacceptable decline in the Air Force’s commitment to perform the nuclear mission and, until very recently, little has been done to reverse it” and that “the readiness of forces assigned the nuclear mission has seriously eroded.”

Following these incidents, the Air Force instituted broad changes to improve oversight and management of the nuclear mission and the inventory of nuclear weapons, including creating the Air Force Global Strike Command to organize, train, and equip intercontinental-range ballistic missile and nuclear-capable bomber crews as well as other personnel to fulfill a nuclear mission and implement a stringent inspections regime.

The success of these changes has been limited. In January 2014, the Air Force discovered widespread cheating on nuclear proficiency exams and charged over 100 officers with misconduct. The Navy had a similar problem, albeit on a smaller scale. The Department of Defense conducted two nuclear enterprise reviews, one internal and one external. Both reviews identified a lack of leadership attention, a lack of resources to modernize the atrophied infrastructure, and unduly burdensome implementation of the personnel reliability program as some of the core challenges preventing a sole focus on accomplishing the nuclear mission.

The ICBM Force Improvement Program was initiated and mostly implemented.
throughout 2014 and into 2015, and the Air Force shifted over $160 million to address problems, modernize certain facilities, and generally improve morale. The Air Force has also seen an increase in badly needed manpower—but not nearly enough to alleviate manpower concerns. If changes in the nuclear enterprise are to be effective, leaders across the executive and legislative branches will have to continue to provide sufficient resources to mitigate readiness and morale issues within the force in the years ahead.

Fiscal uncertainty and a steady decline in resources for the nuclear weapons enterprise (trends that have begun to reverse in recent years) have negatively affected the nuclear deterrence mission. Admiral Cecil D. Haney, Commander, U.S. Strategic Command (STRATCOM), testified in March 2016 that:

Much remains to be done to sustain and modernize the foundational nuclear deterrent force that we need to protect the Nation from existential threats in an increasingly uncertain and unpredictable environment. We must continue to meet critical investment timelines to ensure that aging platforms and weapons systems do not reach the point at which their viability becomes questionable.

In recent years, the Administration has advanced a comprehensive modernization program for nuclear forces—warheads, delivery systems and command and control—and has robustly funded this program in its budget requests. At the same time, Congress in large part has funded the modernization program. Because such modernization activities require long-term funding commitments, it is important that a bipartisan approach continue this commitment in future years.

**Implications for U.S. National Security**

U.S. nuclear forces play an important role in the global nonproliferation regime by providing U.S. assurances to NATO, Japan, and South Korea that lead these allies either to keep the number of their nuclear weapons lower than otherwise would be the case (France, the U.K.) or to forgo their development and deployment altogether. North Korea has proven that a country with very limited intellectual and financial resources can develop a nuclear weapon if it decides to do so. Iran continues to be on a path to obtaining a nuclear weapon, and the Joint Comprehensive Plan of Action might make reaching the goal easier by providing Iran with money and access to advanced technologies.

This makes U.S. nuclear assurances to allies and partners ever more important. Should the credibility of American nuclear forces continue to degrade, countries such as South Korea could pursue an independent nuclear option, which would raise several thorny issues including possible additional instability across the region.

Certain negative trends could undermine U.S. nuclear deterrence if problems are not addressed. There is no shortage of challenges on the horizon, from an aging nuclear weapons infrastructure and workforce to the need to recapitalize all three legs (land, air, and sea) of the nuclear triad, from the need to conduct life-extension programs while maintaining a self-imposed nuclear weapons test moratorium to limiting the spread of nuclear know-how and the means to deliver nuclear weapons. Additionally, the United States must take account of adversaries who are modernizing their nuclear forces, particularly Russia and China.

Deterrence is a complex interplay between U.S. conventional and nuclear forces and the psychology of both allies and adversaries that the U.S. would use these forces to defend both the interests of the U.S. and those of its allies. Nuclear deterrence must reflect the mindset of the adversary the U.S. seeks to deter. If an adversary believes that limited nuclear war can be fought and won, then the task for U.S. leaders is to convince the adversary otherwise.
even if U.S. leaders think it is not possible to control escalation. The U.S. nuclear portfolio must be structured in terms of capacity, capability, variety, flexibility, and readiness to achieve this objective. In addition, military requirements and specifications for nuclear weapons will be different depending on who is being deterred, what he values, and what the U.S. seeks to deter him from doing.

Due to the complex interplay among strategy, policy, actions that states take in international relations, and other actors’ perceptions of the world around them, it is quite possible that one might never know precisely if and when a nuclear or conventional deterrent provided by U.S. forces loses credibility. Nuclear weapons capabilities take years or decades to develop, as does the infrastructure supporting them—an infrastructure that the U.S. has neglected for decades. We can be reasonably certain that a robust, well-resourced, focused, and reliable nuclear enterprise is more likely to sustain its deterrent value than is an outdated and questionable one.

The U.S. is capable of incredible mobilization when danger materializes. The nuclear threat environment is dynamic and proliferating, with old and new actors developing advanced capabilities while the U.S. enterprise is relatively static, potentially leaving the United States at a technological disadvantage. This is worrisome because of its implications both for the security of the United States and for the security of its allies and the free world generally.

Scoring U.S. Nuclear Weapons Capabilities

The U.S. nuclear weapons enterprise is composed of several key elements that include warheads; delivery systems; nuclear command and control; intelligence, surveillance, and reconnaissance; aerial refueling; and the physical infrastructure that designs, manufactures, and maintains U.S. nuclear weapons. The complex also includes the talent of people from physicists to engineers, maintainers, and operators, without which the continuous maintenance of the nuclear infrastructure would not be possible.

The factors selected below are the most important elements of the nuclear weapons complex. They are judged on a five-grade scale, where “very strong” means that a sustainable, viable, and funded plan is in place and “very weak” means that the U.S. is not meeting its security requirements and has no program in place to redress the shortfall, which has the potential to damage vital national interests if the situation is not corrected.

Current U.S. Nuclear Stockpile Score: Strong

U.S. warheads must be safe, secure, effective, and reliable. The Department of Energy (DOE) defines reliability as “the ability of the weapon to perform its intended function at the intended time under environments considered to be normal” and as “the probability of achieving the specified yield, at the target, across the Stockpile-to-Target Sequence of environments, throughout the weapon's lifetime, assuming proper inputs.” Since 1993, reliability has been determined through an intensive warhead surveillance program; non-nuclear experiments (that is, without the use of experiments producing nuclear yield); sophisticated calculations using high-performance computing; and related evaluations.

Nuclear warhead and delivery system reliability becomes more important as the number and diversity of nuclear weapons in the stockpile decreases, because fewer types of nuclear weapons leave a smaller margin of error should one type of a weapon be affected by a technical problem that requires either the repair or the decommissioning of a weapon type or its delivery system. Americans and allies must be confident that U.S. nuclear warheads will perform as expected.

As warheads age, they become less able to perform their mission as expected, and this can
complicate military planning significantly. Despite creating impressive amounts of knowledge about nuclear weapons physics and materials chemistry, the U.S. may not be completely certain about the long-term effects of aging components that comprise a nuclear weapon. Former NNSA spokesman Bryan Wilkes said, “We know that plutonium pits have a limited lifetime.”

A plutonium pit is a crucial component of a nuclear weapon, and with life-extension programs introducing new components to warheads whose radiological effects are not fully known, the level of uncertainty has increased.

The United States has the world’s safest and most secure stockpile, but security of long-term storage sites including overseas sites, potential problems introduced by improper handling, or unanticipated effects stemming from long-term handling could compromise the integrity of U.S. warheads. The nuclear warheads themselves contain security measures that are designed to make it difficult, if not impossible, to detonate a weapon absent a proper authorization.

**Grade:** The Department of Energy and Department of Defense are required to assess the reliability of the nuclear stockpile annually. This assessment does not include delivery systems, although the U.S. Strategic Command does assess overall weapons system reliability, which includes both the warhead and delivery platforms.

Absent nuclear weapons testing, the assessment of weapons reliability becomes more subjective, albeit based on experience and non-nuclear tests rather than fact. While certainly an educated opinion, it is not a substitute for the type of objective data obtained through nuclear testing. Testing was used to diagnose potential problems and to certify the effectiveness of fixes to those problems. Given that modern simulation is based on nuclear tests that were conducted primarily in the 1950s and 1960s, using testing equipment of that era, there is a great deal that modern testing equipment and computer capability could teach about nuclear physics.

According to the late Major General Robert Smolen, some of the nuclear weapon problems the U.S. now faces “in the past would have [been] resolved with nuclear tests.” By 2005, a consensus emerged in the NNSA, informed by the nuclear weapons labs, that it would “be increasingly difficult and risky to attempt to replicate exactly existing warheads without nuclear testing and that creating a reliable replacement warhead should be explored.”

When the U.S. did conduct nuclear tests, it was frequently found that small changes in a weapon’s tested configuration had a dramatic impact on weapons performance. In fact, the 1958–1961 testing moratorium resulted in weapons with serious problems being introduced into the U.S. stockpile.

In fiscal year (FY) 2015, the NNSA assessed that it met its goal of maintaining a safe, secure, and effective stockpile.

The lack of nuclear weapons testing creates some uncertainty concerning the adequacy of fixes to the stockpile when problems are found. This includes updates made in order to correct problems that were found in the weapons or changes in the weapons resulting from life-extension programs. It is simply impossible to duplicate exactly weapons that were designed and built many decades ago. According to former Defense Threat Reduction Agency Director Dr. Stephen Younger, we have had “a number of problems that were never anticipated” and had to fix them by using “similar but not quite identical parts.”

The high costs of having to certify weapons without nuclear testing are resulting in fewer types of weapons and, as a consequence, a greater impact across the inventory if there is an error in the certification process.
Secretary of Defense Robert Gates warned in October 2008 that, “[t]o be blunt, there is absolutely no way we can maintain a credible deterrent and reduce the number of weapons in our stockpile without either resorting to testing our stockpile or pursuing a modernization program.” The U.S. is pursuing warhead life-extension programs that replace aging components before they can cause reliability problems. However, the national commitment to this modernization program, including the necessary funding over the long term, continues to be uncertain.

In light of our overall assessment, we grade the U.S. stockpile as “strong.”

Reliability of U.S. Delivery Platforms Score: Strong

Reliability encompasses not only the warhead, but the strategic delivery vehicles as well. This includes a successful missile launch, the separation of missile boost stages, the performance of the missile guidance system, the separation of the multiple re-entry vehicle warheads from the missile post-boost vehicle, and the accuracy of the final re-entry vehicle in reaching its target.

The U.S. conducts ICBM and submarine launched ballistic missile (SLBM) flight tests every year to ensure the reliability of its systems. Anything from electrical wiring to faulty booster separations could degrade the efficiency and safety of the U.S. strategic deterrent if it were to malfunction. U.S. strategic, long-range bombers regularly conduct intercontinental training and receive upgrades in order to sustain a high level of combat readiness. However, potential challenges are on the horizon.

Grade: U.S. ICBMs and SLBMs are flight tested annually, and these tests were successful in 2015. To the extent that data from these tests are publicly available, they provide objective evidence of the delivery systems’ reliability and send a message to U.S. adversaries that the system works. The aged systems, however, occasionally have reliability problems. Overall, this factor earns a grade of “strong.”

Nuclear Warhead Modernization Score: Weak

During the Cold War, the United States maintained a strong focus on designing and developing new nuclear warhead designs in order to counter Soviet advances and modernization efforts and to leverage advances in understanding the physics, chemistry, and design of nuclear weapons. Today, the United States is focused on sustaining the existing stockpile, not on developing new warheads, even though all of its nuclear-armed adversaries are developing new nuclear warheads and capabilities and accruing new knowledge in which the U.S. used to lead. Since the collapse of the Soviet Union, nuclear weapons and delivery vehicles have not been replaced despite being well beyond their designed service life. This may increase the risk of failure due to aging components and signal to adversaries that the United States is less committed to nuclear deterrence.

New weapon designs could allow American engineers and scientists to improve previous designs and address more effective means to address existing military requirements (for example, the need to destroy deeply buried and hardened targets) that have emerged in recent years. With new warheads, the safety and security of American weapons could also be enhanced in ways that may not be possible today without nuclear testing.

An ability to work on new weapon designs would also help American experts to remain engaged and knowledgeable, would help to attract the best talent to the nuclear enterprise, and could help the nation to gain additional insights into foreign nations’ nuclear weapon programs. As the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile noted, “Only through work on advanced designs will it be possible to train the next generation of weapon designers and producers. Such efforts are also needed to exercise the DoD/NNSA weapon development interface.” Other nations maintain their levels of proficiency by having their scientists work on new nuclear warheads and
possibly conducting very low-yield nuclear weapons tests.

**Grade:** The lack of plans to modernize nuclear weapons—life-extension programs are not modernization—and the restrictions on thinking about new designs that might be able to accomplish the deterrence mission in the 21st century more effectively earn nuclear warhead modernization a grade of “weak.”

**Nuclear Delivery Systems**

**Modernization Score:** Marginal

Today the United States fields a triad of nuclear forces with delivery systems that are safe and reliable. That said, as these systems age, there is increased risk of significant negative impact on operational capabilities. The older weapons are, the more at risk they are from faulty components or malfunctioning equipment. Age can degrade reliability by increasing the potential for systems to break down or fail to respond correctly. Corrupted systems, defective electronics, or performance degradation due to long-term storage defects (in the case of nuclear warheads as well) can have serious implications for American deterrence and assurance. If a strategic delivery vehicle cannot be counted on to operate at all times, its deterrence and assurance value is significantly reduced.

While the U.S. Air Force and U.S. Navy have plans to modernize or replace each leg of the nuclear triad in the next several decades, fiscal constraints are likely to make such efforts difficult. The Navy is fully funding its programs to replace the *Ohio*-class submarine and to life extend and eventually replace the Trident SLBM, but existing ICBMs and SLBMs are expected to remain in service until 2032 and 2042, respectively, and new bombers are not planned to enter into service until 2023 at the earliest. Budgetary shortfalls are leading to uncertainty as to whether the nation will be able to modernize all three legs of the nuclear triad. Yet a triad is a “requirement” according to the U.S. Strategic Command. This requirement, which has been validated by all U.S. Nuclear Posture Reviews since the end of the Cold War, provides U.S. leadership with credibility and flexibility, attributes that are necessary for any future deterrence scenarios.

Maintenance issues caused by the aging of American SSBNs and long-range bombers could make it difficult to deploy units overseas for long periods of time or remain stealthy in enemy hotspots. The United States can already send only a limited number of bombers on missions at any one time. As Bradley Thayer and Thomas Skypek have noted, “Using 2009 as a baseline, the ages of the current systems of the nuclear triad are 39 years for the *Minuteman III*, 19 years for the *Trident II D-5 SLBM*, 48 years for the B-52H, 12 years for the B-2, and 28 years for the *Ohio Class SSBNs.*” Remanufacturing some weapon parts is difficult and expensive because some of the manufacturers are no longer in business or the materials that constituted the original weapons are no longer available (for example, due to environmental restrictions). The ability of the U.S. to produce solid-fuel rocket engines and possible U.S. dependence on Russia as a source for such engines are other long-range concerns.

**Grade:** U.S. nuclear platforms are in dire need of recapitalization. The U.S. has put into place plans for nuclear triad modernization, and despite some delays, funding for these programs has been sustained by Congress notwithstanding difficulties caused by sequestration. At the same time, there is uncertainty regarding when the new platforms will enter into force and be nuclear-certified and uncertainty regarding U.S. future stockpile strategy. These considerations earn this indicator a grade of “marginal.”

**Nuclear Weapons Complex Score:** Weak

A large part of maintaining a reliable and effective nuclear stockpile depends on the facilities where U.S. devices and components are developed, tested, and produced. These facilities constitute the foundation of our strategic arsenal and include the:
• Los Alamos National Laboratories,
• Lawrence Livermore National Laboratory,
• Sandia National Laboratory,
• Nevada National Security Site,
• Pantex Plant,
• Kansas City Plant,
• Savannah River Site, and
• Y-12 National Security Complex.

In addition to these government sites, the defense industrial base supports the development and maintenance of American delivery platforms.

These complexes design, develop, test, and produce the weapons in the U.S. nuclear arsenal. Their maintenance is of critical importance. As the 2010 Nuclear Posture Review (NPR) stated:

In order to remain safe, secure, and effective, the U.S. nuclear stockpile must be supported by a modern physical infrastructure—comprised of the national security laboratories and a complex of supporting facilities—and a highly capable workforce with the specialized skills needed to sustain the nuclear deterrent.35

A flexible and resilient infrastructure is an essential hedge in the event that components fail or the U.S. is surprised by the nuclear weapon capabilities of potential adversaries.36 U.S. research and development efforts and the industrial base that supports modernization of delivery systems are an important part of this indicator.

Maintaining a safe, secure, effective, and reliable nuclear stockpile requires modern facilities, technical expertise, and tools both to repair any malfunctions quickly, safely, and securely and to produce new nuclear weapons if required. The existing nuclear weapons complex is not fully functional. The U.S. cannot produce more than a few new warheads per year. There are limits on the ability to conduct life-extension programs. Dr. John Foster has reported that the U.S. no longer can “serially produce many crucial components of our nuclear weapons.”37

If the facilities are not properly funded, the U.S. will gradually lose the ability to conduct high-quality experiments. Obsolete facilities and poor working environments make maintaining a safe, secure, reliable, and militarily effective nuclear stockpile exceedingly difficult, in addition to demoralizing the workforce and hampering further recruitment. The NNSA's facilities are old: More than 50 percent are more than 40 years old, nearly 30 percent date to the Manhattan Project of the 1940s, and 12 percent are considered excess or no longer needed.38 As a consequence, the NNSA had about $3.7 billion in deferred maintenance at the end of FY 2015.

Since 1993, the DOE has not had a facility dedicated to production of plutonium pits, one of the main components of America’s nuclear warheads. The U.S. currently keeps about 5,000 plutonium pits in strategic reserve. There are significant disagreements as to the effect of aging on pits and whether the U.S. will be able to maintain them indefinitely without nuclear weapons testing. Currently, the U.S. can produce no more than about 10 plutonium pits a year at the Los Alamos PF-4 facility. Infrastructure modernization plans for PF-4, if funded, will boost that number to about 20 by the middle of the next decade and to between 50 and 80 by the end of the next decade. Russia can produce around 2,000 pits a year.39

Manufacturing non-nuclear components can be extremely challenging either because some materials may no longer exist or because manufacturing processes have been forgotten and must be retrieved. There is a certain element of art to the process of building a nuclear weapon, and such a skill can be acquired and maintained only through actual hands-on experience.
Grade: On one hand, the U.S. maintains some of the world’s most advanced nuclear facilities. On the other, some parts of the complex—most importantly, parts of the plutonium and highly enriched uranium component manufacturing infrastructure—have not been modernized since the 1950s, and plans for long-term infrastructure recapitalization remain uncertain. The infrastructure therefore receives a grade of “weak.”

Quality of People Working in the National Nuclear Laboratories Score: Marginal

Combined with nuclear facilities, U.S. nuclear weapons scientists and engineers are critical to the health of the complex and the stockpile. The 2010 NPR emphasizes that:

[A] highly skilled workforce [is] needed to ensure the long-term safety, security, and effectiveness of our nuclear arsenal and to support the full range of nuclear security work to include non-proliferation, nuclear forensics, nuclear, counter-terrorism, emergency management, intelligence analysis and treaty verification.40

The ability to maintain and attract a high-quality workforce is critical to assuring the future of the American nuclear deterrent. Today’s weapons designers and engineers are first-rate, but they also are aging and retiring, and their knowledge must be passed on to the next generation that will take on this mission. To do that, young designers need challenging warhead design and development programs to hone their skills. No such challenging programs are in place today. The NNSA and its weapons labs understand this problem and are taking steps, with the support of Congress and despite significant challenges, to mentor the next generation.

The U.S. currently relies on non-yield-producing laboratory experiments, flight tests, and the judgment of experienced nuclear scientists and engineers to ensure continued confidence in the safety, security, effectiveness, and reliability of its nuclear deterrent. Without their experience, the nuclear weapons complex could not function. A basic problem is that few scientists or engineers at the NNSA weapons labs have had the experience of taking a warhead from initial concept to a “clean sheet” design, engineering development, and production. The complex must attract and retain the best and brightest. Between 2014 and 2016, the NNSA lost 106 people out of a total of 2,340 employed as of April 2016.41 The average age of the workforce increased to 48.1 years.42

Grade: In addition to employing world-class experts, the NNSA labs have had recent success in attracting and retaining talent. The NNSA, however, has had less success in providing these people with challenging warhead design and development programs. Because many scientists and engineers with practical nuclear weapon design and testing experience are retired, nuclear warhead certifications will therefore rely on the judgments of people who have never tested or designed a nuclear weapon. Management challenges and a lack of focus on the nuclear weapon mission contribute to the lowering of morale in the NNSA complex. In light of these issues, which have to do more with policy than with the quality of people, the complex earns a score of “marginal.”

Readiness of Forces Score: Marginal

The readiness of forces is a vital component of America’s strategic forces. The military personnel operating the three legs of the nuclear triad must be properly trained and equipped. It is also essential that these systems be maintained in a high state of readiness.

During FY 2016, the services continue to align resources in order to preserve strategic capabilities in the short term, but long-term impacts remain uncertain. Continued decline in U.S. general purpose forces could eventually affect nuclear forces, especially the bomber leg of the nuclear triad. Changes prompted by the 2014 Navy and Air Force cheating scandals have begun to address some of the morale issues. A sustained attention to the situation in the nuclear enterprise is critical.
Grade: Uncertainty regarding the further potential impacts of budgetary shortfalls, as part of the overall assessment, earns this indicator a grade of “marginal.”

Allied Assurance Score: Marginal

The number of weapons that U.S. allies keep is an important element when speaking about the credibility of America’s extended deterrence. Allies that already have nuclear weapons can coordinate action with other powers or act independently. During the Cold War, the U.S. and the U.K. cooperated to the point where joint targeting was included.43 France maintains its own independent nuclear arsenal, partly as a hedge against the uncertainty of American credibility. The U.S. also deploys nuclear gravity bombs in Europe as a visible manifestation of its commitment to its NATO allies.

The U.S., however, must concern itself not just with NATO, but with Asian allies as well. The United States provides nuclear assurances to Japan and South Korea, both of which are technologically advanced industrial economies facing nuclear-armed adversaries and potential adversaries. If they do not perceive U.S. assurances as credible, they have the capability and know-how to build their own nuclear weapons and to do so quickly. That would be a major setback for U.S. nonproliferation policies.

Grade: At this time, most U.S. allies are not seriously considering developing their own nuclear weapons. European members of NATO continue to express their commitment to and appreciation for NATO as a nuclear alliance. Doubts about the modernization of dual-capable aircraft and even about the weapons themselves, as well as NATO’s lack of attention to the nuclear mission and its intellectual underpinning, preclude assigning a score of “very strong.” Additionally, the perception among some that America has accepted Iran’s nuclear program may encourage other countries in the Middle East region to seek similar capabilities. Thus, allied assurance remains “marginal.”

Nuclear Test Readiness Score: Weak

Testing is one of the key elements of maintaining a safe, secure, effective, and reliable nuclear deterrent. While the U.S. is currently under a self-imposed nuclear testing moratorium, it maintains a low level of nuclear test readiness at the Nevada National Security Site (formerly Nevada Test Site). The approach is questionable with regard to its efficacy in assuring that the U.S. has the timely ability to conduct yield-producing experiments should it discover a flaw in one or more types of its nuclear weapons that requires experimentation to correct. The U.S. might need to test to develop a weapon with new characteristics that can be validated only by testing and to verify render-safe procedures. Yield-producing experiments can also play an important role if the U.S. needs to react strongly to other nations’ nuclear weapons tests and communicate its resolve or to understand other countries’ new nuclear weapons.

Current law requires that the U.S. be prepared to conduct a nuclear weapons test within a maximum of 36 months after a presidential decision to do so. The current state of test readiness is between 24 and 36 months, although both the NNSA and Congress required the NNSA to be ready within 18 months in the past.44 The U.S. could meet the 18-month requirement only if certain domestic regulations, agreements, and laws were to be waived.45

“Test readiness” refers to a single test or a very short series of tests, not a sustained nuclear testing program. Because of a shortage of resources, the NNSA has been unable to achieve this goal. The test readiness program is supported by experimental programs at the Nevada National Security Site, nuclear laboratory experiments, and advanced diagnostics development.46

Grade: As noted, the U.S. can meet the readiness requirement mandated by the law only if certain domestic regulations, agreements, and laws are waived. In addition, the U.S. is not prepared to sustain testing activities beyond a few limited experiments, which
certain scenarios might require. Thus, testing readiness earns a grade of “weak.”

**Overall U.S. Nuclear Weapons Capability Score: Marginal**

Though modernization programs for warheads and delivery systems are quite uncertain, the infrastructure supporting nuclear programs is aged, and nuclear test readiness has revealed troubling problems within the forces, those weak spots are offset by strong delivery platform reliability and allies who remain confident in the U.S. nuclear umbrella. Averaging the subscores across the nuclear enterprise therefore results in an overall score of “marginal.”

### U.S. Military Power: Nuclear

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Endnotes:


2. Ibid.


9. Ibid.


19. Ibid.


42. Ibid.


