U.S. Military Power

An Assessment of U.S. Military Power

America is a global power with global interests, and its military is tasked with defending the country from attack and protecting its national interests on a correspondingly global scale. The United States therefore does not have the luxury of focusing only on one geographic area or narrow challenge to its interests. Its economy depends on global trade; it has obligations with many allies; and it must account for several major competitors that routinely, consistently, and aggressively challenge its interests and seek to displace its influence in key regions. It follows that its military should be commensurately sized for the task and possess the necessary tools, skills, and readiness for action. Beyond that, the U.S. military must be capable of protecting the freedom to use the global commons—the sea, air, space, and cyberspace domains on which American prosperity and political influence depend.

As noted in all preceding editions of the *Index of U.S. Military Strength*, however, the U.S. does not have the necessary force to address more than one major regional contingency (MRC) and is not ready to carry out its duties effectively. In fact, its condition has worsened over the past two to three years.

- The U.S. finds itself increasingly challenged both by major competitors such as China and Russia and by the destabilizing effects of terrorist and insurgent elements operating in regions that are of substantial interest to the U.S.

- Russia's large-scale, conventional invasion of Ukraine in February 2022 and the war that has ravaged Ukraine since then are proof that war in regions of interest to the U.S. remains a feature of modern times—something that is not lost on China as it expands its military power and threatens Japan and other U.S. allies and partners in the Indo-Pacific region more aggressively.

- Poland, Germany, Lithuania, Japan, and several other countries have taken note of this and are committed to substantially improving the capacity, capability, and readiness of their military forces, although progress has been spotty. The United States, however, has not made a similar commitment and has seen further decline as inflation has eroded the funding that is provided to the military.

How to Think About Sizing Military Power

Military power consists of many things and is the result of how all of its constituent pieces are brought together to create an effective warfighting force, but it begins with the people and equipment used to conduct war: the weapons, tanks, ships, airplanes, and supporting tools that make it possible for a force to impose its will on another or to prevent such an outcome from happening, which is the point of deterrence.

However, simply counting the number of people, tanks, or combat aircraft that the U.S. possesses would be insufficient 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 might be needed or none at all. It might be that relevant terrain 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 not well 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 battle. Get these wrong—tools, objective, competence, 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. Because 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 that requires informed but not certain judgment.

The war in Ukraine is a powerful illustration of this. By the numbers, Russia should have achieved a quick victory over the smaller, less modern Ukrainian military. For various reasons that include leadership, tactics, training, and resupply, the Ukrainians have performed much better than the Russians, who have performed poorly overall. And yet, in spite of its demonstrated incompetence, Russia's much larger military has been able to sustain operations through its willingness to commit its vast reserves of munitions, equipment, and people to battle. Tactical and operational brilliance has its place, but so does sheer mass.

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. A thinking adversary will analyze his opponent for weaknesses or patterns of behavior and seek to develop techniques, approaches, and tools that exploit such shortfalls or predictable patterns—the asymmetries of war. One need not try to match an enemy tank for tank: In many cases, not trying is more effective.

This appears to be what China is doing. Having analyzed U.S. forces, the performance characteristics of U.S. platforms and weapons, and the geography and basing options affecting U.S. defense posture in the Indo-Pacific, China has invested heavily in shore-based long-range missiles, an extensive fleet of ships optimized for the local maritime environment, and a deepening inventory of guided munitions. China does not need a force that mirrors that of the U.S.: It is building a force that leverages the asymmetries between China's situation and that of the United States.

All of these factors and a multitude of others affect 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 advising the President in his role as Commander in Chief of U.S. military forces.

Measuring hard combat power in terms of its capability, capacity, and readiness to defend U.S. vital interests is difficult, especially in such a limited space as this *Index*, but not impossible. However difficult the task, the Secretary of Defense and the military services have to make such 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 apply. Although that 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 exactly what is needed in terms of 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 that will be necessary to support that power. After defining the national interests to be protected, the Department of Defense (DOD) 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 very different conclusions about the necessary level of military strength.

For example, one Administration might view China as a rising belligerent power bent on dominating the Asia–Pacific region. Another Administration might view China as an inherently peaceful rising economic power and the expansion of its military capabilities as naturally commensurate with its strengthening status. There can be dramatically different perspectives with respect to how China might use its military power and what would constitute an effective U.S. response, and the difference

between these perspectives can dramatically affect how one thinks about U.S. defense requirements. So, too, can policymakers amplify or downplay risk to justify defense budget decisions.

There also can 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 and 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 in addition to or a subset of a military force that is sized to handle big wars?

- How much value should be assigned to advanced technologies as they are incorporated into the force, especially if they have not been proven in combat settings?

- What is the likelihood of conventional war, and (if one thinks it is minimal) what level of risk is one willing to accept that sufficient warning will allow for rearming?

Where to Start

There are two major 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 that are 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 example that is frequently cited by analysts. 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."[1]

The BUR formally established the requirement that U.S. forces should be able "to achieve decisive victory in two nearly simultaneous major regional conflicts and to conduct combat operations characterized by rapid response and a high probability of success, while minimizing the risk of significant American casualties."[2] Thus was formalized the two-MRC standard.

Since that study, the government has undertaken others as Administrations, national conditions, and world events have changed the context of national security. Quadrennial Defense Reviews (QDRs) were conducted in 1997, 2010, and 2014 and were accompanied by independent National Defense Panel (NDP) reports that reviewed and commented on them. Both sets of documents purported to serve as key assessments, but analysts came 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.

The QDR was replaced by the National Defense Strategy (NDS), released in 2018,[3] and the independent perspectives of the formal DOD review by the National Defense Strategy Commission, which released its view of the NDS in November 2018.[4] Departing from their predecessors, neither document proposed specific force structures or end strength goals for the services, but both were very clear in arguing that America's military should be able to address more than one major security challenge at a time. The commission's report even criticized the NDS for not making a stronger case for a larger military that would be capable of meeting the challenges posed by four named competitors—China, Russia, Iran, and North Korea—while also possessing the capacity to address lesser, though still important, military tasks that included presence, crisis response, and assistance missions.

The Biden Administration released a National Defense Strategy in 2022[5] (replacing the Trump Administration's 2018 NDS) in conjunction with its overarching National Security Strategy (NSS).[6] The 2022 NDS echoes the general goal for the U.S. military to "deter and prevent adversaries from

directly threatening the United States and our allies, inhibiting access to the global commons, or dominating key regions,"[7] all of which are themes that have remained remarkably consistent from one Administration to the next for several decades. Taken at face value and considering the challenges posed simultaneously by a multitude of competitors in several regions, the Biden NSS and NDS imply that the military should have the capability and capacity to meet this objective, but they are less explicit than predecessor documents.

The current NSS and NDS prioritize the threat posed by China but, while naming other threats that include Russia, Iran, North Korea, and violent extremist organizations, purport to deal with them by improved forward posture of U.S. forces, improving national resilience to attack, and bettering the ability of the U.S. to collaborate with regional allies. Whether one agrees with the efficacy of this approach or not, there is consistency even in the current leading documents in acknowledging that the U.S. must contend with numerous threats to its interests in many different regions.[8]

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 since the late 1980s have made comparing combat power more difficult. What was largely a platform-versus-platform model has shifted to a munitions-versus-target model. Evidence of this has been seen on recent battlefields in Nagorno–Karabakh and Ukraine.

The proliferation of precise weaponry means increasingly that each round, bomb, rocket, missile, and even (in some instances) individual bullet can hit its intended target, thus decreasing the number of munitions needed to prosecute an operation. It also means that an operating environment's lethality increases significantly for the people and platforms involved. We have reached the point at which, instead of focusing primarily on how many ships or airplanes the enemy can bring to bear against one's own force, 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.[9] The increasing presence of unmanned systems that can deliver precision-guided munitions against targets adds complexity and danger to the modern battlefield. There is also the higher cost of fielding precision weapons rather than less expensive but also less accurate conventional (unguided) munitions.

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 than ever before with fewer assets.

- Signature reduction (stealth) makes it harder for the enemy to find and target platforms, and the increased precision of weapons makes it possible for fewer platforms, when carrying such weapons, to hit many more targets.

- The U.S. military's ability to harness computers, modern telecommunications, space-based platforms—such as for surveillance, communications, and positioning-navigation-timing (PNT) support from GPS satellites—and networked operations potentially means that in certain situations, smaller forces can have far greater effect in battle than was possible at any other time in history (although these same advances also enable enemy forces).

- Some 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. For example, the number of infantry squads needed to secure an urban area where line of sight is constrained and precision weapons have limited utility is the same as the number needed in World War II. Again, current operations in Ukraine are illustrative as Russian forces have found that seizing, occupying, and holding ground is a manpower-intensive effort.

Regardless of the improved capability of smaller forces, there is a downside to fewer numbers. With smaller forces, each element of the force represents a greater percentage of its combat power. Each casualty or equipment loss therefore 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 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.[10] Consequently, it may well be that the outcomes of future wars will depend far more 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 become more important than absolute advances in capability.

All of this illustrates both the need to exercise judgment in assessing the adequacy of America's military power and the difficulties involved in exercising that judgment. Yet without such an assessment, all that remains are the defense strategy 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* assesses the adequacy of America's defense posture as it pertains to a conventional understanding of hard power, defined as the ability of U.S. military forces to engage and defeat an enemy's forces in battle at a scale commensurate with America's vital national interests. While some hard truths in military affairs are appropriately addressed by mathematics 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 competence 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 our 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. The authors of these military sections bring a combined total of more than a hundred years of uniformed military experience to their analysis.

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, but practitioners of war 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 that is 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 used is very much an art-of-war matter that is learned through experience over time.

What Is Not Being Assessed

In assessing the current status of America's military forces, this *Index* uses the primary measures 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).
- The Marine Corps structures itself by battalions.
- For the Navy, it is the number of ships in its combat fleet.
- The most consistent measure for the Air Force is the total number of aircraft, sometimes broken down into the two primary subtypes of fighters and bombers.

Obviously, this is not the totality of service capabilities, and it certainly is not everything needed for war. Even the services would argue that "what they bring to the fight" is more than these simple metrics. But discussions about the complexity, nuance, and permutations of military power that

take place among career professionals are endless and can be incomprehensible to most people who have not spent years closely studying such issues. Nevertheless, measures must be found by which to discuss military power in common terms, and these measures can be viewed as surrogates that subsume or represent the vast number of other things that make these units of measure possible and effective in battle. For example:

- Combat forces depend on a vast logistics system that supplies everything from food and water to fuel, ammunition, and repair parts.
- Military operations require engineer support, and the force needs medical, dental, and administrative capabilities.
- The military also fields units that transport combat power and its sustainment to wherever they may be needed around the world.

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 tip. Thus, in assessing the basic units of measure for combat power, one can get a sense of what is probably 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. It also does not assess the services' Reserve and National Guard components, although they account for roughly one-third of the U.S. military force and have been essential to the conduct of operations since September 2001.[11] Consistent assessment of their capability, readiness, and operational role is challenging because each service determines the balance among its Active, Reserve, and National Guard elements differently: Only the Army and Air Force have Guard elements; the Navy and Marine Corps do not. This balance can change from year to year and is based on factors that include the respective elements' costs, availability for operational employment, and time needed to respond to an emergent crisis as well as the allocation of roles among the elements and political considerations.[12]

As with other elements that are essential to the effective employment of combat power—logistics, medical support, strategic lift, training, etc.—the U.S. military could not handle a major conflict without the Reserve and Guard forces. Nevertheless, to make the challenge of annually assessing the status of U.S. military strength using consistent metrics over time more manageable, this *Index* looks at something that is usually associated with the Active component of each service: the baseline requirement for a given amount of combat power that is readily available for use in a major combat operation. There are exceptions, however. For example, in the *2020 Index*, four Army National Guard BCTs were counted as "available" for use because of the significant amounts of additional resources that had been dedicated specifically to these formations to raise their readiness levels.[13]

The Defense Budget and Strategic Guidance

How much we spend on defense does not automatically determine the U.S. military's posture or capacity. As a matter of fact, simply looking at how much is allocated to defense does not tell us much about the capacity, modernity, or readiness of the forces. Proper funding is a necessary condition for a capable, modern, and ready force, but it is not sufficient by itself. A larger defense budget, for example, can be associated with less military capability if the money is allocated inappropriately or spent wastefully. Nevertheless, the budget does reflect the importance assigned to defending the nation and its interests in prioritizing federal spending, and there is a rough correlation between the percentage of the federal budget or national gross domestic product that is spent on defense and the military's status because costs for equipment, personnel, and readiness tend to reflect general costs across the economy and the evolution of new technologies and materials that are harnessed for military affairs.

Absent a significant threat to the country's survival, the U.S. government will always balance spending on defense against spending in all of the other areas of government activity that are deemed necessary or desirable. 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, what would be needed to defeat those

threats, and the costs associated with that capability; and then determining what the country can afford or is willing to spend. *Any difference between assessed requirements and the amount of money actually spent on defense would constitute a risk to U.S. security interests.*

This *Index* enthusiastically adopts this 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 composition of the force and the understanding of military risk have become more salient issues with the shift toward competition with China and Russia. Certainly, Russia's war against Ukraine has revealed the reality of war in its appetite for resources and the relative effectiveness of military units possessing various types of equipment, munitions inventories, and histories of training.

Assessments of potential conflict between the U.S. and Russia or China tend toward theory in peacetime and can underestimate what would be needed to prevail in war. War in its reality can be not just illuminating, but shocking when compared to peacetime estimates. The 2017 National Security Strategy,[14] 2021 Interim National Security Strategic Guidance,[15] 2022 National Security Strategy,[16] and 2022 National Defense Strategy[17] all have recognized that meeting the challenges posed by these two large, well-equipped, and well-resourced countries requires a U.S. force that is modern, ready, and effective in all domains of warfare.

Fiscal year (FY) 2023 continued the Biden Administration's trend of increasing non-defense spending at a higher rate than defense spending. The Administration initially requested $773 billion for the DOD base discretionary budget, which was a 4.1 percent increase over the previous fiscal year's budget.[18] Continuing a trend from the previous year, this relative frugality stood in contrast to the substantially larger increases requested for other federal agencies with requests for non-defense funding rising 10 percent across the board.[19]

Congressional leaders saw the Administration's proposal as inadequate, and both chambers acted through the appropriations and authorization bills to increase the defense budget by $45 billion over the requested amount in order to counter the effects of inflation and accelerate implementation of the National Defense Strategy.[20] This increase represented both a rejection of platform retirements proposed by the Biden Administration and Congress's assessment of what is needed to tackle the challenges and threats faced by our armed forces. For example, the munitions industrial base was strengthened by congressional additions both through additional funding and through the authority to enter into multi-year contracts.

The FY 2023 DOD base discretionary budget was $816.7 billion.[21] This represents the resources allocated to pay for America's military forces (manpower, equipment, and training); their enabling capabilities (things like transportation, satellites, defense intelligence, and research and development); and their institutional support (bases and stations, facilities, recruiting, and the like).

With the congressional increase, the FY 2023 defense budget was 8 percent higher in nominal terms than the FY 2022 budget.[22] Unfortunately, as in FY 2022, the nation continued to experience levels of inflation in FY 2023 that it had not experienced for 40 years: Despite falling from the massive 7 percent to 9 percent rates experienced in FY 2022, inflation in the middle of FY 2023 still stood at around 4 percent.[23] By increasing fuel, food, raw materials, and labor costs, inflation affects the defense budget as much as it does any household budget. Therefore, the price of merely maintaining our current force structure has risen considerably in the past year and is likely to rise further in the coming years as inflation continues to raise costs.

Adding to these challenges, part of the federal government's response to the coronavirus pandemic was a substantial increase in government spending. Federal outlays jumped from $4.4 trillion in 2019 to $6.8 trillion in 2021, and the result was a $3.1 trillion budgetary deficit in FY 2020 and a $2.7 trillion deficit in FY 2021.[24] Federal deficit spending was roughly $1.4 trillion for FY 2022 and $1.2 trillion for FY 2023—lower than it was during the coronavirus pandemic but hundreds of billions more than it had been in pre-pandemic 2019. This extremely high level of budgetary deficit should shape how the country assesses the federal government's budgetary priorities, especially when added to a national debt that had reached $32 trillion during FY 2023.[25] The public debt, which has been

building for years, will continue to consume federal taxpayers' dollars and will have to be balanced against all other federal priorities.

The decision to fund national defense at a level that is commensurate with interests and prevailing threats reflects our national priorities and risk tolerance. 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.

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 relatively rare, although they have occurred every 15 years on average.[26] In between (and even during) such occurrences, the military is used to support regional engagement, crisis response, strategic deterrence, and humanitarian assistance as well as to support civil authorities and U.S. diplomacy.

All of the U.S. Unified Geographic Combatant Commands, or COCOMS[27]—Northern Command (NORTHCOM); European Command (EUCOM); Central Command (CENTCOM); Indo-Pacific Command (INDOPACOM); Southern Command (SOUTHCOM); and Africa Command (AFRICOM)—have annual and long-term plans for engaging with countries in their assigned regions. Engagements range from very small unit training events with the forces of a single partner country to larger bilateral and sometimes multilateral military exercises. Such events help to foster 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 their respective regions or that operate in them temporarily on a rotational basis. To make these regional rotations possible, the services must maintain base forces that are large enough to train, deploy, support, receive back, and again make ready a stream of units that ideally is 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 (three periods of time at home for every period deployed) is sustainable. If a unit is to be out for six months, for example, it will be home for 18 months before deploying again. Obviously, a service needs enough 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 and the amount of military power (typically measured in terms of combat units and major combat platforms, which inform total end strength) that is 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. A commander who wants one U.S. warship stationed off the coast of a hostile country, for example, 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 is otherwise unavailable because of major maintenance or modernization work.

This *Index* focuses on the forces required to win two major wars as the baseline force-sizing metric for the Army, Navy, and Air Force and the one-war-plus-crisis-response paradigm for the Marine Corps. The three large services are sized for global action in more than one theater at a time; the Marines, by virtue of overall size and most recently by direction of the Commandant, focus on one major conflict while ensuring that all Fleet Marine Forces are globally deployable for short-notice, smaller-scale actions.[28] 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 America's military 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) with the design, performance characteristics, technological advancement, and suitability that the force needs to perform its function against an enemy 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 in Iraq to depose Saddam Hussein 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 of power projection has been more moderate in places like Yugoslavia, Somalia, Bosnia and Serbia, 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.

The most recent evidence of this was seen in the hasty evacuation of civilians from Afghanistan in August 2021 once the Biden Administration ordered the end of U.S. operations in that country. Though subject to severe criticism both during and after its execution, almost all of which had to do with the politics surrounding the decision to withdraw and the context that framed the nature of the operation, the operation itself was an extraordinary feat of military effectiveness within tight time constraints and tremendous pressure. Approximately 124,000

TABLE 6

Historical U.S. Force Allocation

Troop figures are in thousands.

	Korean War	Vietnam War	Persian Gulf War	Operation Iraqi Freedom
ARMY				
Total Troop Deployment During Engagement	206.3	219.3	267.0	99.7
Divisions*	6	7	4	1
Reserve Component Divisions Total for Strategic Documents	n/a	n/a	n/a	n/a
Total Army End Strength During Engagement, During Year of Strategy Document Active	1,313.8	1,113.3	738.0	499.0
Total Active End Strength Recommendations	n/a	n/a	n/a	n/a
NAVY				
Total Fleet During Engagement	904	770	529	297
Aircraft Carriers	6	5	6	5
Carrier Air Wings	6	5	6	5
Large Surface Combatants	37	14	30	23
Small Surface Combatants	16	47	16	9
Attack Submarines	4	0	12	12
Amphibious Vessels	34	26	21	7
Combat Logistics and Support Ships	28	29	45	42
Fighter/Attack Squadrons	21	43	22	24
MARINE CORPS				
Total Troop Deployment During Engagement	33.5	44.7	90.0	66.2
Active Divisions*	1	2	2	1
Reserve Divisions	n/a	n/a	n/a	n/a
Marine Expeditionary Force	1	1	1	2
Air Wings Active/Reserve	1	1	1	1
Total Marine Corps End Strength During Engagement by Year of Strategy Document	187.0	289.0	196.3	178.0
Total Recommended End Strength	n/a	n/a	n/a	n/a
AIR FORCE				
Bombers or Bomber Squadrons**	21	23	3	4
Fighter Squadrons	26		30	30
Active Fighter Wings	7	8	10	10
Reserve Fighter Wings				
Airlift/Tankers	239	167	388	293

* 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.

	1993 BUR	1997 QDR	2001 QDR	2006 QDR	2010 QDR	2010 Indep. Panel	2-MRC Paper	2014 QDR	2014 NDP
ARMY									
Total Troop Deployment During Engagement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Divisions*	10	10	10	11	18	11	10	10	n/a
Reserve Component Divisions Total for Strategic Documents	n/a	5	8	8		7	8	8	n/a
Total Army End Strength During Engagement, During Year of Strategy Document Active	572.0	492.0	481.0	505.0	566.0	566.0	550.0	490.0	490.0
Total Active End Strength Recommendations	n/a	n/a	n/a	482.4	n/a	1,106.0	600.0	450.0	490.0
NAVY									
Total Fleet During Engagement	346	310	n/a	n/a	n/a	346	350	n/a	346
Aircraft Carriers	12	12	12	11	11	11	11	11	n/a
Carrier Air Wings	12	11	11	n/a	10	10	10	10	n/a
Large Surface Combatants	124	116	116	n/a	84–88	n/a	120	92	n/a
Small Surface Combatants				n/a	14–28	n/a	n/a	43	n/a
Attack Submarines	55	50	55	n/a	53–55	55	50	51	n/a
Amphibious Vessels	41	36	36	n/a	29–31	n/a	38	33	n/a
Combat Logistics and Support Ships	65	n/a	n/a	n/a	58	n/a	75	n/a	n/a
Fighter/Attack Squadrons	33	30	30	n/a	30	30	30	30	n/a
MARINE CORPS									
Total Troop Deployment During Engagement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Active Divisions*	4	3	3	n/a	3	n/a	n/a	3	n/a
Reserve Divisions	1	1	1	n/a	1	n/a	n/a	1	n/a
Marine Expeditionary Force	3	3	3	n/a	3	3	3	2	n/a
Air Wings Active/Reserve	n/a	4	4	n/a	4	n/a	n/a	4	n/a
Total Marine Corps End Strength During Engagement by Year of Strategy Document	174.0	174.0	173.0	180.0	202.0	202.0	196.0	182.0	182.0
Total Recommended End Strength	n/a	n/a	n/a	175.0	n/a	243.0	202.0	182.0	182.0
AIR FORCE									
Bombers or Bomber Squadrons**	200	187	112	n/a	96	180	200	96***	n/a
Fighter Squadrons	54	54	46	n/a	42	66	54	48	n/a
Active Fighter Wings	13	12+	15	n/a	n/a	20	20	9	n/a
Reserve Fighter Wings	7	8	12	n/a	n/a	n/a		7	n/a
Airlift/Tankers	n/a	n/a	n/a	n/a	1023	1023	1,000	954	n/a

civilians were evacuated via the Hamid Karzai International Airport, situated on the outskirts of Kabul, during the latter two weeks of August. The effort involved 6,000 troops on the ground and approximately 800 aircraft from 30 countries (250 of which were U.S. Air Force transports), all coordinated and controlled by U.S. military personnel.[29] No other country could have executed such a mission under such conditions.

A modern "major combat operation"[30] 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 undersea); 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.

Since 2018, given its focus on counterinsurgency, stability, and advise-and-assist operations since 2004 and the 2018 NDS directive to prepare for conflict in an era of great-power competition, the military community has focused on its suitability and readiness for major conventional warfare.[31] In general terms, this focus has been sustained through the release of the 2022 NDS, perhaps spurred by the observed realities of the Russia–Ukraine war and China's rapid expansion of its military capabilities and activities.

- 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.

- The Marine Corps has undertaken a dramatic restructuring to posture itself more effectively for high-end warfare against a major opponent, focusing specifically on China and the littorals of the Indo-Pacific but also appreciating that its new capabilities will be broadly applicable elsewhere.

- Both the Navy and the Air Force have acknowledged the evolved threat environment that will demand more of them in the coming decade than they have had to deal with during the past 20 years.

This *Index* ascertains the relevance and health of military service capabilities by looking at such factors as the average age of equipment, the generation of equipment relative to the current state of competitor efforts as reported by the services, and the status of replacement programs that are 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 addressed by senior service officials when providing testimony to Congress or examining 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. When speaking of platforms such as planes and ships, a troubling and fairly consistent trend within U.S. military acquisition characterizes the path from requirement to fielded capability. Along the way to acquiring the capability, several linked things happen that result in far less of a presumed "critical capability" than was supposedly required.

- The military articulates a requirement that the manufacturing sector attempts to satisfy.

- "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 altogether, and the military finally fields fewer platforms

at a higher cost per unit 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 it currently fields only 22 in order to make resources available for experimentation and modernization and to sustain its contributions to U.S. Special Operations Command (investing a regiment in Marine Forces Special Operations Command).[32]

- In 2012, the Army was building toward 48 brigade combat teams, but incremental budget cuts reduced that number over time to 31—less than two-thirds the number that the Army originally thought was necessary.

- The Navy has produced various assessments of fleet size since the end of the Cold War, from 313 ships to 372 ships with some working estimates as high as 500 manned ships.

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 going to be needed to win in battle against a credible opponent when the crisis is profound enough to threaten a vital national 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 for most of the force. This benchmark is the *minimum* standard for U.S. hard-power capacity because one will never be able to employ 100 percent of the force at any given time. Some percentage of the force will always be unavailable because of long-term maintenance overhaul, especially for Navy ships; unit training cycles; employment in myriad engagement and small-crisis response tasks that continue even during major conflicts; a standing commitment with allies to maintain U.S. forces in a given country or region; and the need to keep some portion of the force uncommitted to serve as a strategic reserve.

The historical record shows that, on average, the U.S. Army commits 21 BCTs to a major conflict; thus, a two-MRC standard would require that 42 BCTs be 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. Although new technologies and additional capabilities have made current BCTs more capable than those they replaced, one thing remains the same: Today's BCT, like its predecessors, can be committed only to one place at a time and must be able to account for combat losses, especially if it engages a similarly modernized enemy force. Thus, regardless of modernity, numbers still matter.

Again, this *Index* assesses only the Active component of the service, albeit 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 long-running debate within the total Army about the roles and contributions of its various components. A similar situation exists within the Air Force and Marine Corps.

The balance among Active, Reserve, and Guard elements is beyond the scope of this study. Our focus 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,[33] 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 percent, both to account for forces and platforms that are 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:** at least 400 ships and 624 strike aircraft.
- **Air Force:** 1,200 fighter/attack aircraft.
- **Marine Corps:** 30 battalions.

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

Readiness. The consequences of the sharp reductions in funding mandated by sequestration from 2011 until 2021 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.[34] To avoid this, the services traded quantity/capacity and modernization to ensure that what they do have is "ready" for employment.

Supplemental funding in FY 2017, a higher topline in FY 2018, and sustained increases in FY 2019 and FY 2020 helped to stop the bleeding and enabled the services to plan and implement readiness recovery efforts. Massive federal spending in response to the COVID-19 pandemic in calendar years 2020 and 2021 led to fiscal pressure on defense accounts in future years, but gains in readiness were preserved during FY 2020.

Ensuring adequate readiness in FY 2021 was difficult given the challenges created by COVID-19 during the preceding year. In FY 2022, the services continued their effort to find an appropriate balance among capability, capacity, and readiness, at first benefiting from a reduction in combat operations and the easing of COVID-related restrictions and disruptions but then forced to contend with a loss in spending power caused by rising inflation. Continuing inflationary problems presented a new budgeting challenge to the services with the dramatic spike in interest rates, which increased from 0.0 percent–0.25 percent in FY 2022 to as high as 5.0 percent–5.25 percent in FY 2023.[35]

It is one thing to have the right capabilities to defeat the enemy in battle. It is another thing to have enough of those capabilities to sustain operations and many battles against an enemy over time, especially when attrition or dispersed operations are significant factors. But sufficient numbers of the right capabilities are rather meaningless if the force is not ready 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. Simple numbers, while important, do not tell the whole story.

We believe that the logic underlying our methodology is sound. This *Index* draws 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. It then considers several questions, including:

- How does one place a value on the combat effectiveness of such concepts as Air-Sea Battle, Multi-Domain Operations, Littoral Operations in a Contested Environment, Distributed Maritime Operations, Network-centric Operations, or Joint Operational Access when they have not been tested in battle?[36]

- 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. is pursuing so that the political will to conduct sustained operations in the face of mounting losses might differ dramatically?

- How does one neatly quantify the element of combat experience, the erosion of experience as combat operation events recede in time and those who participated in them leave the force, the health of a supporting workforce, the value of "presence and engagement operations," and the related force structures and patterns of deployment and employment that presumably deter war or mitigate its effects if it does occur?

New capabilities such as unmanned systems, cyber tools, hypervelocity platforms and weapons, and the use of artificial intelligence to achieve a better understanding of operations and orchestrate them more effectively have the potential to change military force posture calculations. At the present time, however, they are not realized in any practical sense.

This *Index* is 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, both in and out of government, who have covered these issues for many years.

Taking everything 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.

Endnotes

1. Les Aspin, Secretary of Defense, *Report on the Bottom-Up Review*, U.S. Department of Defense, October 1993, p. iii, https://www.hsdl.org/?view&did=448259 (accessed June 27, 2023).
2. Ibid., p. 8.
3. See James Mattis, Secretary of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*, U.S. Department of Defense, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf (accessed July 22, 2022).
4. Commission on the National Defense Strategy, *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, https://www.usip.org/sites/default/files/2018-11/providing-for-the-common-defense.pdf (accessed June 27, 2023), and press release, "National Defense Strategy Commission Releases Its Review of 2018 National Defense Strategy," United States Institute of Peace, November 13, 2018, https://www.usip.org/press/2018/11/national-defense-strategy-commission-releases-its-review-2018-national-defense (accessed June 27, 2023).
5. See Lloyd J. Austin III, Secretary of Defense, *2022 National Defense Strategy of the United States of America Including the 2022 Nuclear Posture Review and the 2022 Missile Defense Review*, U.S. Department of Defense, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF (accessed June 27, 2023).
6. President Joseph R. Biden, Jr., *National Security Strategy*, The White House, October 2022, https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf (accessed June 27, 2023).
7. President Joseph R. Biden, Jr., *Interim National Security Strategic Guidance*, The White House, March 2021, p. 9, https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf (accessed June 27, 2023).
8. See Biden, *National Security Strategy*, p. 20, and Austin, *2022 National Defense Strategy of the United States of America*, pp. 2, 4–5, and 8–11.
9. 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. Naval planners are much more concerned about ship-based, air-based, and shore-based anti-ship cruise missiles than they are about the number of conventional surface combatants armed with large-caliber guns that an enemy navy has, and 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 typically 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. Adding this to the rise of unmanned platforms capable of carrying anti-platform weapons makes the threat environment even more complicated. 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 ($70 million) or F-35A Lightning II ($78 million).
10. The use of low-cost drones to attack tanks and other armored vehicles during the 2020 war between Armenia and Azerbaijan proved devastatingly effective, a precursor to what has been seen in the Russia–Ukraine War on a dramatically larger scale. See Benjamin Brimelow, "A Brief, Bloody War in a Corner of Asia Is a Warning About Why the Tank's Days of Dominance May Be Over," *Business Insider*, November 24, 2020, https://www.businessinsider.in/international/news/a-brief-bloody-war-in-a-corner-of-asia-is-a-warning-about-why-the-tanks-days-of-dominance-may-be-over/articleshow/79399695.cms (accessed June 27, 2023). In late June 2021, U.S. forces conducted air strikes against Iranian-backed militia groups in Syria that had been using drones to attack U.S. forces in the region—further evidence of the proliferation of these unmanned systems that enable non-state groups to attack state forces with some level of effectiveness. See David Martin and Tucker Reals, "U.S. Airstrikes Hit Iranian-Backed Militias in Iraq and Syria," CBS News, updated June 28, 2021, https://www.cbsnews.com/news/us-airstrikes-iran-linked-militias-iraq-syria/ (accessed June 27, 2023). The war in Ukraine has seen a dramatic expansion in the use of "drones" (unmanned aerial systems) from long-range platforms designed as weapons of war to very small, commercially available systems that have been adapted for such use. For one of many reports on this topic, see Joe Tidy, "Ukraine Rapidly Expanding Its 'Army of Drones' for Front Line," BBC News, April 26, 2023, https://www.bbc.com/news/technology-65389215 (accessed June 27, 2023).
11. For a detailed discussion of this force, see Richard J. Dunn III, "America's Reserve and National Guard Components: Key Contributors to U.S. Military Strength," in *2016 Index of U.S. Military Strength*, ed. Dakota L. Wood (Washington: The Heritage Foundation, 2015), pp. 61–73, https://s3.amazonaws.com/ims-2016/PDF/2016_Index_of_US_Military_Strength_FULL.pdf. For the percentage of U.S. military capability that resides in the Guard/Reserve, see ibid., p. 63.
12. One example of force balancing was the Army's Aviation Restructuring Initiative, in which the active-duty force sought to redistribute certain rotorcraft platforms among units of the active-duty Army and the National Guard. The Guard has contended that this plan would reduce the capabilities it has gained during recent combat engagements, such as its pilots' proficiency in 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, April 27, 2015, http://www.gao.gov/assets/670/669857.pdf (accessed June 27, 2023), and Enclosure 1, "Force Structure: Army's Analysis of Aviation Alternatives, Briefing for Congressional Defense Committees," updated April 27, 2015, in ibid., pp. 8–44.
13. Thomas W. Spoehr, "U.S. Army," in *2021 Index of U.S. Military Strength*, ed. Dakota L. Wood (Washington: The Heritage Foundation, 2021), pp. 362 and 368, https://www.heritage.org/sites/default/files/2020-11/2021_IndexOfUSMilitaryStrength_ASSESSMENT_POWER_ARMY.pdf.

14. *National Security Strategy of the United States of America*, The White House, December 2017, pp. 2–3, 25–26, and 28, https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf (accessed June 27, 2023).
15. Biden, *Interim National Security Strategic Guidance*, p. 14.
16. Biden, *National Security Strategy*, pp. 3, 20–21, and 23–27.
17. Austin, *2022 National Defense Strategy of the United States of America*, pp. iii, 2–5, and 10.
18. Figure 1.1, "Department of Defense Budget," in U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, *United States Department of Defense Fiscal Year 2023 Budget Request: Defense Budget Overview*, April 2022, p. 1-3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2023/FY2023_Budget_Request_Overview_Book.pdf (accessed June 27, 2023).
19. Congressional Budget Office, "An Analysis of the Discretionary Spending Proposals in the President's 2023 Budget," July 2022, https://www.cbo.gov/system/files?file=2022-07/57972-APB-discretionary.pdf (accessed June 27, 2023).
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21. Figure 1.1, "Department of Defense Budget," in U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, *United States Department of Defense Fiscal Year 2024 Budget Request: Defense Budget Overview*, March 2023, p. 1-3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2024/FY2024_Budget_Request_Overview_Book.pdf (accessed June 27, 2023).
22. Bryant Harris, "Congress Authorizes 8% Defense Budget Increase," *Defense News*, December 15, 2022, https://www.defensenews.com/congress/budget/2022/12/16/congress-authorizes-8-defense-budget-increase/ (accessed June 27, 2023).
23. Jeff Cox, "Inflation Rose at 4% Annual Rate in May, the Lowest in 2 Years," CNBC, June 13, 2023, https://www.cnbc.com/2023/06/13/cpi-inflation-report-may-2023-.html (accessed June 27, 2023).
24. Table 1.1, "Summary of Receipts, Outlays, and Surpluses or Deficits (–): 1789–2027," in Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government, Fiscal Year 2023: Historical Tables*, https://www.whitehouse.gov/wp-content/uploads/2022/03/hist01z1_fy2023.xlsx (accessed June 27, 2023).
25. U.S. Department of the Treasury, Fiscal Data, "What Is the National Debt?" https://fiscaldata.treasury.gov/americas-finance-guide/national-debt/ (accessed June 27, 2023).
26. Since World War II, the U.S. has fought four major wars: the Korean War (1950–1953); the Vietnam War (1965–1973); the Gulf War/Operation Desert Shield/Desert Storm (1990–1991); and the Iraq War/Operation Iraqi Freedom (2003–2011). Operation Enduring Freedom (OEF), commenced immediately following the terrorist attacks of September 11, 2001, was focused primarily on combat operations in Afghanistan but included related actions against terrorist organizations worldwide. OEF was concluded in 2014 when combat operations in Afghanistan were shifted to advisory support operations under the name Operation Freedom's Sentinel. While OEF was not at the same level of intensity as the other named wars, its duration and demand for a constant rotation of forces, to include continuous airpower support, took a similar toll in terms of wear on equipment, consumption of fuel and ammunition, and repeated deployments by personnel.
27. U.S. Space Command (USSPACECOM) is also considered a geographic command, but within the context of this discussion, SPACECOM's interactions with other countries and the extent to which it must deal with units and peoples operating on its terrain are very different from those of terrestrial commands.
28. In previous editions of the *Index*, the capacity of the Marine Corps was assessed against a two-war requirement of 36 battalions: a historical average of 15 battalions for a major conflict (twice that for two) and a 20 percent buffer, bringing the total to 36. The Corps has consistently maintained that it is a one-war force and has no intention of growing to the size needed to fight two wars. Its annual budget requests and top-level planning documents reflect this position. Having assessed that the Indo-Pacific region will continue to be of central importance to the U.S., that China is a more worrisome "pacing threat" than any other competitor, and that the Joint Force lacks the ability to operate within the range of intensely weaponized, layered defenses featuring large numbers of precision-guided munitions, the Corps is reshaping itself to optimize its capabilities and organizational structures for this challenge. This *Index* concurs with this effort but assesses that the Corps will still need greater capacity to succeed in war in the very circumstances for which the Marines believe they must prepare. For a detailed examination of the current state of the Corps, see Dakota Wood, "The U.S. Marine Corps: A Service in Transition," Heritage Foundation *Backgrounder* No. 3501, June 16, 2020, https://www.heritage.org/sites/default/files/2020-06/BG3501_0.pdf.
29. Courtney Kube and Teaganne Finn, "U.S. to Send 1,000 More Troops to Kabul After Afghan Government Collapses," NBC News, August 15, 2021, https://www.nbcnews.com/politics/national-security/u-s-send-additional-1-000-troops-kabul-amid-afghan-n1276881 (accessed June 27, 2023), and Rachel S. Cohen, "The Air Force Evacuated 124,000 People from Afghanistan, but Its Work Still Isn't Done," *Military Times*, September 24, 2021, https://www.militarytimes.com/news/your-air-force/2021/09/24/the-air-force-evacuated-124000-people-from-afghanistan-but-its-work-still-isnt-done/ (accessed June 27, 2023).
30. Defense references to war have varied over the past few decades from "major combat operation" (MCO) and "major theater war" (MTW) to the current "major regional contingency" (MRC). Arguably, there is a supporting rationale 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.
31. Mattis, *Summary of the 2018 National Defense Strategy of the United States of America*, p. 4.

32. General David H. Berger, Commandant of the Marine Corps, "Force Design 2030," March 2020, pp. 7–8, https://www.hqmc.marines.mil/Portals/142/Docs/CMC38%20Force%20Design%202030%20Report%20Phase%20I%20and%20II.pdf?ver=2020-03-26-121328-460 (accessed June 27, 2023).
33. The Department of Defense, through the Joint Staff and Geographic Combatant Commanders, manages a relatively small set of real-world operational plans (OPLANS) that are focused on specific situations in which 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 the presumed enemy. They are highly detailed and account not only for the amount of force the U.S. expects that 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 initially; 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 so that it can 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 America's national security interests. All of these efforts and their products are classified national security information and therefore not available to the public.
34. For more on the potential for a hollow force, see Association of the United States Army, "Preventing a Hollow Force Is Army's Top Priority," May 25, 2017, https://www.ausa.org/news/preventing-hollow-force-army%E2%80%99s-top-priority (accessed June 27, 2023), and J. V. Venable, "America's Air Force Is in Bad Shape," *National Review*, June 13, 2017, http://www.nationalreview.com/article/448556/us-air-force-weakened-funding-cuts-shrinking-workforce-aging-fleet-hurt-preparedness (accessed June 27, 2023).
35. Chart, "Federal Funds Effective Rate," in Federal Reserve Bank of St. Louis, Fred Economic Data, "Federal Funds Effective Rate (FEDFUNDS)," updated June 1, 2023, https://fred.stlouisfed.org/series/fedfunds (accessed June 27, 2023).
36. While some of these concepts are dated, they serve as examples to illustrate that the military is constantly at work improving its understanding of operational challenges and how best to use what it has—or to inform developmental efforts—to resolve such issues. The point, however, is that any concept remains unproven until it is employed in war. Consequently, assessing its actual effectiveness is impossible.

U.S. Army

Thomas W. Spoehr

The U.S. Army is America's primary agent for the conduct of land warfare. Although it is capable of all types of operations across the range of military operations and support to civil authorities, its chief value to the nation is its ability to defeat and destroy enemy land forces in battle.

The Army is engaged throughout the world in protecting and advancing U.S. interests. As of April 19, 2023, the Army had "137,000 soldiers in over 140 countries" supporting America's security interests.[1] Most notably, it has deployed significant forces to NATO countries as a deterrent to further aggression by Russia. As of May 2, 2023, 43,000 soldiers were deployed to Europe bolstering NATO and demonstrating U.S. commitment to the region.[2]

On May 2, 2023, speaking of the deployments to Europe, Secretary of the Army Christine Wormuth and then-Army Chief of Staff General James C. McConville testified that:

> In Poland, the Army has forward-stationed the V Corps Headquarters Forward Command Post—the first permanent U.S. forces on NATO's eastern flank. We are maintaining a substantial rotational force in Poland, including an Armored Brigade Combat Team (ABCT), combat aviation brigade, and a division headquarters. In Romania, we have headquartered a rotational brigade combat team, supporting an additional maneuver force on the eastern flank. In the Baltics, we have enhanced our rotational deployments—which include armored, aviation, air defense, and special operations forces—to reinforce Baltic security, enhance interoperability, and demonstrate the flexibility and combat readiness of U.S. forces.[3]

The Army, like the other military services, finds itself under extraordinary operational and financial pressure. In some cases, advances in firepower like ballistic and cruise missiles, electronic warfare capabilities, and loitering munitions delivered by drones fielded by adversaries like China, Russia, and Iran have outpaced the U.S. Army's capabilities. Information-age warfare requires new levels of speed and precision in Army sensor-to-shooter chains. Autonomy is changing the character of warfare, and the Army has developed some bold ideas about how to take advantage of this technology, but today they are aspirational.

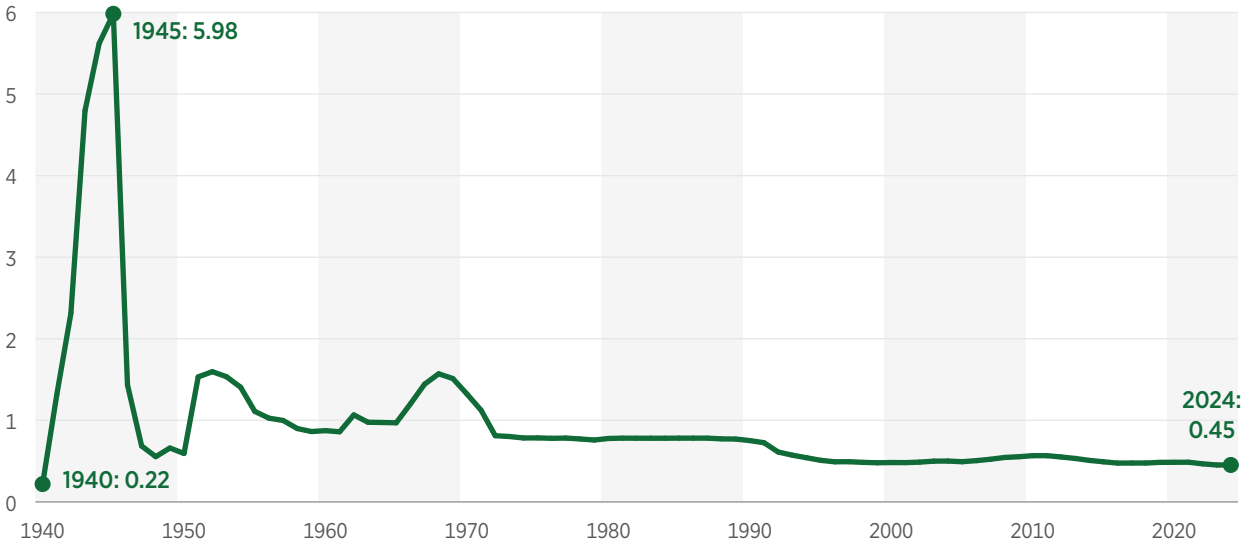
In her initial message to the Army, Secretary Wormuth set out six objectives. The first and arguably most important is to "put the Army on a sustainable strategic path amidst this uncertainty." Wormuth acknowledged that the Army is "facing increased fiscal pressures," and while the objective of "a sustainable strategic path" is noble and well-founded, it is not at all clear how the Army will be able to find such a path given its significant and continuing year-over-year losses in buying power.[4]

When official inflation is factored in, the Army has cumulatively lost over $74 billion in buying power from fiscal year (FY) 2019 to the President's Budget Request for FY 2024. If Army budgets since 2019 had merely kept up with inflation, the request for FY 2024 would have been $210.9 billion. Instead, the requested budget was $185.5 billion.[5] Signs of budget strain are clearly visible in the Army's proposal to cut large procurement programs such as Paladin Integrated Management (PIM) (reduced by $211 million from FY 2023); Stryker upgrades (reduced by $277 million from FY 2023); and Abrams tank upgrades (reduced by $549 million from FY 2023).[6]

CHART 11

Army End Strength Lowest Since 1940

END STRENGTH/FULL-TIME EMPLOYEES, IN MILLIONS



SOURCE: Table 7-5, "Department of Defense Manpower," in U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY 2024*, May 2023, pp. 288–290, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2024/FY24_Green_Book.pdf (accessed September 14, 2023). heritage.org

Arguments are being made that America no longer needs a strong modern Army because, for example, China is largely a maritime threat, but such arguments ignore history.[7] We need to look no further than the ongoing war in Europe between Russia and Ukraine to remember that capable land power is an enduring need for the United States.

America has a horrible record of predicting where it will fight its next war. As former Secretary of Defense Robert Gates famously said:

> When it comes to predicting the nature and location of our next military engagements, since Vietnam, our record has been perfect. We have never once gotten it right, from the Mayaguez to Grenada, Panama, Somalia, the Balkans, Haiti, Kuwait, Iraq, and more—we had no idea a year before any of these missions that we would be so engaged.[8]

America should not be willing to gamble that the next conflict will be in the Indo-Pacific and put all our eggs in one basket—largely naval—and ignore the continuing need for land power that would be essential in many regions and contexts. Many overlook the fact that great-power competition with China and Russia is a global contest, which means that we face the enduring need to counter aggression wherever it may occur, not just within the territory or waters of China or Russia. All of this reinforces the reality that America has a long-term need for modernized, sufficiently sized land power.

An Army Recruiting Crisis. In its FY 2023 budget request, the Army asked for and received a cut of 12,000 in its Regular Army end strength from 485,000 to 473,000. Later in 2023, based on a rapidly deteriorating recruiting forecast, the Army requested that its end strength be lowered by an additional 21,000 to 452,000 for a total of 33,000 compared to its original request for that year. This extraordinary move reflects the dire nature of the recruiting crisis facing both the Army and, to a degree, the other services as well.[9] Pentagon leaders

testified in April 2023 that "[t]he Army, Navy, and Air Force will not make enlistment goals this year."[10]

The Army is facing a recruiting crisis the likes of which it has not experienced since the transition to the All-Volunteer Force in 1973.[11] Since 2018, the Army has been missing its recruiting goals and making up the difference with strong numbers of reenlistments. Now facing extraordinary financial pressure and in order to save money, it has been forced to face reality and cut spaces for servicemembers that it does not anticipate being able to recruit. The reasons for this crisis are many.

- The percentage of Americans that qualify for military service without a waiver dropped from 29 percent in 2017 to 23 percent in 2022.
- The predominant factor in disqualification is obesity.[12]
- Low unemployment makes recruiting difficult, and as this book was being prepared, the U.S. unemployment rate was 3.5 percent.[13]
- Finally, for a variety of reasons that are beyond the scope of this study, fewer Americans are expressing a desire to serve in the armed forces.[14]

The results of this recruiting crisis include lower manning in Army formations, critical shortages in certain career fields, and lower overall readiness. If the crisis is not ameliorated, its longer-term implications are even more consequential.

Chronic Underfunding. The U.S. Army is currently the world's most powerful army in terms of the equipment it uses and the combat effectiveness of its formations, but it is also too small and insufficiently modern to meet even the modest requirements of the 2022 National Defense Strategy (NDS),[15] much less to handle two major regional contingencies (MRCs) simultaneously, which many experts believe is necessary.[16]

Even though the conflict in Iraq has ended and the military was withdrawn from Afghanistan, the Army's focus on counterinsurgency during the period from 2001 to 2016 essentially precluded the service from modernizing the key combat capabilities that it needs now for near-peer competition. In 2011, for example, the Army cancelled its only mid-tier air defense program, the Surface Launched Advanced Medium-Range Air-to-Air Missile (SLAMRAAM), based on its assessment that it would not face a threat from the air in the foreseeable future.[17] In 2022, the Army contracted to buy from Norway largely the same system, the National Advanced Surface-to-Air Missile System (NASAMS), that it cancelled in 2011, now to support Ukraine.[18]

The Army's last major modernization efforts occurred in the 1980s with the fielding of the M-1 Abrams Tank, the M-2 Bradley Fighting Vehicle, and the Blackhawk and Apache helicopters. As General McConville has cogently argued, "the Army is changing to meet our future challenges. These changes cannot happen through incremental improvements. We must transform the Army, and the time is now."[19] This implies a modernization effort contemporary with the current threat environment rather than that of the Cold War and an updating of warfighting concepts not rooted in the Cold War but developed and experienced during nearly two decades of counterinsurgency operations.

The Army's ability to transition from counterinsurgency operations was further constrained by a period of fiscal austerity that began with the Budget Control Act (BCA) of 2011 and lasted for ten years.[20] The inability to fund what was needed led to difficult across-the-board trade-offs in equipment, manpower, and operations accounts. Downward budget pressure drove the Department of Defense (DOD) in 2014 to consider cutting the Army's Active component end strength from more than 500,000 to 420,000. If implemented, this would have resulted in "the smallest number of troops since before the Second World War."[21] Multiple equipment modernization programs were cancelled.

The change of Administrations in 2017 forestalled those cuts in end strength. However, the addition of billions of dollars by Congress and the Trump Administration, while it served to arrest the decline of the Army and significantly improve unit readiness, was not sufficient to modernize or significantly increase the size of the force.[22]

Uncertain Strategic Direction. The Biden Administration's National Security Strategy, published in October 2022, was strangely silent on the topic of military force; in fact, the U.S. Army does not appear at all in the document. The National Defense Strategy similarly contains little useful guidance with respect to the Administration's views on the Army and its role in defending U.S. national interests.[23] As

TABLE 7

Brigade Combat Teams Deployed to Europe in Support of Ukraine

The addition of three units more than doubles the Army's presence in Europe.

DEPLOYED TO EUROPE TO SUPPORT UKRAINE DETERRENCE*	
Region	**Unit**
Europe	2nd Brigade Combat Team, 3rd Infantry Division
Europe	2nd Brigade Combat Team, 1st Armored Division
Romania	1st Brigade Combat Team, 101st Airborne Division

UNITS NORMALLY PRESENT IN EUROPE	
Region	**Unit**
Germany	2nd Cavalry Regiment
Italy	173rd Infantry Brigade (Airborne)

* As of July 2023.

NOTE: A Brigade Combat Team is comprised of approximately 4,500 soldiers.

SOURCES:

- U.S. Army Public Affairs, "Army Announces Upcoming Unit Deployments," March 8, 2023, https://www.army.mil/article/264554/army (accessed September 11, 2023).
- John Vandiver, "Soldiers from 101st Airborne, 10th Mountain Divisions Expected to Deploy to Romania," *Stars and Stripes*, January 23, 2023, https://www.stripes.com/branches/army/2023-01-23/romania-101st-10th-mountain-army-8859339.html (accessed September 11, 2023).
- U.S. Army Europe and Africa, "U.S. Army Europe and Africa Units," https://www.europeafrica.army.mil/Units/ (accessed September 11, 2023).

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but one consequence, this absence of clarity in mission, prioritization, and even value as they related to land power has not helped the Army to make a compelling case for programs, capacity, and focus.

Loss of Buying Power. Despite relatively broad agreement that the DOD budget needed real growth of 3 percent to 5 percent to avoid a strategy–budget mismatch,[24] the Army budget topline did not meet that target in FY 2019 and has not done so since.

Of all the services, the Army has fared the worst in terms of resources. Its funding levels plateaued with the FY 2020 budget and since then have declined in constant dollars. The Army received approximately $181 billion in FY 2019, $186 billion in FY 2020, $177 billion in FY 2021, $185 billion in FY 2022, and $185 billion for FY 2023 and requested approximately $185 billion for FY 2024, amounting to a relatively flat budget over the past half-decade while the costs of manpower, matériel, and energy have increased.[25]

Testifying before the House Appropriations Committee's Subcommittee on Tactical Air and Land Forces in April 2023, Lieutenant General Erik Peterson, Army Deputy Chief of Staff for Programs, summarized the situation in starkly candid terms:

> Several years of ruthless prioritization, eliminating, reducing and deferring lower priority and less necessary efforts, as well as divesting of legacy capabilities, has left little flexibility in our topline. We made the easy choices the first couple of years of this effort. We're now well into the realm of hard choices, really hard choices and downright excruciating choices.[26]

General McConville's more than $1.9 billion Unfunded Priority List for FY 2024, containing dozens of critical items, is testament to what the Army was not able to include in its budget request: air defense systems, organic industrial base modernization, and helicopter replacement—among many other programs.[27]

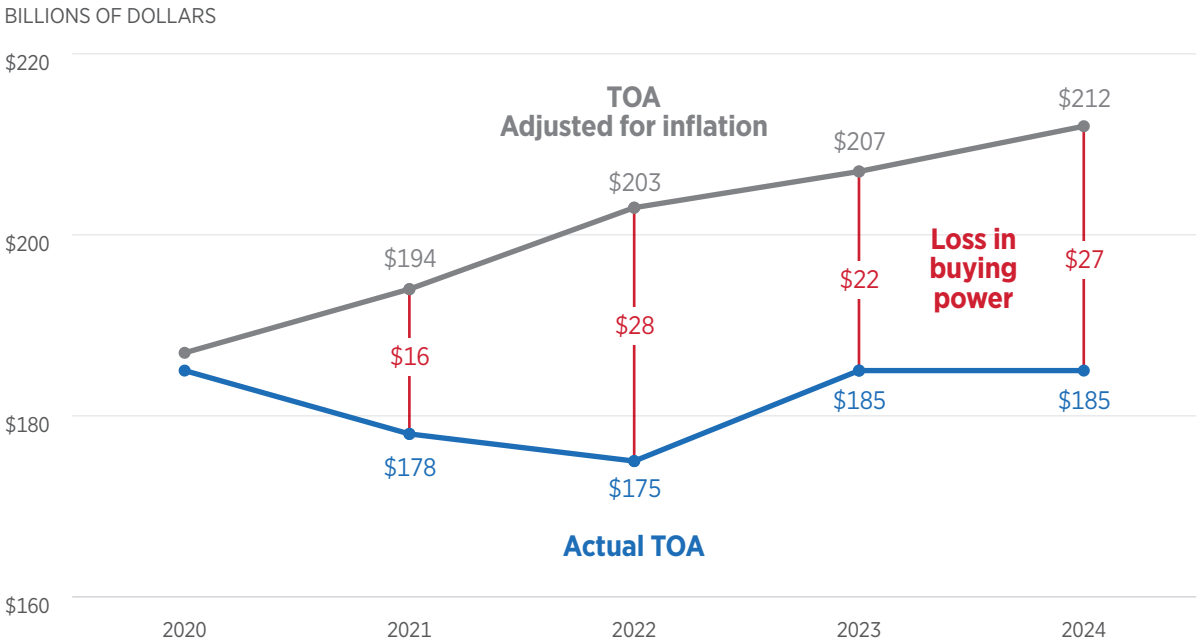
Capacity

Capacity refers to the sufficiency of forces and equipment needed to execute the National Defense

CHART 12

Army Budget Hit by Both Cuts and Inflation

Not only is the Army's total obligation authority (TOA) declining in real terms, but due to inflation, those declines have resulted in an additional loss of buying power since 2020. Combined losses from 2020 to 2024 total $93 billion.



SOURCES: Honorable Gabe Camarillo, Under Secretary of the Army, "Army Fiscal Year 2024 Budget Overview," PowerPoint Presentation, p. 14, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2024/pbr/Army%20FY%202024%20Budget%20Overview%20Briefing.pdf (accessed September 14, 2023), and Table S-9, "Economic Assumptions," in Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government, Fiscal Year 2024*, p. 167, https://www.whitehouse.gov/wp-content/uploads/2023/03/budget_fy2024.pdf (accessed September 14, 2023).

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Strategy. One of the ways the Army quantifies its warfighting capacity is by its number of Brigade Combat Teams (BCTs).

Brigade Combat Teams. BCTs are the Army's primary combined arms, close combat force. They often operate as part of a division or joint task force, both of which are the basic building blocks for employment of Army combat forces. BCTs are usually employed within a larger framework of U.S. land operations but are equipped and organized so that they can conduct limited independent operations as circumstances demand.[28]

BCTs range between 4,000 and 4,700 soldiers in size. There are three types: Infantry, Armored, and Stryker. At its core, each of these formations has three maneuver battalions enabled by multiple other units such as artillery, engineers, reconnaissance, logistics, and signal units.[29]

The simplest way to understand the status of hard Army combat power is to know the readiness, quantity, and modernization level of BCTs. This section deals with the number of BCTs in the force.

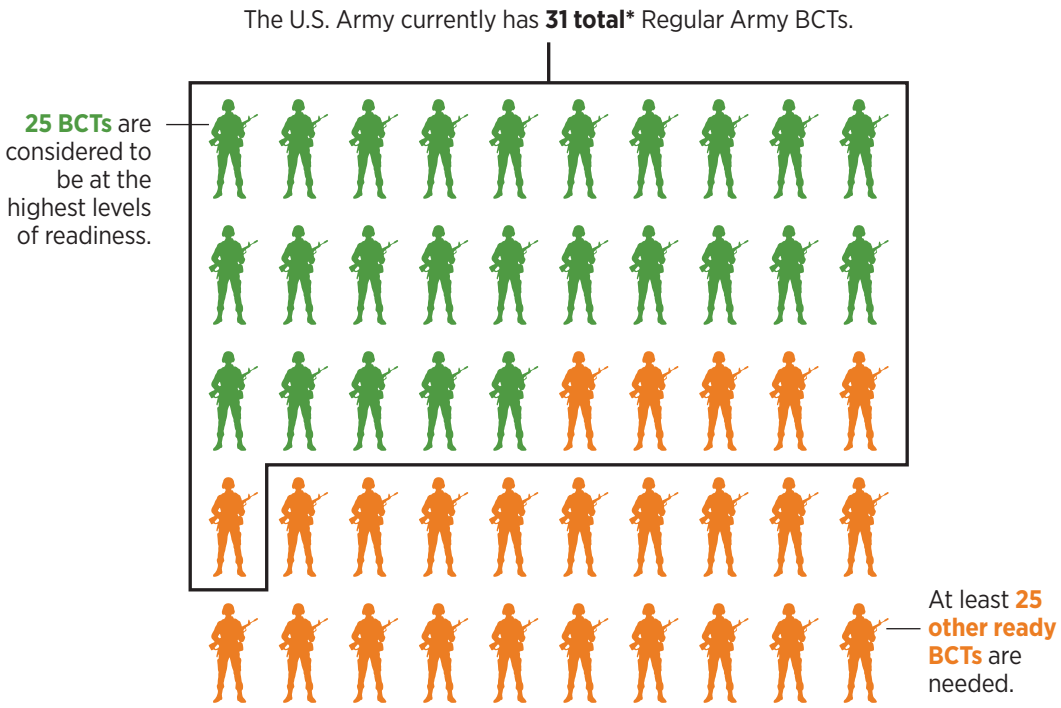
In 2013, the Army announced that because of end strength reductions and the priorities of the prior Administration, the number of Regular Army BCTs would be reduced from 45 to 33.[30] Subsequent reductions reduced the number of Regular Army BCTs from 33 to 31, where they remain today.[31]

When the Trump Administration and Congress reversed the planned drawdown in Army end

FIGURE 3

Army Capacity: Brigade Combat Teams

Based on historical force requirements, The Heritage Foundation assesses that the Army needs a total of 50 Brigade Combat Teams (BCTs).



* Includes four Army National Guard BCTs.

SOURCE: Email from Professional Staff, U.S. House of Representative, Committee on Appropriations, July 14, 2023.

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strength and authorized personnel growth beginning in 2018, instead of "re-growing" the numbers of BCTs, the Army chose to "thicken" the force and raise the manning levels within the individual BCTs to increase unit readiness. The Army's goal was to fill operational units to 105 percent of their authorized manning,[32] but the decision announced in the FY 2023 budget to cut end strength by 33,000 soldiers (to 452,000) will reverse those trends and cause units to be undermanned instead of overmanned.

Combat Aviation Brigades. The Regular Army also has a separate air component that is organized into Combat Aviation Brigades (CABs). CABs are made up of Army rotorcraft, such as the AH-64 Apache, and perform various roles including attack, reconnaissance, and assault. The number of Army aviation units also has been reduced. There are now 11 CABs in the Regular Army.[33]

Generating Force. CABs and Stryker, Infantry, and Armored BCTs make up the Army's main combat fighting forces, but they obviously do not make up the entirety of the Army. Assuming that the Army shrank proportionately in all categories as it reduced to 452,000 in the Active component, there are approximately 194,000 soldiers in combat units, 123,000 in support units, and 134,000 in overhead units. Overhead is composed of administrative units and units that provide such types of support as preparing and training troops for deployments, carrying out key logistics tasks, staffing headquarters, and overseeing military schools and Army educational institutions.[34]

TABLE 8

Major Army Combat Formations

Brigade Combat Teams	Regular Army	Army National Guard	Total
Infantry Brigade Combat Teams	14	20	33
Stryker Brigade Combat Teams	6	2	9
Armored Brigade Combat Teams	11	5	16
Total	**31**	**27**	**58**

Aviation Brigades	Regular Army	Army National Guard	Total
Combat Aviation Brigades	11	–	11
Expeditionary Combat Aviation Brigades	–	8	8
Theater Aviation Brigades	–	2	2
Total	**11**	**10**	**21**

SOURCES:

- U.S. Department of the Army, *Department of the Army Fiscal Year (FY) 2024 Budget Estimates, Volume 1, Operation and Maintenance, Army, Justification of Estimates*, March 2023, pp. 62 and 128, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2024/Base%20Budget/Operation%20and%20Maintenance/Regular%20Army%20Operation%20and%20Maintenance%20Volume%201.pdf (accessed September 14, 2023).
- U.S. Department of the Army, *Department of the Army Fiscal Year (FY) 2024 Budget Estimates, Volume 1, Operation and Maintenance, Army National Guard, Justification Book*, March 2023, pp. 42 and 101, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2024/Base%20Budget/Operation%20and%20Maintenance/National%20Guard%20Army%20Operation%20and%20Maintenance.pdf (accessed September 14, 2023).

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Functional or Multifunctional Support Brigades. In addition to the institutional Army, a number of functional or multifunctional support brigades provide air defense; engineering; explosive ordnance disposal; chemical, biological, radiological, and nuclear protection; military police; military intelligence; and medical support among other types of battlefield support. Special operations forces such as the 75th Ranger Regiment, six Special Forces Groups, and the 160th Special Operations Aviation Regiment are also included in these numbers.

The Army is revising its force structure to accommodate a lower active end strength. When its end strength was reduced from 485,000 to 452,000 in FY 2023, the Army did not announce any changes in force structure. This has resulted in understrength units. Among other changes, the Army is reportedly considering a 10 percent cut in Special Forces structure.[35] Other changes are likely.

New Concepts and Supporting Force Structure. At the same time the Army is facing the need to cut units to meet its new end strength, it is also trying to adapt its force structure to meet the anticipated new demands of near-peer competition. The foundations for these changes are contained in the Army's Multi-Domain Operations (MDO) concept, published in December 2018, which describes how the Army views the future.[36]

In January 2022, the Army announced that it planned to modify its force structure for MDO under the designation "Army 2030." Other than that announcement, the Army has been silent on future force structure and its plans are seemingly in flux as it grapples with recruiting shortfalls. As part of its adaptation to MDO, the Army did reactivate V Corps Headquarters on October 16, 2020, to provide operational planning, mission command, and oversight of rotational forces in Europe.[37] On June 8,

2022, the Army reactivated the 11th Airborne Division in Alaska as an element of its "arctic strategy."[38]

The Army also has announced plans to create five Multi-Domain Task Forces (MDTFs): "theater-level maneuver elements designed to synchronize precision effects and precision fires in all domains against adversary anti-access/ area denial (A2/AD) networks in all domains, enabling joint forces to execute their operational plan (OPLAN)-directed roles."[39] One MDTF is currently stationed at Joint Base Lewis–McChord in Washington State. The second is stationed in Wiesbaden, Germany, aligned to Europe,[40] and the third was activated on September 23, 2022, in Hawaii.[41] These task forces contain rockets, missiles, military intelligence, and other capabilities that will allow Army forces to operate seamlessly with joint partners and conduct multi-domain operations. The Army has not announced plans for the remaining two of the five MDTFs that were originally envisioned.

To relieve the stress on the use of BCTs for advisory missions, the Army has activated six Security Force Assistance Brigades (SFABs), one in the National Guard and the other five in the Regular Army. These units, each one of which is composed of 816 soldiers, are designed specifically to train, advise, and mentor other partner-nation military units. The Army had been using BCTs for this mission, but because train-and-assist missions typically require senior officers and noncommissioned officers, a BCT comprised predominantly of junior soldiers was a poor fit. Other than the National Guard SFAB, the five active SFABs are regionally aligned to combatant commands.[42]

Force Too Small to Execute the NDS. Army leaders have consistently stated that the Army is too small to execute the National Defense Strategy at less than significant risk. For FY 2023, the Army had an authorized total end strength of 1,010,500 soldiers:

- 452,000 in the Regular Army,
- 177,000 in the Army Reserve, and
- 325,000 in the Army National Guard (ARNG).[43]

In March 2021, General McConville stated that "I would have a bigger...sized Army if I thought we could afford it, I think we need it, I really do.... I think the regular Army should be somewhere around 540–550 [thousand]," and "we're sitting right now at 485,000." (Of course, the Army is "sitting" now at 452,000.) He further observed that "I've probably already had to give up the growth that we're going to have planned" and that "[w]e're probably not going to grow the Army even though I'd like to, more, because end strength is something we have to take a look at."[44]

The Army's prior plans to increase the size of the Regular Army force were slammed into reverse because of recruiting challenges. The Army had planned to raise the Regular Army incrementally to above 500,000 by adding approximately 2,000 soldiers per year.[45] At that rate, it would have reached 500,000 by around 2028. Now that modest plan is off the table.[46]

Overall end strength dictates how many BCTs the Army can form, and by cutting end strength, the service not only will be unable to add more combat units or other in-demand units such as air and missile defense units, but also will have to reduce the manning levels in the units it possesses. This will drive a higher operational tempo (OPTEMPO) for Army units and increase risk both for the force and for the Army's ability to carry out its mission.

Many outside experts agree that the U.S. Army is too small. In 2017, Congress established the National Defense Strategy Commission to provide an "independent, non-partisan review of the 2018 National Defense Strategy." (Two of the commissioners, Dr. Kathleen Hicks and Mr. Michael McCord, are now top DOD leaders.) Among its findings, the commission unanimously reported that the NDS now charges the military with facing "five credible challengers, including two major-power competitors, and three distinctly different geographic and operational environments." The commission assessed that "[t]his being the case, a two-war force sizing construct makes more strategic sense today than at any previous point in the post-Cold War era." In other words, "*[s]imply put, the United States needs a larger force than it has today if it is to meet the objectives of the strategy.*"[47]

In addition to the increased strategic risk of not being able to execute the NDS within the desired time frame, the combination of an insufficient number of BCTs and a lower-than-required Army end strength has resulted in a higher-than-desired level of OPTEMPO. Assistant Deputy Chief of Staff,

G-3/5/7, Major General Sean Swindell recently stated that the Army had tried to reduce the demands on the force but that this "effort has been going in the opposite direction."[48]

Army Force Posture. The Army also has transitioned from a force with a third of its strength typically stationed overseas, as it was during the Cold War, to a force that is based mostly in the continental United States. An average of 311,870 troops were stationed in Europe from 1986 to 1990, and the majority were Army soldiers. When the Berlin Wall fell, that number plunged to 109,452 from 1996–2000,[49] and the numbers have continued to drop. In 2023, only two BCTs are permanently stationed overseas: the 173rd Airborne BCT in Italy and the 2nd Cavalry Regiment in Germany. The desire to find a "peace dividend" following the dissolution of the Soviet Union, combined with a reluctance to close bases in the United States, led to large-scale base closures and force reductions overseas. Even though the 2022 NDS places a high premium on how the Joint Force is postured, most of the Army remains in the U.S., thousands of miles from where it will be needed.

Among Army units that deploy periodically are Armored and Stryker Brigade Combat Teams (ABCTs) and Patriot Battalions that rotate to and from Europe, Kuwait, and Korea. Rather than relying on forward-stationed BCTs, the Army currently rotates ABCTs to Europe and Kuwait and Stryker BCTs to Korea on a "heel-to-toe" basis so that there is never a gap.

The Russia–Ukraine war has brought the question of stationing more Army forces in Europe back to the forefront. Joint Chiefs of Staff Chairman General Mark Milley has suggested that the U.S. should establish more permanent European bases and rotate more forces to the continent.[50] There is disagreement as to which represents the better option: rotated forces or forward-stationed forces.

- Proponents of rotational BCTs argue that they arrive fully trained, that they remain at a high state of readiness throughout their typically nine-month overseas rotation, and that the cost of providing for accompanying military families is avoided.

- Those who favor forward-stationed forces point to a lower overall cost (when their equipment remains in place), forces that typically are more familiar with the operating environment, and a more reassuring presence for our allies.[51]

In reality, both types of force postures are needed, not only for the reasons mentioned, but also because the mechanisms by which a unit is deployed, received into theater, and integrated with the force stationed abroad should be practiced on a regular basis.

Capability

Capability in this context refers to the quality, performance, suitability, and age of the Army's various types of combat equipment. In general, the Army is using equipment developed in the 1970s, fielded in the 1980s, and incrementally upgraded since then. This "modernization gap" was caused by several factors: the predominant focus on the wars in Iraq and Afghanistan since 9/11; pressures caused by budget cuts, especially those associated with the BCA; and failures in major modernization programs like the Future Combat System, Ground Combat Vehicle, and Crusader artillery system.

Army leaders today clearly view this situation as a serious challenge. General James Rainey, the head of Army Futures Command, has said that "[w]e need to approach 2040 with a sense of urgency now" because "[t]ransforming the Army to ensure war-winning future readiness...is the best guarantee that our successful materiel modernization efforts will produce lethal formations that will deter our enemies, and, if required, dominate the land domain in conflict."[52]

General McConville has similarly urged that "[w]e must transform the Army" and that "the time is now...to transform our doctrine, our organizations, our training...our equipment, and...how we compete around the world in order to protect the freedoms and the global order we enjoy today." He further suggests "that about every 40 years, the Army transforms to meet the National Security threats of that time. We did it in 1940's for World War II; we did it in 1980's for the Cold War; we are doing it now in 2020 for the Great Power Competition environment that we live in."[53]

The Army has embarked on an ambitious program to modernize and hopes to put 24 new systems into the hands of soldiers in FY 2023. Among

these systems are hypersonic missiles, a precision strike missile, a directed energy air defense capability, and the Lower Tier Air and Missile Defense Sensor. These systems represent tangible progress.

Interested parties also should pay attention to additional areas other than the number of systems being fielded: the quantities of the systems being fielded and the times that will be required for the Army to reach their acquisition objectives for new equipment. Because of budget limitations, the initial quantities of systems being fielded are relatively modest: for example, 120 Precision Strike Missiles. Reaching the acquisition objective for other pieces of new equipment will take many years: for the Armored Multipurpose Vehicle, 25 years; the Joint Lightweight Tactical Vehicle, 23 years, and Mobile Protected Firepower, 14 years.[54]

Loss of Competitive Advantage. These new modernization programs cannot come quickly enough. As an example of how Army equipment is falling behind that of our competitors, the Army Tactical Missile System (ATACMS), first introduced in 1991, is the Army's only ground-launched precision missile with a range greater than 100 kilometers (km). Because of restrictions in the Intermediate Range Nuclear Forces Treaty and other factors, it was limited to a maximum range of 300 km.

China and Russia have much more substantial inventories of conventional, precision, ground-launched missiles and rockets. China has nine major ground-launched missile systems and more than 425 launchers. These capable systems can range from 600 km (DF-11A and DF-15) to 4,000 km (DF-26).[55] Russia, on the other hand, at least before the war in Ukraine, had the widest inventory of missiles in the world: at least four conventional ground-launched missile systems that can range from 120 km (SS-21) to 2,500 km (SSC-8).[56] The Army plans to start fielding the Precision Strike Missile in the fourth quarter of 2023, but the initial quantities will be modest (120).[57]

Another example of this loss in competitive advantage can be found in main battle tanks. When the M-1 Abrams was introduced in 1980, it was indisputably the world's best tank. Since then, Russia has developed—and before the Ukraine War was reportedly prepared to export—versions of its T-14 Armata tank, which has an unmanned turret, reinforced frontal armor, an information management system that controls all elements of the tank, an active protection system, a circular Doppler radar, an option for a 155 mm gun, and 360-degree ultraviolet high-definition cameras.[58] Other defense assessments rate two other tanks—the German Leopard 2A7V and the South Korean K2 Black Panther—as superior to the M-1A2 SEP v3.[59]

The point is not to pick the best tank in the world. Rather, the point is that although the M-1A2 SEP v3 (the most recent version) is a very good tank, the decisive advantage the U.S. once enjoyed in tank design has disappeared.

Similarly, the U.S. Army's Patriot Missile System is an excellent system, but countries such as Saudi Arabia, Turkey, and India have either purchased or recently expressed interest in buying the Russian competitor system, the S-400.[60] Why? Part of the answer lies in cost. The Patriot system is tremendously expensive; a Patriot battery (one-fourth of a battalion) costs about $3 billion for the launchers and a basic load of missiles, and an S-400 battery has been estimated to cost $500 million.[61]

Within the Army's inventory of equipment are thousands of combat systems, including small arms, trucks, aircraft, soldier-carried weapons, radios, tracked vehicles, artillery systems, missiles, and drones. The following sections provide updates with respect to some of the major systems as they pertain to Armored, Stryker, and Infantry BCTs and Combat Aviation Brigades.

Armored Brigade Combat Team (ABCT). The Armored BCT's role is to "close with the enemy by means of fire and movement to destroy or capture enemy forces, or to repel enemy attacks by fire, close combat, and counterattack to control land areas, including populations and resources."[62] The Abrams Main Battle Tank (most recent version in production: M1A2 SEPv3, first unit equipped in FY 2020[63]) and Bradley Fighting Vehicle (most recent version: M2A4, first unit equipped in April 2022[64]) are the primary Armored BCT combat platforms.

The M-1 tank and Bradley Fighting Vehicle first entered service in 1980 and 1981, respectively. There are 87 M-1 Abrams tanks and 152 Bradley Fighting Vehicle variants in an ABCT.[65] Despite upgrades, the M-1 tank and the Bradley are now at least 40 years old, and their replacements will not arrive until the platforms are at least 50 years old.

Optionally Manned Fighting Vehicle (OMFV). The Army's replacement program for the Bradley, the Optionally Manned Fighting Vehicle,

was on an aggressive timeline, but the Army cancelled the request for proposals (RFP) in January 2020 and rereleased an RFP for what it called a "concept design" in December 2020. Five teams were selected to come up with designs for the OMFV. The next milestone was in July 2022 when the government released a final RFP. An award for three contractors to produce detailed designs is expected in the second quarter of FY 2023,[66] and "[t]he Army then intends to select one vendor for Low-Rate Initial Production near the end of FY2027."[67]

Procurement funding for the OMFV does not yet appear in the Army's FY 2024–FY 2029 program. Flat or declining funding such as the Army is currently experiencing could affect those plans.

A New Tank? A potential clean-sheet replacement for the M-1 tank is even farther down the road. Major General Glenn Dean, Program Officer, Ground Combat Systems, reportedly has said that "funding to pursue what could be next for Abrams would likely not appear in a budget cycle until fiscal 2025 at the earliest."[68] Meanwhile, the Army has another upgrade for the Abrams platform in the works: the M1A2 SEPv4, which would incorporate a "3rd Generation Forward Looking Infrared (3GEN FLIR)" in addition to "new color cameras to the gunner/commander primary sights" as well as "an improved laser range finder, integration of a laser warning receiver system, improved lethality via Fire Control System (FCS) digital communication with a new Advanced Multi-Purpose round, improved accuracy via integration of a meteorological sensor, and improved onboard diagnostics."[69] Fielding will begin in FY 2024.

Armored Multi-Purpose Vehicle (AMPV). The venerable M113 multi-purpose personnel carrier is also part of an ABCT and fills multiple roles such as mortar carrier and ambulance. It entered service in 1960 and is being replaced by the new Armored Multi-Purpose Vehicle (AMPV), which after numerous delays entered low-rate initial production on January 25, 2019. The system's first fieldings took place on March 13, 2023.[70] The Army's FY 2024 budget includes a request for procurement of 91 AMPVs. At that rate of procurement and given prior year procurements, it will take the Army at least 25 years from 2024 to meet its objective of 2,897 AMPVs by FY 2049.[71]

Stryker Brigade Combat Team (SBCT). The Stryker BCT "is an expeditionary combined arms force organized around mounted infantry" and is able to "operate effectively in most terrain and weather conditions" because of its rapid strategic deployment and mobility.[72] Stryker BCTs are equipped with approximately 321 eight-wheeled Stryker vehicles.[73] Relatively speaking, these vehicles are among the Army's newest combat platforms, having entered service in 2001.

In response to an Operational Needs Statement, the Stryker BCT in Europe received Strykers fitted with a 30 mm cannon to provide an improved anti-armor capability.[74] Based on the success of that effort, the Army decided to outfit at least three of its SBCTs that are equipped with the Double V-hull, which affords better underbody protection against such threats as improvised explosive devices, with the 30 mm autocannon.[75] The next SBCT to receive the cannons (after the 2nd Cavalry Regiment) will be the 1-2 SBCT at Joint Base Lewis–McChord in Washington State; delivery was scheduled for July 2023.[76] The Army is also integrating Javelin anti-tank missiles on the Stryker platform and began to train crews on this capability in May 2022.[77]

Infantry Brigade Combat Team (IBCT). The Infantry BCT "is an expeditionary, combined arms formation optimized for dismounted operations in *complex terrain,"* which the Army defines as "a geographical area consisting of an urban center larger than a village and/or of two or more types of restrictive terrain or environmental conditions occupying the same space."[78] Infantry BCTs have fewer vehicles and rely on lighter platforms such as trucks; High Mobility Multipurpose Wheeled Vehicles (HMMWVs); and Joint Light Tactical Vehicles (JLTVs) for mobility.

Joint Light Tactical Vehicle (JLTV). The JLTV aspires to combine the protection offered by Mine Resistant Ambush Protected Vehicles (MRAPs) with the mobility of the original unarmored HMMWV. The vehicle features design improvements that increase its survivability against anti-armor weapons and improvised explosive devices (IEDs). The Army Procurement Objective is 49,099 trucks,[79] replacing about 50 percent of the current HMMWV fleet.

Requested FY 2024 funding of $839.4 million would support procurement of 1,753 JLTVs and 848 trailers. This reflects an increase in funding ($664.1 million was enacted for FY 2023), suggesting that the Army is recommitted to this program.

TABLE 9

Procurement of Select Army Systems Will Take Decades to Complete

System	Army Acquisition Objective	Funded Through FY 2024	Years Needed to Complete Army Fielding at FY 2024 Procurement Rate
Armored Multi-Purpose Vehicle (AMPV)	2,897	519	25
Joint Assault Bridge (JAB)	297	126	28
Mobile Protected Firepower (MPF)	504	33	15
Joint Lightweight Tactical Vehicle (JLTV)	49,099	6,365	24
Ground Mobility Vehicle	2,593	739	14

SOURCES: U.S. Department of the Army, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Army, Justification Book Volume 1 of 1, Procurement of W&TCV, Army*, March 2023, pp. 1 and 12, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2024/Base%20Budget/Procurement/Procurement%20of%20Weapons%20and%20Tracked%20Combat%20Vehicles.pdf (accessed September 14, 2023), and U.S. Department of the Army, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Army, Justification Book Volume 1 of 3, Other Procurement, Army, Tactical and Support Vehicles, Budget Activity 1*, March 2023, p. 39 and 49, https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2024/Base%20Budget/Procurement/Other%20Procurement%20-%20BA%201%20-%20Tactical%20&%20Support%20Vehicles.pdf (accessed September 14, 2023).

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Considering the 4,612 JLTVs the Army has already procured[80] and procurement at a rate of 1,753 vehicles (the FY 2024 quantity), the Army will not reach its procurement objective of 49,099 for the JLTV until 2048, leaving it to rely on aging HMMWVs that began fielding in 1983.[81]

Mobile Protected Firepower (MPF). The Army has developed a light tank, previously called Mobile Protected Firepower and now officially named the M10 Booker, to provide IBCTs with the firepower to engage enemy armored vehicles and fortifications.[82] In June 2022, the Army awarded General Dynamics Land Systems a contract for 96 MPF systems. The first units are expected to receive the M10 in the fourth quarter of FY 2025. The Army's acquisition objective is for 504 M10s, organized in battalions of 42 systems. The $394.6 million requested in the FY 2024 budget will acquire 33 systems.[83] At that rate of procurement, the Army will meet its objective in FY 2038.

Ground Mobility Vehicle (GMV). Airborne BCTs are the first IBCTs to receive a new platform to increase their speed and mobility. The GMV (also referred to as the Infantry Squad Vehicle) provides enhanced tactical mobility for an IBCT nine-soldier infantry squad with their associated equipment. GM Defense was selected for the production contract in June 2020. The Army has approved a procurement objective of 11 IBCT sets at 59 vehicles per IBCT for a total of 649 vehicles. The approved Army acquisition objective is 2,593. Given prior procured quantities of 596 and at the procurement rate of 143 per year, the Army will reach its acquisition objective in FY 2037.[84]

Combat Aviation Brigade. CABs are composed of AH-64 Apache attack, UH-60 Black Hawk medium-lift, and CH-47 Chinook heavy-lift helicopters. The Army has been methodically upgrading these fleets for decades, but the FY 2024 budget request continues the reduction in legacy aircraft procurement that began in FY 2022, presumably to create "budget room" for the planned introduction of two new aircraft: the Future Long-Range Assault Aircraft (FLRAA) and Future Attack Reconnaissance Aircraft (FARA). This is a continued reflection of downward budget pressure and incurs additional risk for the Army as its legacy helicopters are expected to be around for decades.

UH/HH-60. The acquisition objective for the H-60 medium-lift helicopter is 1,375 H-60Ms and 760 recapitalized 60-A/L/Vs for a total of 2,135 aircraft. The FY 2024 procurement request for the UH-60M is $760.7 million, which would support the procurement of 24 aircraft, 11 less than the 35 that were funded in FY 2023. The FY 2024 budget request reflects planned UH-60 procurement in FY 2026.[85]

CH-47. The CH-47F Chinook, a rebuilt variant of the Army's CH-47D heavy-lift helicopter, has an acquisition objective of 535 aircraft and, with no planned replacement on the horizon, is expected to remain the Army's heavy-lift helicopter for the foreseeable future. The FY 2024 budget request of $221.4 million would support the service life extension of six aircraft, as well as retrofits, all of which would be for the MH-47G special operations model.[86]

AH-64. The AH-64E heavy attack helicopter has an Army acquisition objective of 812 aircraft (a combination of remanufactured and new build), which is being met by the building of new aircraft and remanufacturing of older AH-64 models. The $828.9 million FY 2024 procurement request would support the purchase of 42 AH-64E aircraft, nine more than the 33 funded in FY 2023 budget.[87]

Overall, the Army's equipment inventory, while increasingly dated, is maintained well. Under its current modernization plans, "the Army envisions [the M-1 Abrams Tank, M-2/M-3 Bradley Fighting Vehicle (BFV), and M-1126 Stryker Combat Vehicle] to be in service with Active and National Guard forces beyond FY2028."[88]

Future Programs and Efforts. In addition to seeing to the viability of today's equipment, the military must look to the health of future equipment programs. Although future modernization programs do not represent current hard-power capabilities that can be applied against an enemy force today, they are a leading indicator of a service's overall fitness for future sustained combat operations. In future years, the service could be forced to engage an enemy 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 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.

After 20 years of a singular focus on counterinsurgency followed by concentration on the current readiness of the force, the Army is now playing catch-up in equipment modernization.

New Organizations and Emphasis on Modernization. In 2017, the Army established eight cross-functional teams (CFTs) to improve the management of its top modernization priorities, and in 2018, it established a new four-star headquarters, Army Futures Command, to lead modernization efforts.[89] In 2023 the Army announced the creation of a new Cross Functional Team to handle logistics.[90]

Even though it has been six years, it is still too early to assess whether these new structures, commands, and emphasis will result in long-term improvement in the Army's modernization posture. The Army aspires to develop and procure an entire new generation of equipment based on its six modernization priorities: "long range precision fires, next generation combat vehicles, future vertical lift, network, air and missile defense, and Soldier lethality."[91]

Although the Army has put in place new organizations, plans, and strategies to manage modernization, the future is uncertain, and Army programs remain in a fragile state with only a few in an active procurement status. The Army has shown great willingness to make tough choices and reallocate funding toward its modernization programs, but this has usually been at the expense of end strength or reduction in the total quantity of new items purchased.

As budget challenges such as nuclear deterrence programs, inflation, rising personnel costs, health care, and the need to invest in programs to respond to China's increasingly aggressive activities continue to present themselves, the Army desperately needs time and funding to modernize its inventory of equipment. Recent modernization programs seem to be on track except for the Extended Range Cannon program,[92] the Improved Turbine Engine Program,[93] and the Integrated Visual Augmentation System,[94] all of which have suffered some setbacks. The Army also is experiencing some success, one example being the number of Stryker vehicle-mounted Maneuver Short Range Air Defense

(M-SHORAD) systems that have been delivered to Europe.[95] Army officials are currently optimistic about future fielding dates for equipment like the hypersonic weapon firing battery and the Precision Strike Missile, both of which are scheduled to begin delivery in FY 2023, but their success will depend on sustained funding.

Readiness

BCT Readiness. Over the past four years, the Army has made steady progress in increasing the readiness of its forces. Its goal is to have 66 percent of the Regular Army and 33 percent of National Guard BCTs "at the highest levels of readiness."[96]

As of July 14, 2023, the Army reported that "83 percent of Active Component Brigade Combat Teams are at the highest levels of tactical readiness."[97] This is 17 percentage points above its goal and two percentage points above last year's reported level. This means that 25 of the Army's 31 active BCTs were at either C1 or C2, the two highest levels of tactical readiness, and ready to perform all or most of their wartime missions immediately. The *2023 Index* reported that 25 Regular Army BCTs were at the highest levels of readiness.

There also are 27 BCTs in the Army National Guard: five Armor, 20 Infantry, and two Stryker. The Army has allocated two Combat Training Center (CTC) rotations for two National Guard BCTs. These two BCTs "are resourced to achieve company-level proficiency, while the remaining 25 BCTs and enabler units are on a path to platoon minus-level proficiency and will meet Directed Readiness Table requirements."[98] These training levels usually reveal the extent to which additional training time would be required before the unit could be deployed. Given the paucity of data provided by the Army, it is hard to assess the current readiness of ARNG units.

Steady Decline in Training Resources. When measuring resourcing for the training of Brigade Combat Teams, the Army formerly used full-spectrum training miles (FSTMs), representing the number of miles that formations are resourced to drive their primary vehicles on an annual basis. In FY 2024, the Army changed the terminology to Composite Training Miles but explained that they are the same thing. Since FY 2019, these training resources have been declining. In FY 2021, the Army budgeted 1,598 FSTMs to train BCTs to 100 percent of the requirement.[99] According to the Army's FY 2024 budget justification exhibits, only 1,137 Composite Training Miles are funded for non-deployed units. This is a cut of 28 percent, suggesting that unless the Army's training strategy radically changed, *BCTs are funded only to 72 percent of the training requirement*.

For Combat Aviation Brigades, the Army uses hours per crew per month (H/C/M), which reflects the number of hours that aviation crews can fly their helicopters per month. The 9.2 flying hours budgeted in the FY 2024 request are 13 percent lower than the 10.6 active flying hours per crew per month enacted in the FY 2023 budget.[100]

Uncertain Training Level Goals. Starting with the FY 2022 budget justification books, the Army began to omit the Unit Proficiency Level Goal, which for years has been to train a BCT to operate as a BCT; it is likely now training to act as a battalion or company. This implies that brigade combat teams will not be effective in executing brigade-level or brigade-size tasks if called into action. Having competent companies or battalions is one thing; being able to orchestrate their actions to achieve higher-order tactical and operational tasks is much different.

CTC Rotations. The Army uses Combat Training Centers to train its forces to desired levels of proficiency. Specifically, this important program "provide[s] realistic joint and combined arms training...approximating actual combat" and increases "unit readiness for deployment and warfighting."[101] For FY 2024, the Army is resourcing 22 CTC rotations: eight at the National Training Center, eight at the Joint Readiness Training Center, four at the Joint Multinational Readiness Center, and two exportable rotations. Two of these 22 rotations are for Army National Guard Brigades.[102]

New Readiness Model. The Army has transitioned from one readiness model to another. Its Sustainable Readiness Model, implementation of which began in 2017, was intended to give units more predictability. Its new Regionally Aligned Readiness and Modernization Model (ReARMM) is designed to "better balance operational tempo (OPTEMPO) with dedicated periods for conducting missions, training, and modernization."[103] ReARMM features units that spend eight months in a modernization-training-mission cycle while preparing to deploy to a specific part of the world. The Army shifted to this new model on October 1, 2021.[104] Since announcing the model in 2021, the Army has been silent on the topic.

In general, the Army continues to be challenged by structural readiness problems as evidenced by too small a force attempting to satisfy too many global presence requirements and Operations Plan (OPLAN) warfighting requirements. If demand is not reduced, the funding cuts and end strength reduction featured in the FY 2023 budget submission and continued in the FY 2024 submission can be expected to result in a continued decline in readiness.

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 (MRC). 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 approximately 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 and 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, our assessment is that 42 BCTs would be needed to fight two MRCs.[105] Taking into account the need for a strategic reserve, the Army force should also include an additional 20 percent of the 42 BCTs, resulting in an overall requirement of 50 BCTs.

Previous editions of the *Index of U.S. Military Strength* counted a small number of Army National Guard BCTs in the overall count of available BCTs. Because the Army no longer makes mention of Army National Guard BCTs at the highest state of readiness, they are no longer counted in this edition of the *Index*. The Army has 31 Regular Army BCTs compared to a two-MRC construct requirement of 50. The Army's overall capacity score therefore remains unchanged from 2022.

- **Two-MRC Benchmark:** 50 Brigade Combat Teams.
- **Actual FY 2022 Level:** 31 Regular Army Brigade Combat Teams.

The Army's current BCT capacity equals 62 percent of the two-MRC benchmark and is therefore scored as "weak."

Capability Score: Marginal

The Army's aggregate capability score remains "marginal." This aggregate score is a result of "marginal" scores for "Age of Equipment," "Size of Modernization Programs," and "Health of Modernization Programs." More detail on these programs can be found in the equipment appendix following this section. The Army is scored "weak" for "Capability of Equipment."

Despite modest progress with the JLTV, M10 Booker, Ground Mobility Vehicle, and AMPV programs, and in spite of such promising developments as creation of Army Futures Command, CFTs, and the initiation of new Research, Development, Testing and Evaluation (RDTE) funded programs, nearly all new Army equipment programs remain in the development phase and in most cases are at least a year from being fielded. FY 2024 requested funding levels for procurement and research and development are down 8 percent compared to the FY 2023 enacted levels, which further slows the pace of Army equipping and reduces the speed of procurement to below industry's minimum sustainment rates in some cases. The result of the FY 2024 budget request would be an Army that is aging faster than it is modernizing.

Readiness Score: Very Strong

The Army reports that 83 percent of its 31 Regular Army BCTs are at the highest state of readiness.[106] The Army's internal requirement is for "66 percent...of the active component BCTs [to be] at the highest readiness levels."[107] Using the assessment methods of this *Index*, this results in a percentage of service requirement of 100 percent, or "very strong."

Overall U.S. Army Score: Marginal

The Army's overall score is calculated based on an unweighted average of its capacity, capability, and readiness scores. The unweighted average is 3.33; thus, the overall Army score is "marginal." This was derived from the aggregate score for capacity ("weak"); capability ("marginal"); and readiness ("very strong"). This score is the same as the assessment of the *2023 Index*, which rated the Army as "marginal" overall.

U.S. Military Power: Army

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity		✓			
Capability			✓		
Readiness					✓
OVERALL			✓		

ARMY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Main Battle Tank

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
M1A1/2 Abrams Inventory: **540/1,605** Fleet age: **21/14** Date: **1980/1993** The Abrams is the Army's primary ground combat system and main battle tank in its Armored Brigade Combat Teams (ABCTs). It is a tracked, low-profile, land combat assault weapon that provides mobility, lethal firepower, and protection. The Abrams has gone through several remanufacture programs to extend its life expectancy to 2045.	3	4	**Decisive Lethality Platform (DLP)** The DLP program, in its earliest stages of conceptualization, is a notional manned or unmanned vehicle that could replace some or all of the Abrams tanks. This program is part of the Next Generation Combat Vehicle (NGCV) program, which is number two among the Army's "Big Six" modernization priorities. The earliest a replacement for the Abrams tank could conceivably be introduced is sometime in 2033.		

Infantry Fighting Vehicle

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
M2 Bradley Inventory: **3,721** Fleet age: **23** Date: **1981** The Bradley is a fully tracked, lightly armored vehicle meant to transport infantry by providing protection from artillery and employing mounted firepower. The Bradley complements the Abrams tank in Armored Brigade Combat Teams (ABCTs). The Bradley has undergone remanufacture programs to extend its life expectancy to 2045.	2	3	**Optionally Manned Fighting Vehicle (OMFV)** The XM30 Mechanized Infantry Combat Vehicle is intended to replace the M2-Bradley Infantry Fighting Vehicle (IFV) and in its objective state will have the ability to conduct remotely controlled operations. The vehicle will include a hybrid-electric engine; a remotely operated cannon (in the objective state 50 mm); machine guns; anti-tank guided missiles; an advanced third-generation forward-looking infrared sensor; "intelligent fire control"; integrated active protection systems; kitted armor; and advanced signature management capabilities. In 2021, the Army awarded five firm fixed-price contracts as part of the XM30 Concept Design Phase where competing firms were asked to develop digital designs. In June 2023, the U.S. Army chose General Dynamics Land Systems and American Rheinmetall to move forward to the detailed design phase. Both companies will produce 11 prototypes for testing in the first quarter of 2025. The Army will choose a winning design in 2027 and begin fielding in 2029. This program is part of the Next Generation Combat Vehicle (NGCV) program, which is number two among the Army's "Big Six" modernization priorities. The Army plans for the first unit to be equipped by FY 2029.		

NOTE: See page 429 for details on fleet ages, dates, and procurement spending.

ARMY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Armored Fighting Vehicle

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Stryker Inventory: **4,223** Fleet age: **16.5** Date: **2001** The Stryker is a wheeled vehicle that is the main platform in Stryker BCTs. The program was considered an interim vehicle to serve until the arrival of the Future Combat System (FCS), but that program was cancelled because of technology and cost hurdles. The original Stryker is being replaced with Double-V-Hull variants. The Double V Hull provides increased under-vehicle blast protection. The Stryker is expected to remain in service for 30-plus years.	4	4	None		

Armored Personnel Carrier

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
M113 Armored Personnel Carrier Inventory: **4,800** Fleet age: **40** Date: **1960** The fully tracked M113 personnel carrier serves in a supporting role for Armored Brigade Combat Teams (ABCTs) and in units above brigade level. As the first mass-produced aluminum combat vehicle, the M113 was made to protect against small-arms fire while being light enough to be transportable. The Army planned to replace the M113 with the Armored Multi-Purpose Vehicle, but due to reduced production rates and higher commodity prices, the cost per vehicle has increased, and the replacement program will take an extended period of time. Plans are to use the current platform until 2045.	1	1	**Armored Multi-Purpose Vehicle (AMPV)** Timeline: **2018–TBD** The AMPV has been adapted from the Bradley Fighting Vehicle, which largely allowed the program to bypass an extensive technology development phase. The fleet will consist of five variants. Although total AMPV production remains behind schedule due to early manufacturing troubles, AMPV production rates reportedly are planned to increase to 131 vehicles per year by FY 2024 and to continue at that rate until at least 2027. **PROCUREMENT** 447 / 2,450 **SPENDING** *($ millions)* $2,826 / $16,970	2	3

Light Wheeled Vehicle

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
HMMWV Inventory: **106,767** Fleet age: **20.5** Date: **1985** The High Mobility Multipurpose Wheeled Vehicle (HMMWV) is a lightweight, highly mobile, high-performance wheeled vehicle used for a variety of purposes in combat or combat support services units. Its expected life span is 15 years. A portion of the HMMWV fleet is being slowly replaced by the Joint Light Tactical Vehicle (JLTV).	1	1	**Joint Light Tactical Vehicle (JLTV)** Timeline: **2015–2036** The JLTV vehicle program is an Army-led, joint-service program that is replacing a portion of the Army's HMMWVs with armored tactical wheeled vehicles. The JLTV provides improved protection, reliability, maneuverability, and survivability of vehicles. In June 2019, the Army approved the JLTV for full-rate production. Production is underway, although current budget shortfalls have forced the Army to reduce procurement quantities. **PROCUREMENT** 5,752 / 4,097 **SPENDING** *($ millions)* $2,465 / $3,512	3	4

NOTE: See page 429 for details on fleet ages, dates, timelines, and procurement spending.

ARMY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Attack Helicopter

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
AH-64 D Apache Inventory: **250** Fleet age: **18.5** Date: **1997** The Apache attack helicopter is designed to support Brigade Combat Teams (BCTs) as well as independent operations in the full spectrum of modern warfare including destroying armor, personnel, and material targets. The Apache has a modular open systems architecture that allows it to incorporate the latest communications, navigation, sensor, and weapon systems. Its expected life cycle is about 20 years.	2	3	**AH-64E Reman** Timeline: **2010–2025** The AH-64E Reman (short for remanufactured) is a program to remanufacture older Apache helicopters into the more advanced AH-64E version, which is fully digital and meets the Army's joint interoperability goals for the future. The AH-64E has a new airframe and can carry modern munitions, including the JAGM missile, giving it significant combat capability as the Army's only heavy attack helicopter. **PROCUREMENT*** 545 / 73 **SPENDING*** *($ millions)* $9,040 / $1,298	3	5
AH-64E Inventory: **490** Fleet age: **5.5** Date: **2012** The AH-64E variant is a remanufactured or newly built version of the AH-64D Apache attack helicopter with substantial upgrades in powerplant, avionics, communications, and weapons capabilities that make it the Army's most advanced attack helicopter. Its expected life cycle is about 20 years. The Army began procurement of the remanufactured version in 2010 and will conclude procurement in 2025.	5	5	**AH-64E New Build** Timeline: **2010-2027** The AH-64E New Build program produces new build rather than rebuilt Apaches. The program is meant to modernize and sustain the current Apache inventory. The AH-64E has more modern and interoperable systems and is able to carry modern munitions, including the JAGM missile. Budget cuts in the 2022 request will likely close the AH-64E New Build line because the need for all-new components makes the cost of procurement significantly higher. **PROCUREMENT*** 81 / 0 **SPENDING*** *($ millions)* $2,139	3	5

* Additional procurement expected.
NOTE: See page 429 for details on fleet ages, dates, timelines, and procurement spending.

ARMY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Medium Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
UH-60A Black Hawk Inventory: **20** Fleet age: **40.5** Date: **1978** The UH-60A is the Army's primary medium-lift utility transport helicopter that provides air assault and aeromedical evacuation and supports special operations. Its expected life span is about 25 years. This variant of the Black Hawk is being replaced by the newer UH-60M variant.	1	1	**UH-60M Black Hawk** Timeline: **2004–TBD** The UH-60M, which began full production in 2007, serves to modernize and replace current Black Hawk inventories. The newer M-variant is a digital networked platform that will improve the Black Hawk's range and lift by upgrading its rotor blades, engine, and computers. **PROCUREMENT*** 1,231 / 74 **SPENDING*** *($ millions)* $18,678 / $2,264	3	5
UH-60M Black Hawk Inventory: **931** Fleet age: **9** Date: **2005** The UH-60M is the modernized version of the original UH-60A Black Hawk helicopter. It has multiple upgrades including multi-mission capabilities, a new airframe, advanced digital avionics, and a powerful propulsion system. As the UH-60A is retired, the M-variant will be the main medium-lift rotorcraft used by the Army until it is replaced by the FLRAA. The UH-60M is expected to remain in service at least until 2040.	5	5			

Heavy Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
CH-47F Chinook Inventory: **450** Fleet age: **10.5** Date: **2002** The F-variant of the CH-47 Chinook heavy-lift helicopter includes a new digital cockpit and monolithic airframe to reduce vibrations. It transports forces and equipment while providing such other functions as parachute drops and aircraft recovery. Its expected life span is 35 years. The Army plans to use the CH-47F at least until the late 2040s.	5	5	**CH-47F** Timeline: **2001–TBD** Currently in production, the CH-47F program is intended to keep the fleet of heavy-lift rotorcraft viable for use in modern combat as older variants of the CH-47, notably the CH-47D, are retired. The program includes both remanufactured and new builds of CH-47s. The F-variant has engine and airframe upgrades to lower its maintenance requirements. Total procurement numbers include the MH-47G configuration, which is used by U.S. Special Operations Command. **PROCUREMENT*** 200 / 26 **SPENDING*** *($ millions)* $5,207 / $1,006	3	5

* Additional procurement expected.
NOTE: See page 429 for details on fleet ages, dates, timelines, and procurement spending.

Intelligence, Surveillance, and Reconnaissance (ISR)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
MQ-1C Gray Eagle Inventory: **180** Fleet age: **0.5** Date: **2011** The Gray Eagle is a medium-altitude long-endurance (MALE) unmanned aerial vehicle (UAV) used to conduct intelligence, surveillance, and reconnaissance (ISR) missions. It offers better range, altitude, and payload flexibility than earlier systems. The Army has no plans to add to the 12 Gray Eagles that it procured in 2023.	4	4	**MQ-1C Gray Eagle** Timeline: **2010–2023** The MQ-1C UAV is an unmanned aircraft system that provides the Army with reconnaissance, surveillance, and target acquisition capabilities. The Army did not plan to procure new MQ-1Cs for FY 2023. **PROCUREMENT** 298 **SPENDING** *($ millions)* $565 $40	5	5

* Additional procurement expected.
NOTES: See Methodology for descriptions of scores. Fleet age is the average between the first and last years of delivery. The date is the year of first delivery. The timeline is from the first year of procurement to the last year of delivery/procurement. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E).

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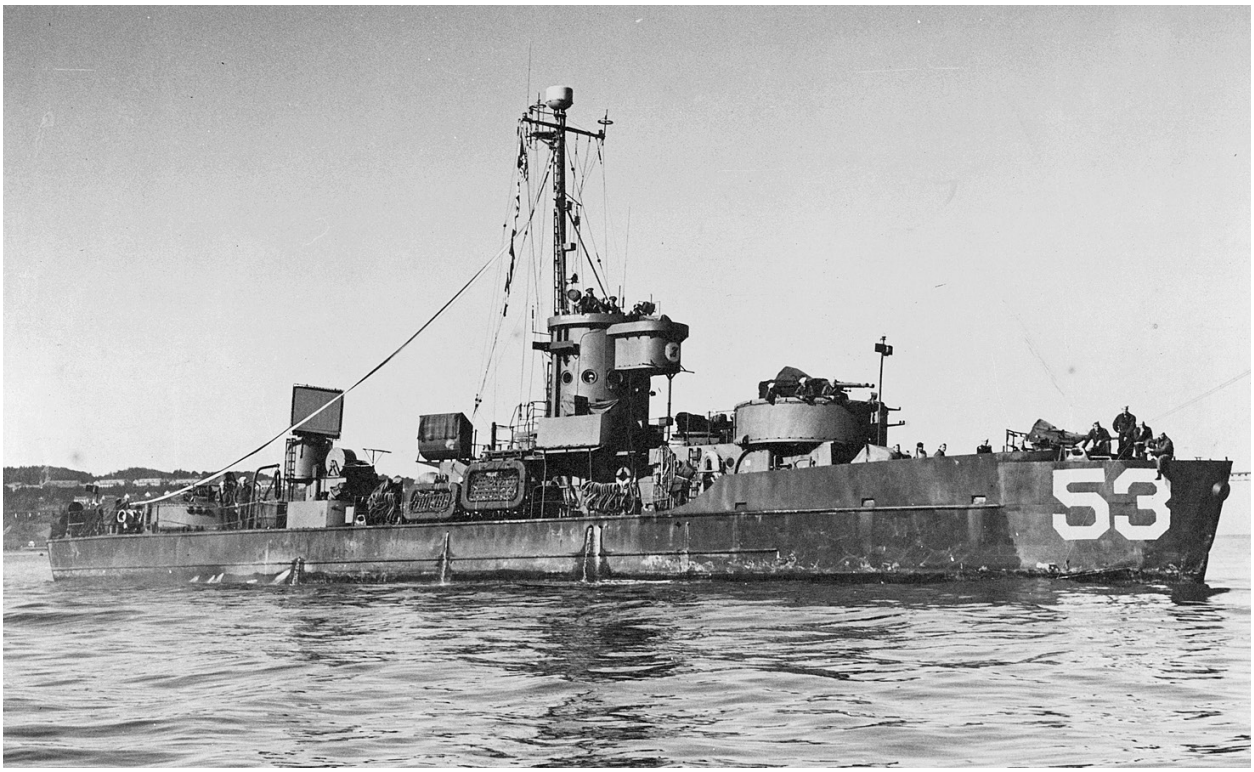


USS LCS(L)(3)-53 under way in San Francisco Bay while returning home in 1946. ENS J. W. Middendorf USNR is the tall man on the bridge. Photo: from Middendorf's personal files.

U.S. Navy Section: Dedication
Ambassador J. William Middendorf II

Throughout his life, Ambassador J. William Middendorf has fought to advance the principles of American freedom both here and abroad. Over the course of his long and distinguished career, he has served as a navigator aboard the USS LCS(L)(3)-53 during World War II, an investment banker, and treasurer of the Republican National Committee and was appointed to ambassadorships in the Netherlands, the Organization of American States, and the European Union. As 62nd Secretary of the Navy, he secured a 60 percent increase in the Navy's budget at a time when those of the Army and Air Force remained flat.

Ambassador Middendorf is a prolific author. His most recent book is *The Great Nightfall: How We Win the New Cold War* (Heritage Harbor Press, 2020), which one critic has described as "a remarkable read" and a "clarion call to action." He was also a driving force behind The Heritage Foundation for many years and served as a Trustee from 1989 to 2022.

In a fitting tribute to this lifetime of service, Heritage Foundation supporters Philip and Patricia Bilden offered a generous gift to Heritage to dedicate the Navy section of the *Index of U.S. Military Strength* to Ambassador Middendorf for the next five years. This is the first time any section of this *Index* has been so dedicated. As chairman of the Naval War College Foundation, Mr. Bilden had the honor of presenting the foundation's highest award—Sentinel of the Sea—to Ambassador Middendorf in 2021 in tribute to his many years of distinguished service to the nation.

We are grateful for the opportunity to honor the many contributions Ambassador Middendorf has made on behalf of individual freedom, traditional American values, and a strong national defense anchored in maritime dominance.

U.S. Navy

Brent D. Sadler

Navies exist to assure access to markets and influence events on land for political ends and to prevail in maritime combat when war occurs. To these ends, the U.S. Navy, Marine Corps, and Coast Guard (known collectively as the sea services) have enabled America to project power across the oceans, controlling activities on the seas whenever and wherever needed.

According to the Department of the Navy's annual budget briefing for fiscal year (FY) 2024, the service's three "enduring priorities" as articulated by the Secretary of the Navy are:

- "Strengthening Maritime Dominance in Order to Defend the Nation,"
- "Taking Care of People through Building a Culture of Warfighting Excellence," and
- "Succeeding through Teamwork by Enhancing Strategic Partnerships."[1]

President Joseph Biden's proposed $202.5 billion Navy budget for FY 2024 represents a $9.7 billion increase over the FY 2023 enacted budget—an increase of 5 percent.[2] While this increase is needed, it is not enough to deliver on the Secretary's goals given persistent inflationary pressures and the rapidly modernizing and expanding Chinese threat.

The Navy remains under immense strain to maintain readiness for combat while also conducting the daily peacetime operations that are necessary to compete with the activities of China and Russia. In the year since publication of the *2023 Index of U.S. Military Strength*, there have been several significant developments that are important to the Navy. For example:

- In January 2023, the Navy shut down its dry docks at the west coast Puget Sound public shipyard and Bremerton naval base to assess vulnerability to earthquake damage.[3] This affected the submarine *Connecticut,* which was awaiting repairs following a collision with an uncharted seamount on October 2, 2021, in the South China Sea, sustaining significant damage.[4]
- On January 10, 2023, the Navy discontinued tracking and reporting on COVID deaths and vaccinations. The final numbers as of February 10, 2023, are 17 uniformed member deaths due to COVID and 1,878 sailors separated for refusing the vaccine.[5]
- On March 13, 2023, after an 18-month review, President Biden was joined in San Diego by prime ministers from the United Kingdom (U.K.) and Australia to announce the way ahead for the Australia–U.K.–U.S. (AUKUS) partnership to develop an Australian nuclear submarine program.[6] This plan includes a rotational presence of U.S. nuclear submarines to be based out of Australia in this decade, ostensibly to train Australian sailors and maintainers in naval nuclear routines as well as to improve forward naval presence.
- On April 4, 2023, the Secretary of the Navy announced that the Fourth Fleet will establish an unmanned task force modeled on the successful Fifth Fleet Task Force 59.[7]

Strategic Framework. In December 2020, to address today's maritime competition more

effectively, the sea services released a naval strategy titled *Advantage at Sea*.[8] It has not yet been fully executed, but there has been some progress regarding forward presence operations that challenge Chinese maritime coercion.[9] To this end, the Navy apparently continues to adjust its deployment patterns to meet new demands caused by the war in Ukraine and increasing tensions in Asia: two carrier strike groups in the Western Pacific (with the exception of four months when only one was present) and a single carrier strike group in the Mediterranean since June 2022. This marks a slight reduction in carrier presence in the Western Pacific from December 2021.[10]

As the U.S. military's primary maritime arm, the Navy is charged with providing the enduring forward global presence that this strategy requires while retaining war-winning forces. The Navy therefore continues to focus its investments on several functional areas: power projection, control of the seas, maritime security, strategic deterrence, and domain access. This approach is informed by several key documents:

- The October 2022 *National Security Strategic Guidance*;[11]
- The December 2020 *Advantage at Sea* naval strategy;
- The 2022 *National Defense Strategy* (NDS) (only an unclassified fact sheet has been released to the public);[12] and
- The Global Force Management Allocation Plan (GFMAP).[13]

U.S. official strategic guidance requires the Navy to act beyond the demands of conventional warfighting. China and Russia use their fleets to establish a physical presence in regions that are important to their economic and security interests in order to influence the policies of other countries. To counter their influence, the U.S. Navy similarly sails ships in these waters to reassure allies of U.S. commitments and signal to competitors that they do not have a free hand to impose their will. This means that the Navy must balance two key missions: ensuring that it has a fleet that is ready for war while also using that fleet for peacetime "presence" operations. Both missions require crews and ships that are materially ready for action and a fleet that is large enough to maintain presence and marshal enough combat power to win in battle.

On July 26, 2022, the Chief of Naval Operations (CNO) released a new Navigation Plan 2022 (NAVPLAN 2022) to provide guidance for the Navy's contribution to the execution of the National Defense Strategy. In this latest edition, the CNO continues his emphasis on forward presence in the United States' daily competition with rivals like China and prioritizes investments in key capabilities like defense against anti-ship missiles and other forms of attack, logistical support capabilities that remain viable in combat, and the ability to share information even when the enemy is targeting the Navy's ability to do so. NAVPLAN 2022 also emphasizes weapons with increased range, new deception capabilities, and improved abilities to make time-critical decisions.[14]

All of this reflects a continuation of demands stemming from the Distributed Maritime Operations concept that has been deemed critical to defeating Chinese anti-access/area denial (A2/AD) capabilities. However, NAVPLAN 2022 lacks a clear timeline either for delivering these capabilities or for ensuring that the fleet is able to employ them in what the CNO acknowledges is a dangerous decade. NAVPLAN 2022 also has added to the several fleet-sizing plans offered by the Navy in recent years, calling for a fleet of 350 manned and 150 unmanned warships along with 3,000 naval aircraft—but without clearly explaining how it will achieve results in a way that the other plans could not.

Lacking a clear operational focus and resourcing strategy, NAVPLAN 2022 has not galvanized political support and has failed to deliver marked improvement either in fleet capabilities or in capacities to deter an increasingly aggressive China. In fact, the most recent long-range shipbuilding plan provides Congress only with a way ahead for a smaller naval force by the end of the decade.[15] Such a disconnect between strategy, plans, and resourcing persists with the latest Battle Force Ship Assessment and Requirement, which indicates that the Navy is short 80 warships (rather than 50) to execute the National Defense Strategy.[16]

This *Index* focuses on the following elements as the primary criteria by which to measure U.S. naval strength:

- Sufficient **capacity** to defeat enemies in major combat operations and provide a credible peacetime forward presence to maintain freedom of shipping lanes and deter aggression,

- Sufficient technical **capability** to ensure that the Navy is able to defeat potential adversaries, and

- Sufficient **readiness** to ensure that the fleet can "fight tonight" given proper material maintenance, personnel training, and physical well-being.

Capacity

Force Structure. The Navy is unique relative to the other services in that its capacity requirements must meet two separate objectives:

1. During peacetime, the Navy must maintain a global presence in distant regions both to deter potential aggressors and to assure allies and security partners.

2. The Navy must be able to win wars. To this end, the Navy measures capacity by the size of its battle force, which is composed of ships it considers directly connected to combat missions.[17]

This *Index* continues the benchmark set in the *2019 Index*: 400 ships to ensure the capability to fight two major regional contingencies (MRCs) simultaneously or nearly simultaneously, as well as a 20 percent strategic reserve, and historical levels of 100 ships that are forward deployed in peacetime.[18] This 400-ship fleet is centered on providing:

- 13 Carrier Strike Groups (CSGs);

- 13 carrier air wings with a minimum of 624 strike fighter aircraft;[19] and

- 15 Expeditionary Strike Groups (ESGs).[20]

Unmanned platforms are not included because they have not matured as a practical asset. They hold great potential and will likely be a significant capability, but until they are developed and fielded in larger numbers, their impact on the Navy's warfighting potential remains speculative. The same holds true across the fleet when it comes to new classes of ships. The Navy is investing in research, modeling, war gaming, and intellectual exercises to improve its understanding of the potential utility of new ship and fleet designs, but until new ships are added to the fleet, it is hard to know how they will affect the Navy's ability to perform its missions. Consequently, this *Index* measures what is known and can be known in naval affairs, assessing the current Navy's size, modernity, and readiness to perform its most important missions today.

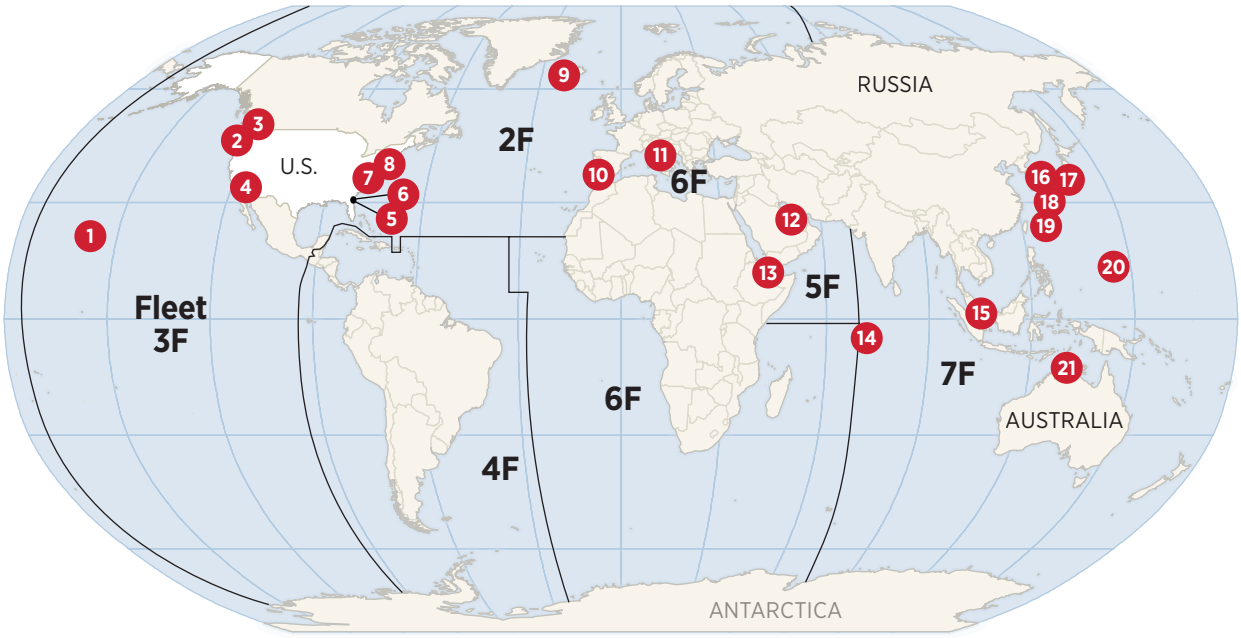
Relative to the above metric, the Navy's fleet of 297 warships as of August 31, 2023—one ship *less* than a year ago—is inadequate and places greater strain on the ability of ships and crews to meet existing operational requirements. To alleviate the operational stress on an undersized fleet, the Navy has attempted since 2016 to build a larger fleet. However, for myriad reasons, it has been unable to achieve sustained growth and in fact has underdelivered by approximately 10 ships each year since 2016.[21] In the past, the Navy has had some success in meeting operational requirements with fewer ships by posturing ships forward as it has done in Rota, Spain; on Guam; and potentially as part of AUKUS in Australia.

At a February 2022 naval conference, the Chief of Naval Operations stated, "I've concluded—consistent with the analysis—that we need a naval force of over 500 ships."[22] He went on to specify that this fleet would include 12 carriers, 19 to 20 large amphibious warships, more than 30 smaller amphibious ships, 60 destroyers, 50 frigates, 70 attack submarines, and a dozen ballistic missile submarines, all backed by 100 support ships and 150 unmanned vessels. Based on the CNO's military advice and Heritage Foundation analysis, today's fleet remains too small to meet today's threats with maximum effectiveness.

Posture/Presence. Although the Navy remains committed to sustaining forward presence, it has struggled to meet the requests of regional Combatant Commanders. The result has been longer and more frequent deployments to meet a historical steady-state forward presence of 100 warships.[23] In 1985, at the height of the Cold War, the percentage of the 571-ship fleet deployed was less than 15 percent, and throughout the 1990s, deployments seldom exceeded the six-month norm: Only 4 percent to 7 percent of the fleet exceeded six-month deployments on an annual basis.[24]

MAP 13

Key U.S. Naval Installations



1. **Joint Base Pearl Harbor-Hickham, HI**
   U.S. Pacific Fleet headquarters
2. **Naval Base Kitsap**
3. **Naval Station Everett, WA**
4. **Naval Base San Diego and Naval Base Coronado, CA**
   U.S. Third Fleet headquarters
5. **Naval Station Mayport, FL**
   U.S. Fourth Fleet headquarters
6. **Naval Submarine Base King's Bay, GA**
7. **Naval Base Norfolk and Joint Expeditionary Base Little Creek, VA**
   U.S. Fleet Forces Command and U.S. Second Fleet headquarters
8. **Naval Submarine Base New London, CT**
9. **Keflavik, Iceland—Expeditionary Maritime Operations Center**
10. **Naval Station Rota, Spain**
11. **Naval Support Activity Gaeta, Italy**
    U.S. Sixth Fleet headquarters
12. **Naval Support Activity, Bahrain**
    U.S. Fifth Fleet headquarters
13. **Lemonnier, Djibouti—Camp Lemonnier**
14. **Diego Garcia—Navy Support Facility Diego Garcia**
15. **Singapore—Commander Logistics Group Western Pacific**
16. **Buson, South Korea—Fleet Activities Chinhae Navy Base**
17. **U.S. Fleet Activity Yokosuka, Japan**
    U.S. Seventh Fleet headquarters
18. **U.S. Fleet Activity Sasebo, Japan**
19. **Okinawa, Japan—Naval Base White Beach**
20. **Naval Base Guam—Navy Expeditionary Force Command Pacific headquarters**
21. **Darwin, Australia—Marine Rotational Force Darwin**

NOTE: Fleet boundaries are approximate.
SOURCE: Heritage Foundation research.

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Using the Navy's aircraft carrier fleet—the most taxed platform—as a sample set, for 20 years, approximately 25 percent of the aircraft carrier fleet has been deployed. Following the 2017 deadly collisions involving USS *McCain* and USS *Fitzgerald*, the overall fleet deployment percentage dropped temporarily to less than 20 percent, but it surged again to almost 30 percent in 2020.[25] High operational tempo (OPTEMPO) remains an issue as the Navy works to secure U.S. interests against increasing Chinese distant naval deployments and provocations, North Korea's ballistic missile submarine, Iranian attacks on and interdiction of commercial shipping in the Persian Gulf, and an active Russian Navy.

The numbers as of August 31, 2023, are typical for a total battle force of 297 deployable ships with 74 warships at sea: 41 deployed and underway and 33 underway on local operations for an OPTEMPO of 24.9 percent, well above Cold War levels.[26] Given Combatant Commanders' requirements for naval presence, there is impetus to have as many ships forward deployed as possible by:

- **Homeporting.** The ships, crew, and their families are stationed at the port or based abroad (for example, a CSG in Yokosuka, Japan).

- **Forward Stationing.** Only the ships are based abroad, and crews are rotated out to the ship.[27] This deployment model is currently used for Littoral Combat Ships (LCS) and *Ohio*–class guided missile submarines (SSGNs) manned with rotating blue and gold crews, effectively doubling the normal forward deployment time (for example, LCS in Singapore).

These options allow one forward-based ship to provide a greater level of presence than four ships based in the continental United States (CONUS) can provide by offsetting the time needed to transit ships to and familiarize their crews with distant theaters.[28] This is captured in the Navy's GFM planning assumptions: a forward-deployed presence rate of 19 percent for a CONUS-based ship compared to a 67 percent presence rate for an overseas-homeported ship.[29] To date, the Navy's use of homeporting and forward stationing has not mitigated the effect of the reduction in overall fleet size on forward presence.

Shipbuilding Capacity. To meet stated fleet-size goals, the Navy must build faster and maintain more ships, exceeding its current capacity. However, significant shortfalls in shipyards, both government and commercial, make it hard to accomplish either task, and underfunded defense budgets make it even more difficult. Given the limited ability to build ships, the Navy will struggle to meet the congressionally mandated 355-ship goal,[30] to say nothing of the 400-ship goal advocated in this *Index*.

Since FY 2020 the Navy's procurement of warships has averaged 12 per year, but only after Congress has added funding above the President's proposed budget to support an average of three additional warships each year. Moreover, subsequent procurement has not kept pace with the threat from China and does not appear to meet congressional mandates. For example, Congress has mandated that the Navy should achieve a fleet of 12 aircraft carriers,[31] but the number is shrinking to nine (possibly to be augmented by a light carrier that has yet to be defined).[32]

However, it was the Navy's failure to propose a long-range build plan that met congressional mandates for 31 amphibious warships that boiled over in 2023.[33] World events demonstrated the danger of having inadequate amphibious forces in April 2023 when Americans were stranded amid flaring factional war in Sudan. Marine Corps Commandant General David Berger made clear before the House Armed Services Committee that the lack of "a sea based option" contributed directly to complicating the evacuation of citizens out of harm's way. Sea-based options are "how we reinforce embassies. That's how we evacuate them. That's how we deter."[34]

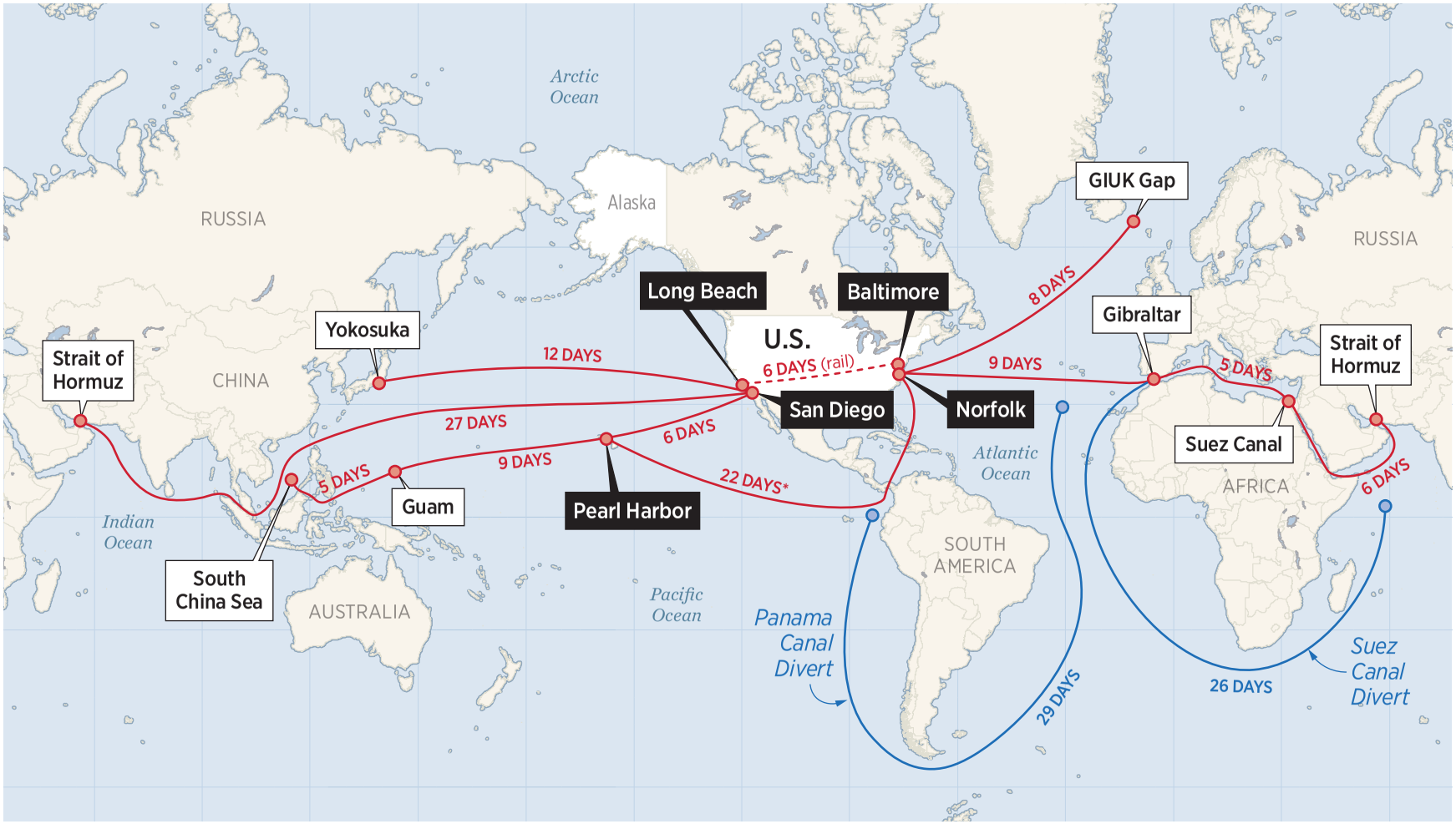
Despite such consequences, the current long-range shipbuilding plan does not provide a plan to reverse downward trends in the fleet. Instead, in accordance with the President's planned procurement over the next five years, the battle force inventory will drop to 280 manned ships by FY 2027.[35]

Meanwhile, diminished demand for ships has led shipbuilders to divest workforce and delay capital investments. From 2005 to 2020, the Navy's procurement of new warships increased the size of the fleet from 291 to 296 warships; at the same time, China's navy grew from 216 to 360 warships.[36] If the Navy is to build a larger fleet, more shipbuilders will have to be hired and trained—a lengthy process that precedes any expansion of the fleet. Recent

MAP 14

Steaming Times to Areas of Vital U.S. National Interest

Steam times are approximate based on an average speed of 15 knots.



* Assumes no delay in passage through the Panama Canal.

SOURCE: Heritage Foundation research.

labor statistics comparing 2017 to 2021 show modest progress with total shipbuilding labor involved in production, like welders and pipefitters, adding 3,134 workers.[37] On the other hand, according to the most recent labor statistics, wages in the nation's shipbuilding sector have not kept pace with inflation, growing at 0.4 percent, and the sector has shed 2.6 percent of its already small cadre of professional naval architects and engineers.[38]

Of particular concern is the need to increase the production of nuclear-powered warships, most notably nuclear-powered submarines that would be vital in any conflict with China. Limited nuclear shipbuilding capacity[39] may constrain the Navy's plans to increase the build rate from two attack submarines per year to three while concurrently building one ballistic missile submarine.[40] To support a larger nuclear-powered fleet, the relevant public shipyards increased their workforce by 16 percent from 2013 to 2020,[41] but recent developments indicate that required workforce growth has not continued. The *Virginia*–class attack submarine program is 25 percent below staffing needs with delays of up to two years in delivery of the latest Block V variant, which will deploy large numbers of cruise missiles and potentially hypersonic strike weapons.[42] As demand for nuclear-powered warships increases, to include added demand to support AUKUS, to pace the threat from China and Russia into the foreseeable future, the public shipyards must be able to sustain the recruitment of skilled labor in the numbers needed.

It remains true, according to the Chief of Naval Operations, that current funding will not build or maintain the larger fleet that both the Navy and this *Index* say is needed and that Congress has mandated. Nothing has changed to alter CNO Admiral Michael Gilday's 2021 assessment that current budgets can only "sustain a Navy of about 300 to 305 ships."[43] In addition, the Government Accountability Office (GAO) has noted that a brittle defense industrial base continues to drive up costs and create delays.[44]

Manpower. In 2018, the Navy assessed that its manpower would need to grow by approximately 35,000 to achieve an end strength of 360,395 sailors to support a 355-ship Navy.[45] For comparison, the last time the Navy had a similar number of ships was in 1997, when it had 359 ships and a total of 398,847 personnel.[46] As of May 19, 2023, the Navy consisted of 335,187 officers and sailors,[47] down 9,640 from the 344,824 reported as of June 2022,[48] leading to a growing deficit of 25,208 below what is needed to meet its 2034 fleet goal.

Regrettably, trends for the Navy's personnel budget and for its recruiting and retention efforts are pointing in the wrong direction. Despite the need for more sailors and officers, total end strength has fallen from 344,441 in FY 2022 to an estimated 341,736 in FY 2023 and is trending toward 342,700 in FY 2028.[49] If approved, the most recent budget request would bend this downward curve by raising FY 2024 manning to 347,000, [50] but this is not necessarily a cure for the Navy's recruiting woes. Authorized manning numbers should reflect the fleet needed rather than what can be recruited today, and it remains to be seen whether retention rates can be sustained to meet long-range manning needs. According to data provided by the Navy's Personnel Command, while officer retention has remained relatively flat in recent years, enlisted retention has declined consistently between FY 2018 and FY 2022.

Failing to meet retention goals while at the same time falling short of recruitment goals will place greater demand on a smaller active-duty end strength, and the consequences will be seen in the operational capabilities of the Navy's fleet. The GAO has reported persistent crew manning shortfalls. A GAO report published in May 2021 showed some ships with crew shortfalls as high as 15 percent, which compounded crew fatigue as smaller crews had to make up the workload. This was a contributing factor in fatal collisions in 2017.[51]

Finally, the effort to attract people to join the Navy is made more difficult by wages that are not keeping up with inflated costs of living. In the battle for people, pay raises in recent years have consistently lagged behind inflation, the latest proposed 5.2 percent raise being the first in several years to be slightly ahead of inflation, which stood at 4.9 percent between April 2022 and April 2023.[52]

Capability

A complete measure of naval capabilities requires an assessment of U.S. platforms against enemy weapons in plausible scenarios. The Navy routinely conducts war games, exercises, and simulations to assess this, but insight into its assessments is limited by their classified nature. This *Index* therefore assesses capability based on

TABLE 10

Navy Fleet Design

Platform Class	Navy Plan, March 2023	BY 2027 Recommendation	BY 2027 Navy Plan, Dec. 2020	BY 2027 Navy Plan, March 2023	BY 2045 Range per Future Naval Force Study, 2020
Unmanned (LUSV, MUSV, XLUUV)	0*	36	21**	0**	143 to 242
Aircraft Carriers (CVN, CVNE, CVS)	11	12	10	10	8 to 17
Large Surface Combatant	85	110	97	85	73 to 88
Small Surface Combatant	33	37	34	23	60 to 67
Logistics and Support Vessels	67	90	82	76	96 to 117
Submarines (SSBN, SSGN, SSN)	68	77	67	63	84 to 90
Amphibious Warships	29	41	32	28	61 to 67
Total Without Unmanned	293	367	322	285	382 to 446
Total	293	403	343	285	525 to 688

* As of June 2023, the U.S. Navy had only prototypes in operation for XLUUV, LUSV, and MUSV.
** 21 unmanned vessels were planned for procurement by fiscal year 2026; the long-range plan included no procurement data for unmanned platforms in 2022.
Sources:

- **Recommendation:** Appendix Table 1, "Naval Shipbuilding Proposal," in Brent D. Sadler, "Rebuilding America's Military: The United States Navy," Heritage Foundation Special Report No. 242, February 18, 2021, p. 83, http://report.heritage.org/sr242.
- **Navy plan, December 2020, and Future Naval Force Study:** U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF (accessed September 9, 2023); David B. Larter and Aaron Mehta, "The Pentagon Is Eyeing a 500-Ship Navy, Documents Reveal," *Defense News*, September 24, 2020, https://www.defensenews.com/naval/2020/09/24/the-pentagon-is-eyeing-a-500-ship-navy-documents-reveal/ (accessed September 9, 2023); and Ronald O'Rourke, "Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL32665, September 17, 2020, pp. 10 and 11, https://www.everycrsreport.com/files/2020-09-17_RL32665_c609d44928ddf6f859c2d347ac90c2ab90a813ed.pdf (accessed September 9, 2023).
- **Navy plan, March 2023:** U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations for Warfighting Requirements and Capabilities–OPNAV N9, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2024*, March 2023, https://www.govexec.com/media/navy_2024_shipbuilding_plan.pdf (accessed September 9, 2023).

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remaining hull life, mission effectiveness, payloads, and the feasibility of maintaining the platform's technological edge.

Most of the Navy's fleet consists of older platforms: Of the Navy's 20 classes of ships, only eight are in production. However, because Congress added almost $15 billion to the FY 2023 budget, the proposed $255.8 billion Department of the Navy budget for FY 2024 represents a real dollar increase of $11.0 billion, which is a relative increase of 4.5 percent from the previous year, and procurement is set to increase by two points to 6 percent of the Navy's budget.[53] The following are highlights by platform.

Ballistic Missile Submarines (SSBN). The *Columbia*–class submarine will relieve the aging *Ohio*–class SSBN fleet. Because of the implications of this change for the nation's strategic nuclear deterrence, the *Columbia*–class SSBN remains the Navy's top acquisition priority. To ensure the continuity of this leg of the U.S. nuclear triad, the first *Columbia*–class SSBN must be delivered on time for its first deterrent patrol in 2031.[54] In November

2020, the Navy signed a $9.47 billion contract with General Dynamics Electric Boat for the first-in-class boat and advanced procurement for long-lead-time components of the second hull.[55] The lead ship's keel-laying ceremony occurred on June 4, 2022.[56]

However, concerns persist in Congress that the Department of Defense (DOD) may not be fully utilizing special authorities granted to the Navy to ensure that this critical program is adequately resourced. Specifically, in 2014, Congress established the National Sea-Based Deterrence Fund (NSBDF), which has saved more than $1.4 billion using flexible funding, but it "has yet to utilize the core function of the NSBDF—namely, to provide increased flexibility to repurpose funds into it to buy down the fiscal impact of the program on our other shipbuilding priorities."[57]

Nuclear Attack Submarines (SSN). SSNs are multi-mission platforms whose stealth enables clandestine intelligence collection; surveillance; anti-submarine warfare (ASW); anti-surface warfare (ASuW); insertion and extraction of special operations forces; land attack strikes; and offensive mine warfare. The newest SSN class, the Block V *Virginia* with the Virginia Payload Module (VPM) enhancement, is important to the Navy's overall strike capacity, enabling the employment of an additional 28 Tomahawk cruise missiles over earlier SSN variants.[58] Construction of Block V submarines began in September 2019 with the *Oklahoma* (SSN 802) to be delivered in May 2027 and three more boats to be delivered before the end of the decade.[59] As noted previously, a limited shipyard workforce is causing this program to be delayed by as many as two years.

The FY 2021 National Defense Authorization Act included additional funds for advanced procurement that preserves a future option to buy as many as 10 *Virginia*–class submarines through the end of the decade. The FY 2024 budget supports this with a sustained build rate of two *Virginia*–class submarines a year through FY 2028. As indicated previously, increasing *Virginia*–class production for AUKUS has raised concerns regarding strain on the industrial base, and the FY 2023 budget put $1.6 billion toward expansion of the submarine industrial base "to support the Navy plan of serial production of 1 COLUMBIA plus 2 VIRGINIAs starting in FY25/26."[60] Marks to the FY 2024 proposed defense budget point to continued congressional support for increased naval shipbuilding capacity.[61]

The effectiveness of such efforts, however, must be measured not by intent, but by results: delivery of warships on time. At the same time, supply-chain quality control is a key factor in submarine construction, and if it is not done well, the consequences can be catastrophic. That is why the premature replacement of critical submarine parts in 2021—parts that are intended to last the life of the boat—remains a concern.[62] Added vigilance will be required as the Navy finds new suppliers to meet future increased submarine production as well as the potential need to provide support to AUKUS.

Aircraft Carriers (CVN). The Navy has 11 nuclear-powered aircraft carriers: 10 *Nimitz*–class and one *Ford*–class. The Navy has been making progress in overcoming nagging issues with several advanced systems, notably advanced weapons elevators, and the *Ford*'s first operational deployment in the fall of 2022 to the North Atlantic.[63] Further bolstering confidence in this new class, the *Ford* deployed to the Mediterranean in May 2023 to sustain a persistent carrier presence there following Russia's February 2022 invasion of Ukraine.[64] The second ship in the class, *USS John F. Kennedy* (CVN 79), was christened on December 7, 2019, but its scheduled delivery to the Indo-Pacific theater has slipped from 2022 to 2025 to support late modifications for fifth-generation fighters like the F-35.[65] The *Kennedy* is to be followed by the *Enterprise* (CVN 80), which is in early construction with delivery planned for 2028.

The U.S. lead in this category of naval power may be waning as China completes construction of its first super carrier. As the U.S. Navy struggles to build, maintain, and crew a fleet of 11 aircraft carriers, China is rapidly catching up both in numbers and in platform capability. Its newest carrier, the Type-003, like the *Ford*–class, will utilize electromagnetic catapults that give its air wing greater range and sortie rates, thus greatly narrowing the capability gap.[66] The Type-003 is China's second indigenously built carrier, marking a significant engineering milestone. There had been renewed emphasis on having the ship delivered before the October 2022 Chinese Communist Party (CCP) Congress,[67] and after a sprint by the shipyard, the new 80,000-ton Type-003 aircraft carrier was launched in June 2022.[68] China's growing naval aviation and aircraft

carrier capabilities place added stress on U.S. naval aviation and air defenses.

Large Surface Combatants. The Navy's large surface combatants consist of the *Ticonderoga*–class cruiser, the *Zumwalt*–class destroyer, and the *Arleigh Burke*–class destroyer. The President's FY 2024 budget would decommission five of the 13 aged *Ticonderoga*–class cruisers in the Navy's FY 2023 inventory.[69] Should Congress succeed in retaining two of these cruisers, decommissioning of the remaining three would still represent a significant decrement of the Navy's sea-launched firepower with the loss of a total of 366 vertical launch tubes. Attempts to repurpose or extend the life of the aging *Ticonderoga*–class cruisers have yielded mixed results, as deferred upgrades and past incomplete maintenance are driving up operating costs.[70]

In FY 2022, the Navy procured two *Arleigh Burke*–class DDG 51 destroyers, bringing the total on active duty in the fleet to 70, and 14 more have been ordered. Since the Navy declined to pursue a new cruiser in 2008, it has relied on a final iteration of the *Arleigh Burke* class, Flight III, to provide air and missile defense for aircraft carrier strike groups.[71] This will remain a stopgap measure until a more capable new destroyer, DDG(X), joins the fleet, probably in the next decade. The Navy's other modern destroyer, the *Zumwalt* class, was never intended as a cruiser replacement and looks to fill a limited long-range strike role.

The *Zumwalt* class was envisioned as bringing advanced capabilities to the fleet, but the program has suffered technological problems and cost overruns, and the Navy has not indicated that it intends to acquire more than the three that have already been purchased and are being built out: the USS *Zumwalt* (DDG-1000), which was delivered on April 24, 2020; USS *Michael Monsoor* (DDG-1001), which was commissioned on January 26, 2019; and USS *Lyndon B. Johnson* (DDG-1002), which is completing checks before delivery to the Navy in 2024.[72] The *Zumwalt* is currently based in San Diego, but its initial operational capability (IOC) has been delayed by a year, overlapping with plans to install the Navy's new hypersonic weapons system, conventional prompt strike (CPS), beginning in October 2023 with the remaining two ships to receive the system in due course.[73] Reports in September 2022 indicated that the *Zumwalt* had conducted it first deployment, albeit truncated, to Seventh Fleet's Western Pacific area of operations.[74]

To reach 355 ships by 2034, the Navy plans several class-wide service life extensions, notably the extension of the DDG-51–class's service life from 35 to 40 years and modernization of older hulls. The FY 2020 budget included $4 billion for modernization of 19 destroyers from FY 2021 through FY 2024.[75] The previously noted planned decommissioning of five cruisers in FY 2023 makes this more critical.

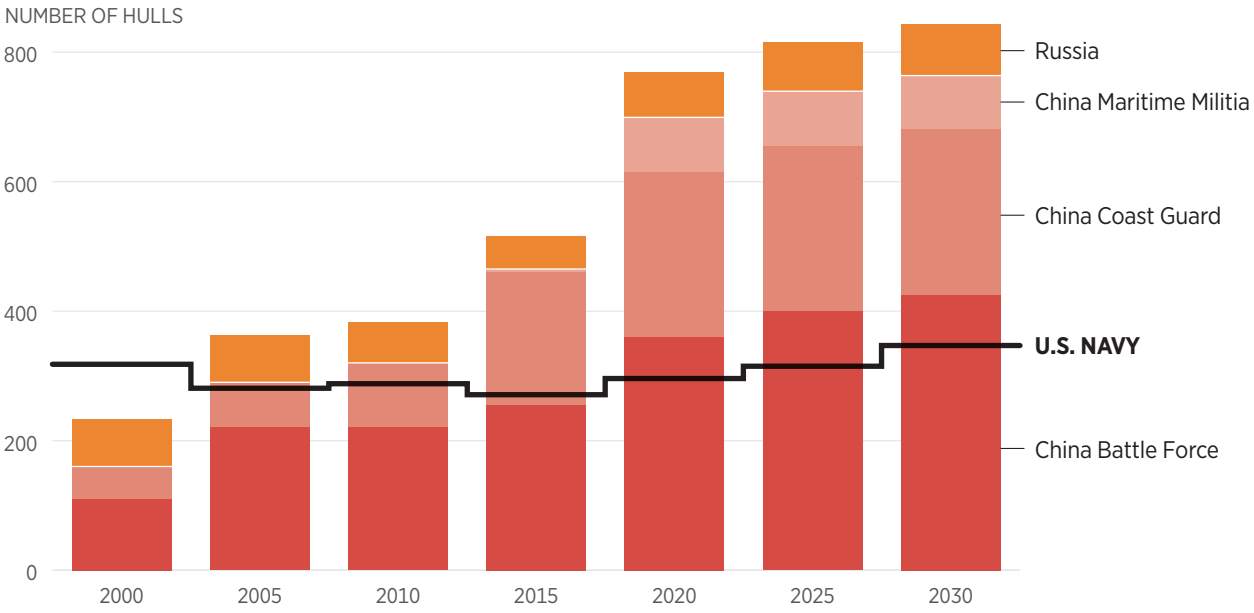
Small Surface Combatants. The Navy's small surface combatants consist principally of the *Avenger*–class mine countermeasures (MCM) ship; the Littoral Combat Ship (LCS); and the *Constellation*–class frigate (FFG), which began production in 2021. In January 2021, the Navy halted production of the mono-hull LCS *Freedom*-variant until issues involving the design of its propulsion system are resolved. After that decision was made, in April 2023, the final *Freedom* variant was launched.[76] In the meantime, the top speed of affected ships (currently 40-plus knots) is reportedly limited to 34 knots.[77] Under the Navy's FY 2020 30-year shipbuilding plan, the fleet of 23 LCSs was expected to grow to 34 and be joined by 18 frigates by FY 2034.[78] Since then, the Navy has reversed course and terminated the LCS anti-submarine mission module program (10 units originally planned) and plans to decommission the remaining nine *Freedom* monohull variants.[79]

On August 20, 2020, the Navy decommissioned three of its aging *Avenger*–class MCM ships, leaving eight in service overseas in Sasebo, Japan, and Manama, Bahrain. These represent the only ship class dedicated to countering the mine threat.[80] The current long-range shipbuilding plan confirms that the Navy intends to operate these aged MCMs through FY 2027.[81]

As these ships reach the end of their service life, the Navy is relying on the development of LCS mine countermeasure mission packages to provide this capability. At an April 2022 webinar, the CNO indicated that these mission modules were on track to reach IOC by the end of 2022.[82] Since then, the Navy has canceled its ASW mission modules because of insurmountable engineering challenges, and on May 1, 2023, it announced that the MCM modules had achieved initial operational capability.[83] In an unanticipated move, the Navy began to

CHART 13

U.S. vs. China and Russia Navies: Fleet Expansion Trends



NOTE: U.S. figures are actual through 2020. Figures for 2025 and 2030 are from the Navy's December 2020 30-year shipbuilding plan. See U.S. Navy, Office of the Chief of Naval Operations, Deputy Chief of Naval Operations (Warfighting Requirements and Capabilities–OPNAV N9), *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels*, December 9, 2020, https://media.defense.gov/2020/Dec/10/2002549918/-1/-1/1/SHIPBUILDING%20PLAN%20DEC%2020_NAVY_OSD_OMB_FINAL.PDF (accessed September 9, 2023).

SOURCES:

- Figure 1, "Growth of China's Maritime Forces Since 2000," in U.S. Department of the Navy, U.S. Marine Corps, and U.S. Coast Guard, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power*, December 2020, p. 4, https://media.defense.gov/2020/Dec/16/2002553074/-1/-1/0/TRISERVICESTRATEGY.PDF (accessed September 9, 2023).
- Table 2, "Numbers of Chinese and U.S. Navy Battle Force Ships, 2000–2030," in Ronald O'Rourke, "China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress," Congressional Research Service *Report for Members and Committees of Congress* No. RL33153, updated January 27, 2021, p. 32, https://crsreports.congress.gov/product/pdf/ RL/RL33153/248 (accessed September 9, 2023).
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- Michael A. McDevitt, Rear Admiral, U.S. Navy (Ret.), prepared statement in hearing, *Department of Defense's Role in Competing with China*, Committee on Armed Services, U.S. House of Representatives, 116th Cong. 2nd Sess., January 15, 2020, pp. 76–88, https://www.govinfo.gov/content/pkg/CHRG-116hhrg40508/pdf/CHRG-116hhrg40508.pdf (accessed September 9, 2023).

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arm LCS with the naval strike missile, giving these ships a long-range anti-ship capability that they had lacked despite notable operations by the class in the South China Sea.[84] On December 9, 2021, the San Diego-based *Independence*-variant *Oakland* received this new capability.[85] Installation and procurement of surface warfare modules and associated surface-to-surface missile modules (LCS SSMM) is progressing; the procurement of 18 LCS SSMM planned for FY 2024 includes offensive and defense systems and associated munitions.[86]

Instead of requesting additional LCS, the Navy has focused on a new frigate. On April 30, 2020, the Navy awarded Fincantieri a $795 million contract to build the lead ship of the new *Constellation*–class frigate at its Marinette Marine shipyard in Wisconsin based on a proven design currently in service with the French and Italian navies.[87] While the

design for the U.S. ship has not been finalized, the frigate is intended to be a multi-mission warship with 32 VLS cells, as many as 16 containerized naval strike missiles (NSM), and one helicopter.[88] As of June 2023, 90 percent of function design and 80 percent of detail design work had been completed despite construction having already begun with some risk of program delay and cost increase.[89] In May 2021, the Navy contracted for the second ship in the class, the USS *Congress* (FFG-63).[90] The Navy purchased a third ship in FY 2022 and plans to purchase two more in FY 2024. The Navy has awarded Fincantieri a $526 million contract for a fourth frigate, but a decision for a second shipyard to begin construction of frigates that was to be made in FY 2023 has been delayed, and this could affect future production rates.[91]

Amphibious Ships. Commandant of the Marine Corps General David Berger issued his "Commandant's Planning Guidance" in July 2019 and "Force Design 2030" in March 2020. Both documents signaled a break with past Marine Corps requests for amphibious lift, specifically moving away from the requirement for 38 amphibious ships to support an amphibious force of two Marine Expeditionary Brigades (MEB).[92] The Commandant envisioned a larger yet affordable fleet of smaller, low-signature amphibious ships—the Landing Ship Medium (LSM)[93]—that enable littoral maneuver and associated logistics support in a contested theater.[94] However, the amphibious fleet remains centered on fewer large ships. This vision remains years away from being realized with Congress holding the line at "not less than 31 operational amphibious warfare ships."[95]

The Navy's Future Naval Force Study (FNFS)[96] and December 2020 30-year shipbuilding plan acknowledged the growing importance of the LSM, which will have to be produced rapidly and in sufficient numbers in order to actualize the naval forces' distributed concepts of operations (for example, Marine Littoral Regiments and Distributed Maritime Operations). According to the April 2022 long-range shipbuilding plan, the Navy intends to purchase the first LSM in FY 2025. The Marine Corps had intended to have the ship under contract by the summer of 2022, but because of delays, it has begun to use alternative platforms to train and work out operational concepts so that it will be ready when the ship eventually is delivered.[97]

As of September 2023, the Navy had nine amphibious assault ships in the fleet (seven *Wasp*–class LHD and two *America*–class LHA); 12 amphibious transport docks (LPD); and 10 dock landing ships (LSD).[98] The FY 2021 budget included $250 million in additional funds to accelerate construction of LHA-9 following the July 2020 catastrophic fire on *Bonhomme Richard* (LHD-6).[99] The decision to decommission the damaged ship further exposed limitations in shipyard capacity, as repairs would have had a negative effect on other planned shipbuilding and maintenance.[100] In December 2022, construction began on the USS *Fallujah* (LHA-9), which, like the *Bonhomme Richard*, is to be configured for F-35B joint strike fighters and MV-22 Osprey tilt-rotor aircraft, at a cost of $2.4 billion.[101]

The Navy's LSDs, the *Whidbey Island*–class and *Harpers Ferry*–class amphibious vessels, are scheduled to reach the end of their 40-year service lives beginning in 2025. The USS *Harrisburg* (LPD-30) of the *San Antonio*–class Landing Platform Dock amphibious ships began construction in April 2020 and when delivered will be the first of 13 *San Antonio*–class Flight II ships to replace the legacy LSD ships. The 12th first flight *San Antonio*–class ship (LPD 28) was delivered six months later than reported in the *2022 Index*.[102]

The FY 2021 budget included $500 million "to maximize the benefit of the amphibious ship procurement authorities provided elsewhere in this Act through the procurement of long lead material for LPD-32 and LPD-33."[103] The Navy's FY 2023 budget funded LPD-32 with a $1.295 billion contract for the ship's construction.[104] LPD-32 is the most recently purchased of the 13 Flight IIs that were originally envisioned. The Marine Corps has sought procurement of LPD-33 and has kept it at the top of its unfunded requirements list.[105] The three-way dispute among the Secretary of Defense's staff, the Navy, and the Marine Corps over the future of the large amphibious warship fleet remains contentious and unresolved.[106]

Unmanned Systems. The Navy does not include unmanned ships in counting its battle force size. Previous long-range shipbuilding plans envisioned the purchase of 13 Large Unmanned Surface Vessels (LUSV); one Medium Unmanned Surface Vessel (MUSV); and eight Extra Large Undersea Unmanned Vessels (XLUUV) by FY 2026.[107] The Navy continues to test and evaluate seven prototype

unmanned platforms, five of which are to be delivered by FY 2028. Additionally, current plans call for procurement of the LUSV to begin in FY 2025 and increase to three per year beginning in FY 2027.[108] On May 18, 2021, an experimental LUSV, the *Nomad*, transited the Panama Canal on its way to Surface Development Squadron (SURFDESRON) 1 based in California.[109] SURFDESRON 1 operates MUSV *Sea Hunter* prototypes, LUSV, and the *Zumwalt* destroyer to advance the Navy's unmanned surface warship capabilities.[110] Since publication of the *2023 Index*, the Navy has made notable progress with its unmanned fleet.

The Navy reached a significant milestone in September 2021 when its small fleet of unmanned surface ships launched and hit a target with an SM-6 interceptor missile.[111] After years in a laboratory and in controlled at-sea navigational tests, unmanned ships are now deploying in operational settings. That same month, Task Force 59, based in the Persian Gulf and comprised of smaller unmanned drones and vessels, conducted International Maritime Exercise 2022 (IMX22), an exercise in the Red Sea that involved 10 nations and more than 80 unmanned platforms.[112] In a sign of growing confidence, the Navy announced that it will establish a similar unmanned vessel task force at Fourth Fleet based in Mayport, Florida.[113]

Logistics, Auxiliary, and Expeditionary Ships. Expeditionary support vessels are highly flexible platforms of two types: those used for prepositioning and sustaining forward operations and others used for high-speed lift in uncontested environments. The Navy has five of the former (two Expeditionary Transfer Dock [ESD] and three Expeditionary Sea Base [ESB] vessels) and 12 of the latter (shallow-draft Expeditionary Fast Transport [EPF] vessels). In March and April 2022, ESB *Hershel Williams* (ESB 4) demonstrated the versatility of these ships during maritime security missions with African coast guards and navies. In August 2021, it conducted a counter-piracy exercise with the Brazilian navy. At the same time, China was attempting to secure a base in Equatorial Guinea.[114] The Navy christened ESB 6, USNS *John L. Canley*, on June 25, 2022.[115] ESB 7, USNS *Robert E. Simanek*, is currently under construction in San Diego, California, with its keel having been laid in October 2021.[116]

With their shallow draft and versatile cargo capacity, EPFs offer unique capabilities that are well suited to austere but uncontested waters. Specifically, these ships can transport 600 short tons of military cargo (for example, main battle tanks) 1,200 nautical miles at 35 knots. The Navy christened its 13th EPF, the USNS *Apalachicola*, on November 13, 2021, and construction is progressing.[117] In March 2021, the Navy revised its contract with Austal USA for $235 million to modify EPF 14 and the future EPF 15 to enable them to serve as high-speed hospital ships with the capability of embarking a V-22 tilt-rotor aircraft.[118] The keel for EPF 14 configured as a hospital ship was laid on January 26, 2022, and construction of EPF 15 in the same configuration commenced the same month.[119] EPF 14, USNS *Cody*, was launched on March 20, 2023.[120]

The Navy's Combat Logistics Force (CLF) includes dry-cargo and ammunition ships (T-AKE); fast combat support ships (T-AOE); and oilers (AO). The CLF provides critical support, including at-sea replenishment, that enables the Navy to sustain the fleet at sea for prolonged periods. The Navy's future oiler *John Lewis* (T-AO 205) was procured in 2016 and launched five years later on January 12, 2021; 20 ships of this class are planned.[121] However, because of a flooding incident at the graving dock, delivery of *John Lewis* was delayed, and this in turn caused cascading delays of 12 to 15 months in construction of the second through sixth ships.[122] The lead ship of the class, *John Lewis*, was delivered to the Navy in July 2022, and three ships of the class are currently under construction.[123]

Secretary of Defense Lloyd Austin's March 7, 2022, decision to dismantle Red Hill fuel storage facilities in Hawaii will generate additional pressure to increase the Navy's at-sea oiler fleet to meet operational needs in the Pacific. A plan specifying how the Navy will mitigate the loss of these massive Pacific fuel storage facilities was due by May 31, 2022.[124] As of June 16, 2023, the details of this plan had not been made public, and it remains uncertain, given delays in the construction of oilers, exactly how the fleet's operational energy needs will be met.[125]

Strike Platforms and Key Munitions. The FY 2024 budget continues the Navy's focus on long-range offensive strikes launched from ships, submarines, and aircraft. Notable capability enhancements include, for example, Conventional Prompt Strike (CPS), a maneuverable hypersonic non-nuclear weapon for long-range strikes that

receives support for initial deployment on the *Zumwalt*–class destroyer in FY 2025, and upgraded Block V Maritime Strike Tomahawk (MST) kits with improved targeting, procurement of which is entering its fourth year.[126]

To counter the threat posed by the Chinese PL-15 long-range air-to-air missile, which has an operational range of 186 miles, the Navy is working with the Air Force to develop the AIM-120 Advanced Medium-Range missile, the operational range of which has not been made public.[127] In March 2021, the Air Force reported a record long-range kill of a drone target by this developmental missile from one of its F-15C fighters.[128] If this report is accurate, it indicates development of a critical capability, but little reporting on progress has been noted since the *2023 Index*.

Shore-Based Anti-Ship Capabilities. Following the August 2019 U.S. withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty, new intermediate-range (500–1,000 miles) conventional ground-launched strike options became politically viable. This is especially important in Asia where such capable missiles deployed to the first island chain would have great relevance in any conflict with China.[129]

The FY 2020 budget included $76 million to develop ground-launched cruise missiles.[130] The FY 2021 budget included an additional $59.6 million to procure 36 ground-based anti-ship missiles.[131] The FY 2023 budget funded low-rate initial production of 115 Naval Strike Missiles and associated development of Marine Corps platoon-level targeting systems.[132] The FY 2024 budget, building on recent successes, continues upward investment in development and increased production of these weapon systems: $363.5 million for the Navy–Marine Expeditionary Ship Interdiction System (NMESIS) anti-ship missile; 34 shore-launched tactical Tomahawk missiles; and 90 Naval Strike Missiles.[133] A photo of the launch of a U.S. Marine Corps truck-mounted Naval Strike Missile—ostensibly part of NMESIS—was released in April 2021, revealing efforts to introduce this weapon capability across naval forces.[134] Ukraine's use of shore-based anti-ship missiles to sink Russia's Black Sea flag ship, the *Moskva*, in April 2022 has sparked renewed interest in such systems.

Electronic Warfare (EW). The purpose of electronic warfare is to control the electromagnetic spectrum (EMS) by exploiting, deceiving, or denying its use by an enemy while ensuring its use by friendly forces. It is therefore a critical element of successful modern warfare. The final dedicated EW aircraft, the EA-18G Growler, was delivered in July 2019, meeting the Navy's requirement to provide this capability to nine carrier air wings (CVW), five expeditionary squadrons, and one reserve squadron.[135] Anticipating the EA-18G's retirement in the 2030s, the Navy has been exploring follow-on manned and unmanned systems, but no new developments on a replacement have been reported since publication of the *2023 Index*. To ensure that the EA-18G remains relevant on the battlefield until 2030, an anticipated upgrade or Block II modification with the improved Next Generation Electronic Attack Unit (NGEAU) is being pursued.

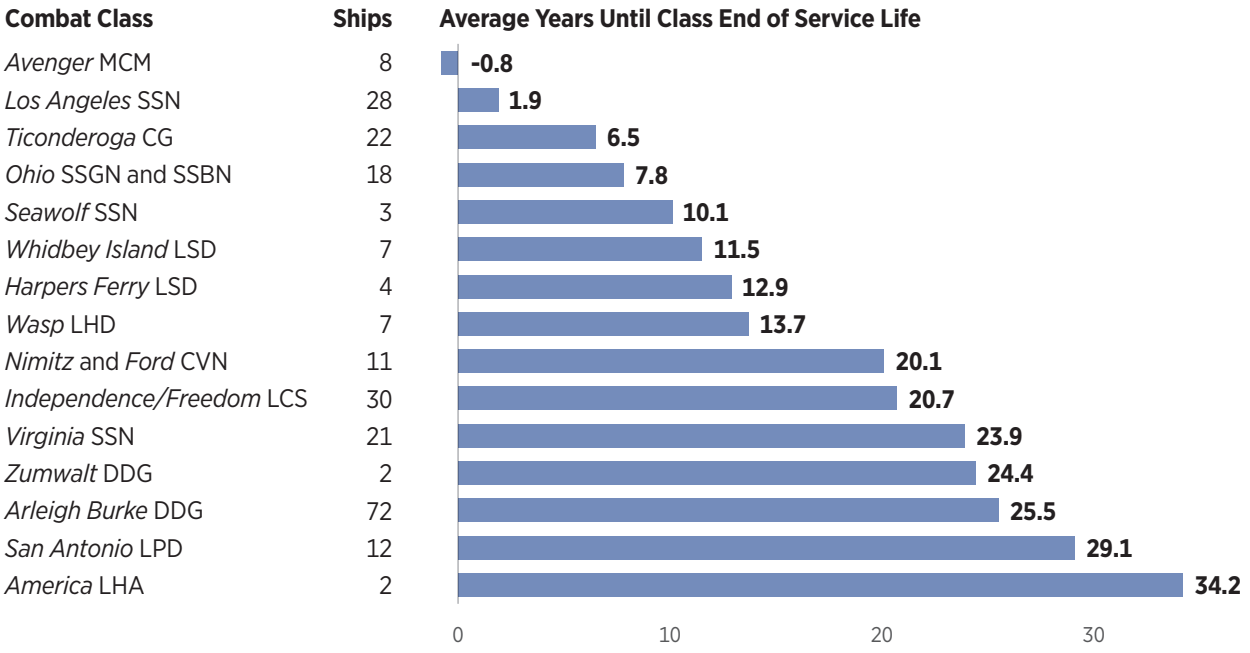
The Navy's earlier proposal to retire all of its expeditionary electronic attack squadrons by FY 2025 came as a surprise.[136] Unless there is a replacement capability, retirement of these aircraft removes the EW coverage provided by these units from forward airfields, shifting the support burden to nearby naval platforms and the other services. Given this uncertainty, Congress stipulated in the FY 2023 NDAA that the Secretary of the Navy may not retire an EA-18G aircraft until September 30, 2027, and required that no later than 180 days after the NDAA's enactment, "the Secretary of the Navy and the Secretary of the Air Force shall jointly submit to the congressional defense committees a report that includes a strategy and execution plan for continuously and effectively meeting the airborne electronic attack training and combat requirements of the joint force."[137] The status of that report is unknown.

Air Early Warning. The E-2D forms the hub of the Naval Integrated Fire Control Counter Air (NIFC-CA) system and provides critical theater air and missile defense capabilities. The Navy's FY 2021 budget supported the procurement of four aircraft with an additional 10 to be procured over the following two years.[138] The FY 2023 budget completed this plan by including procurement of the final five new E-2D aircraft, which are important air control platforms.

High Energy Laser (HEL). HEL systems provide the potential to engage targets or shoot down missiles without being limited by how much ammunition can be carried onboard ship. A significant milestone was achieved when USS *Portland*

CHART 14

Navy Combat Ships Nearing End of Service Life



NOTE: Figures are based on calculations for June 2023.
SOURCE: U.S. Navy, Naval Sea Systems Command, Naval Vessel Register, "Fleet Size," http://www.nvr.navy.mil/NVRSHIPS/FLEETSIZE.HTML (accessed September 9, 2023).

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(LPD-27) used its HEL Weapon System Demonstrator to shoot down an unmanned aerial vehicle (UAV) over the Pacific on May 16, 2020.[139] This was followed by the Navy's decision to begin installation of a HEL system—the High-Energy laser with Integrated Optical Dazzler and Surveillance (HELIOS) (60 kW) laser[140]—on destroyers in 2021 beginning with the USS *Preble*.[141] HELIOS is a scalable laser system that is integrated into the ship's weapons control and radar systems and can dazzle and confuse threats, disable small boats, or shoot down smaller air threats. The Navy's FY 2024 budget will sustain the installation of HELIOS on the USS *Preble* and develop a 100 kW HEL demonstrator system on the USS *Portland*, representing modest investment and progress.[142]

In April 2022, the Navy demonstrated the ability of its Layered Laser Defense HEL system to shoot down a drone simulating a cruise missile.[143] Successful tests like this and the ongoing deployment of the HELIOS on the destroyer *Preble* will be followed by installation of a much stronger 100 kW laser on *Portland* (LPD-27) that approaches the power needed for missile defense.[144] However, until field testing against meaningful threat platforms is conducted across a range of weather conditions, the effectiveness of such systems will remain unproven.

Command and Control. Networked communications are essential to successful military operations. The information passed over these networks includes sensitive data on such subjects as targeting and logistics, and this makes cyber security, communications, and the information systems that generate and relay this information critical elements of the DOD information enterprise.

On October 1, 2020, CNO Michael Gilday signed two memos establishing Project Overmatch. The

goal of Project Overmatch was to achieve situational awareness and effective command and control of a geographically dispersed naval force. In his two memos, the CNO directed that investments be made to deliver network architectures, unmanned capabilities, and data analytics to ensure that the Navy can operate and dominate in a contested environment.[145] The CNO also directed the Navy to leverage related Air Force efforts on the Joint All-Domain Command and Control program (JADC2),[146] now a Joint Force effort involving all of the military branches.

Remarkably, despite the significance of the effort, little has been publicly released on Project Overmatch; what is known is that it involves three classified funding lines with initial deployment or program capabilities slated for 2023.[147] In unofficial venues, it has been hinted that the first platform to employ JADC2 capabilities will be an aircraft carrier, but public statements indicate that the objective is to connect all platform data flows from across the U.S. Joint Force (potentially including partner forces), analyze them for classification, and make predictive targeting recommendations. If successful, artificial intelligence paired with resilient communications and "big data" analytics might enable a key element of Distributed Maritime Operations (DMO).

Readiness

In the 1980s, the Navy had nearly 600 ships in the fleet and kept roughly 100 (17 percent) deployed at any one time. As of June 10, 2023, the fleet's OPTEMPO was 28 percent. With fewer ships carrying an unchanging operational workload, training schedules become shorter and deployments become longer. The commanding officer's discretionary time for training and crew familiarization is a precious commodity that is made scarcer by the increasing operational demands on fewer ships.

FY 2019 marked the first time in more than a decade that DOD and the Navy did not have to operate under a continuing resolution for at least part of the fiscal year. Having a full fiscal year to plan and execute maintenance and operations helped the Navy to continue on its path to restoring fleet readiness. CNO Admiral John Richardson explained to the Senate Armed Services Committee in April 2018 that it would take until late 2021 or 2022 to restore fleet readiness to an "acceptable" level if adequate funding was maintained; without "stable and adequate funding," it would take longer.[148] Unfortunately, the Navy began FY 2020 under another continuing resolution that delayed planned maintenance for the USS *Bainbridge* (DDG 96) and USS *Gonzalez* (DDG 66), revealing yet again that for the Administration and Congress, the need to correct deficiencies in America's naval power was not enough to ensure that they delivered a budget on time.[149]

Given this recent history and the demands of unplanned and urgently needed ship repairs brought about by such incidents as the grounding of the submarine *Connecticut*, the Navy remains deficient in its ability to return ships to sea.

Impact of COVID-19. The eruption of the COVID-19 pandemic in 2020 caused many problems for the U.S. Navy. The USS *Theodore Roosevelt* (CVN 71), for example, was forced to quarantine for 55 days in Guam; the major biannual international Rim of the Pacific Exercise (RIMPAC) was scaled down; 1,629 reservists were called to active duty to backfill high-risk shipyard workers conducting critical maintenance; and the Navy was restricted to using "safe haven" COVID-free ports. In May 2021, the CNO assessed that the Navy managed the pandemic with minimal operational impact but with added time at sea and delays for family reunions pending quarantines.[150]

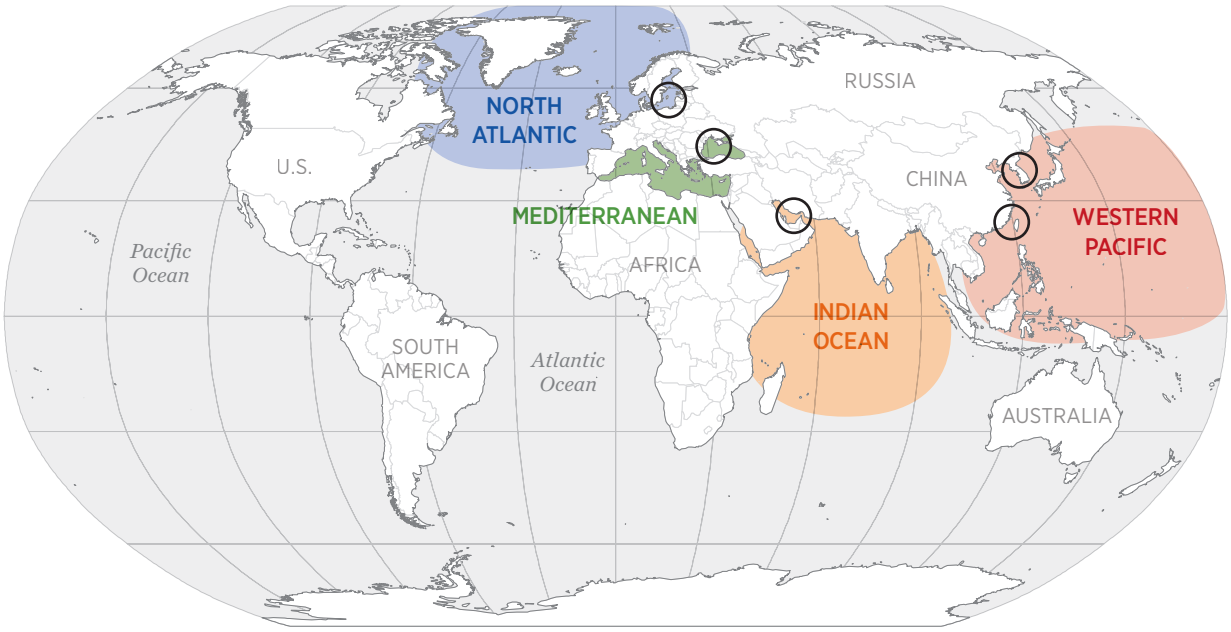
As the pandemic recedes, the Navy's response to account for and mitigate the effects of COVID-driven restrictions has been a success overall. According to the Navy's February 10, 2023, final COVID report, total cumulative COVID cases among active-duty uniformed Navy personnel numbered 109,310 with 17 deaths, 3,350 unvaccinated servicemembers remaining on active duty, and a total of 1,878 sailors separated for refusing the vaccine; previous reporting indicated that 214 religious waivers were granted.[151] Given vaccination rates and ebbing danger, the Navy appears to be past the COVID epidemic. Ideally, the Navy would implement lessons learned from this experience to prepare for future pandemics and biological attacks, but there is as yet little evidence that the service has conducted such a study, implemented new pandemic guidelines, or sought new capabilities to combat a future pandemic.

Maintenance and Repairs. Naval Sea Systems Command completed its Shipyard Optimization and Recapitalization Plan in September 2018.[152]

MAP 15

U.S. Navy Global Presence

○ Potential sites for major war



WEEKS CSG, ARG/ESG PRESENT IN REGION	NORTH ATLANTIC			MEDITERRANEAN			INDIAN OCEAN			WESTERN PACIFIC		
	CSG	ARG/ESG	TOTAL	CSG	ARG/ESG	TOTAL	CSG	ARG/ESG	TOTAL	CSG	ARG/ESG	TOTAL
June 2021–June 2022	1	10	11	22	0	22	22	35	57	77	42	119
June 2022–June 2023	10	18	28	47	0	47	0	0	0	86	54	140
CHANGE	+9	+8	+17	+25	0	+25	−22	−35	−57	+9	+12	+21

NOTES: CSG — Carrier Strike Group, ARG — Amphibious Ready Group, ESG — Expeditionary Strike Group.
SOURCE: Heritage Foundation research based on data from U.S. Naval Institute News, "Category Archives: Fleet Tracker," https://news.usni.org/category/fleet-tracker (accessed September 9, 2023).

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Four years later, the improvement of public shipyard capacities is still just beginning. It was expected that the initial step—building digital models to inform future upgrades to the Navy's four public shipyards—would be complete by the end of 2021, but it remained incomplete as of June 2022.

Attempts by Congress to accelerate the effort have not been effective.[153] At a May 10, 2022, Senate hearing, it became apparent both that the original costs were significantly underestimated and that timelines are slipping. During that hearing, the Government Accountability Office reported that:

- "[F]rom 2017 to 2020, the backlog of restoration and modernization projects at the Navy shipyards has grown by over $1.6 billion, an increase of 31 percent."[154]
- "In 2018, the Navy estimated that it would need to invest about $4 billion in its dry docks to obtain the capacity to perform the 67 availabilities it cannot currently support. This estimate included 14 dry dock projects planned over [a] 20-year span. However...the Navy's first three dry dock projects have grown in cost from an estimated $970 million in 2018 to over

$5.1 billion in 2022, an increase of more than 400 percent."[155]

- "In a 2021 report to Congress, the Navy stated it would complete the [Area Development Plans] by fiscal year 2021. However, in a September 2021 update of that report, the Navy stated the ADPs would be complete four years later, in fiscal year 2025."[156]

More recently, the GAO assessed the Navy's readiness from 2017 through 2021. Because of persistent problems, the Navy's readiness was assessed as degrading: Ship maintenance backlogs were estimated at $1.8 billion, conditions at public shipyards remained poor, and enduring issues of crew shortfalls and fatigue delayed maintenance activities.[157] On top of this, new reports indicate that 37 percent of the Navy's submarine force is unavailable in FY 2023 for missions at sea because of maintenance backlogs; a more normal rate would be 20 percent.[158]

Training, Ranges, and Live-Fire Exercises. Ship and aircraft operations and training are critical to fleet readiness. The Navy has sought to meet fleet readiness requirements by funding 58 underway days for each deployed warship and 24 underway days for each non-deployed warship per fiscal quarter. The Navy's proposed budget would fall short of these goals by funding 97 percent of ship operations, 90 percent of flight hours, and 87 percent of facilities sustainment.[159] Less clear is how much of this time is spent on crew training and whether the Navy assesses this as effective in meeting needed operational proficiencies.

To improve warfighting proficiency, the Navy is seeking to expand and update instrumentation of the training range at Naval Air Station Fallon, Nevada, to enable practice with the most advanced weapon systems.[160] This training range fits into the larger five-year $27.3 billion Pacific Deterrence Initiative (PDI) that, led by Indo Pacific Command, is intended partly to transform the way the Navy trains for high-end conflict and improve training with U.S. allies in the Pacific.[161] Of particular importance to the Navy are PDI investments to modernize the Pacific Missile Range Facility (PMRF); the Joint Pacific Alaska Range Complex (JPARC); and the Combined/Joint Military Training (CJMT) Commonwealth Northern Mariana Islands in order to improve training for operations across all domains: air, land, sea, space, and cyber.[162]

The FY 2024 budget earmarks $9.1 billion of DOD's topline budget for PDI ($3 billion more than in FY 2023). Especially important are long lead time infrastructure projects in Guam and Tinian in the northern Marianas. This year's PDI budget includes $3.25 billion for the Navy: $1.15 billion for operations, $14.6 million for logistics, $313.3 million for exercises, $1.58 billion for infrastructure investments, $42.8 million for added staffing, and $146.7 million to improve partner nations' capabilities.[163] To measure the effectiveness of these investments, the Navy will need to demonstrate increased frequency of exercises that practice high-end warfighting independently, jointly, and with such key allies as Australia, Japan, and South Korea. This should include increased numbers of realistic free-play events and increased by-hull frequency of live-fire drills.

Finally, not forgotten are the 2017 collisions of the USS *John S. McCain* (DDG 56) and USS *Fitzgerald* (DDG 62) in which 17 sailors were lost. Findings of the subsequent investigations, which highlighted the importance of operational risk management and unit readiness, remain relevant.[164] To ensure that these tragic events are not repeated, the Secretary of the Navy's *Strategic Readiness Review* made several broad institutional recommendations:

- "The creation of combat ready forces must take equal footing with meeting the immediate demands of Combatant Commanders."

- "The Navy must establish realistic limits regarding the number of ready ships and sailors and, short of combat, not acquiesce to emergent requirements with assets that are not fully ready."

- "The Navy must realign and streamline its command and control structures to tightly align responsibility, authority, and accountability."

- "Navy leadership at all levels must foster a culture of learning and create the structures and processes that fully embrace this commitment."[165]

A reminder that the above recommendations remain relevant was the October 2021 grounding of the submarine *Connecticut* in the South China Sea. The subsequent investigation found the event avoidable while operating in poorly surveyed waters—a reminder of the risk as well as the vigilance required at sea.[166]

Scoring the U.S. Navy

Capacity Score: Very Weak

This *Index* assesses that the Navy needs a battle force consisting of 400 manned ships to do what is expected of it today. The Navy's current battle force fleet of 298 ships and intensified operational tempo combine to reveal a service that is much too small relative to its tasks. Contributing to a lower assessment is the Navy's persistent inability to arrest and reverse the continued diminution of its fleet as adversary forces grow in number and capability. If it continues on its current trajectory, the Navy will shrink further to 280 ships by 2037. Depending on the Navy's ability to realize aggressive growth, reverse early decommissioning plans, increase its end strength, and develop creative service life extensions, its capacity score will probably remain "very weak" for the foreseeable future.

Capability Score: Marginal Trending Toward Weak

The overall capability score for the Navy remains "marginal" with downward pressure as the Navy's technological edge narrows against peer competitors China and Russia. The combination of a fleet that is aging faster than old ships are being replaced and the rapid growth of competitor navies with modern technologies has only intensified the danger for U.S. naval power. Without meaningful progress in fielding systems that are able to defend against an array of threats, greater integration of unmanned systems into the fleet, and development of a family of new long-range weapons, especially in air-to-air combat, the Navy's capability score could well decline to "weak" in the *2025 Index*.

Readiness Score: Weak

The Navy's readiness score remains "weak." This is due primarily to the Navy's persistent struggle to recapitalize antiquated, inadequate maintenance infrastructure and workforce to meet current needs. The effectiveness of training and exercises measured against China will be an increasingly critical metric in this score.

Overall U.S. Navy Score: Weak

The Navy's overall score in the *2023 Index* is "weak," driven by lower scores in capacity and readiness. To correct this trend, the Navy will have to eliminate several readiness and capacity bottlenecks while seeing to it that America has an operational fleet with the numbers and capabilities postured to counter Russian and Chinese naval advances. There is added urgency given both that China is aggressively posturing itself to obtain maximum advantage over Taiwan and that many of the U.S. Navy's efforts to improve itself will take several years to achieve the desired results.

U.S. Military Power: Navy

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity	✓				
Capability			✓		
Readiness		✓			
OVERALL		✓			

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Aircraft Carrier

PLATFORM	Age Score	Capability Score
***Nimitz*-Class Aircraft Carrier (CVN-68)** Inventory: **10** Fleet age: **32.3** Date: **1975** The *Nimitz*-class is a nuclear-powered multipurpose carrier. The aircraft carrier and its embarked carrier air wing can perform a variety of missions including maritime security operations and power projection. Its planned service life is 50 years with a single midlife refueling. Retirement of the class will begin in FY 2026 with CVN-68 USS *Nimitz*, followed in FY 2027 by CVN-69 USS *Eisenhower*, with the class to be replaced by *Ford*-class carriers.	2	3
***Ford*-Class Aircraft Carrier (CVN-78)** Inventory: **1** Fleet age: **5.9** Date: **2017** The *Ford*-class incorporates new technologies that will increase aircraft sortie rates, reduce manning, provide greater electrical power for future weapons systems, and decrease operating costs. Its planned service life is 50 years. CVN-78 deployed in the fall of 2022 after five years of delays. Delivery of CVN-79 is expected in July of 2025, and while CVN-80 and CVN-81 are under construction.	5	5

REPLACEMENT PROGRAM	Size Score	Health Score
***Ford*-Class Aircraft Carrier (CVN-78)** Timeline: **2017–TBD** Currently in production, the *Ford*-class will replace the *Nimitz*-class aircraft carriers. The *Ford*-class design uses the basic *Nimitz*-class hull form but incorporates several improvements to achieve a 33 percent higher sortie rate, a smaller crew with approximately 600 fewer sailors, two and a half times greater electrical power, and more than $4 billion in life cycle cost savings over the *Nimitz*-class. The ship completed Planned Incremental Availability on March 1 after six months of modernization and maintenance. The ship began its first deployment in fall 2022, and its intended life expectancy is 50 years. **PROCUREMENT** 3 — 1 **SPENDING** *($ millions)* $4,746 — $2,120	2	3

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Large Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
***Ticonderoga*-Class Cruiser (CG-47)** Inventory: **17** Fleet age: **33.5** Date: **1981** The *Ticonderoga*-class is a multi-mission battle force ship equipped with the Aegis Weapons System. While it can perform strikes, anti-surface warfare, and anti-submarine warfare, its primary focus is air and missile defense. The cruisers have a life expectancy of 40 years. The Navy plans to retire the entire cruiser fleet by FY 2027.	2	3	***Zumwalt*-Class Destroyer (DDG-1000)** Timeline: **2016–2026** The DDG-1000 was designed to be a new-generation destroyer capable of handling more advanced weapon systems for long-range strike with a hull that is designed to reduce radar detectability for its original primary mission of naval surface fire support (NSFS). The DDG-1000 program was intended to produce a total of 32 ships, but this number has been reduced to three. The first DDG-1000 was commissioned in October 2016. Delivery of DDG-1002, the last ship of the class, is expected in 2024. **PROCUREMENT** 3 **SPENDING** *($ millions)* $4,092	1	2
***Zumwalt*-Class Destroyer (DDG-1000)** Inventory: **1** Fleet age: **5.6** Date: **2016** The *Zumwalt*-class is a multi-mission destroyer that incorporates several technological improvements, such as a stealthy hull design and integrated electric-drive propulsion system. Although it has passed sea trials, it continues to experience problems with its combat systems. The third and final ship of the class was commissioned in FY 2020, and DDG 1002 is currently awaiting Combat Systems testing before entering the service.	5	3			
***Arleigh Burke*-Class Destroyer (DDG-51)** Inventory: **73** Fleet age: **19.5** Date: **1991** The *Arleigh* Burke–class is a multi-mission guided missile destroyer that features the Aegis Weapons System and has air defense as its primary mission. The Navy procured three in FY 2023 and will continue to procure two each fiscal year. The destroyers will begin to decommission starting in FY 2031 with DDG-51.	3	4	***Arleigh Burke*-Class Destroyer (DDG-51)** Timeline: **1991–2034** DDG-51 production was restarted in FY 2013 to make up for the reduction in DDG-1000 acquisitions. Beginning in FY 2017, all DDG-51s procured will be the Flight III design, which includes the more capable Advanced Missile Defense Radar (AMDR). The Navy procured three destroyers in FY 2023 and plans to procure two each fiscal year. The destroyers are believed to have an estimated service life of 40 years. **PROCUREMENT** 92 12 **SPENDING** *($ millions)* $102,420 $102,524	2	4

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Small Surface Combatant

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Littoral Combat Ship (LCS) Inventory: **27** Fleet age: **4.3** Date: **2008** The Littoral Combat Ship includes two classes: the *Independence*-class and the *Freedom*-class. The modular LCS design depends on mission packages (MP) to provide warfighting capabilities in the SUW, ASW, and MCM mission areas. The ship has an expected service life of 25 years. However, the FY 2023 defense authorization bill authorized the early retirement of four LCS vessels.	5	3	**Littoral Combat Ship (LCS)** Timeline: **1991–2024** The LCS is intended to fulfill the mine countermeasure, antisubmarine warfare, and surface warfare roles for the Navy. It is designed to operate in near-shore environments but is also capable of open-ocean operation. It works better with smaller ships than the DDG-51. The FY 2023 National Defense Authorization Act approved the early retirement of four Freedom-class ships. The *Independence*-class LCS would remain as the sole small surface combatant after the retirement of the MCM ships and until the new FFG-62 frigates are delivered. The decision to scrap the *Freedom*-class LCS does not affect the ships currently under construction. **PROCUREMENT** 33 **SPENDING** *($ millions)* $16,182	2	3
***Avenger*-Class Mine Counter Measure (MCM-1)** Inventory: **8** Fleet age: **30.8** Date: **1983** *Avenger*-class ships are designed as mine sweepers/hunter-killers capable of finding, classifying, and destroying moored and bottom mines. The class has an expected 30-year service life. The remaining MCMs are expected to be decommissioned throughout the 2020s. While there is no direct replacement single-mission MCM ship in production, the Navy plans to fill its mine countermeasure role with the LCS and its MCM MP.	1	2	***Constellation*-Class Frigate** Timeline: **1991–2034** A new program called the FFG-62 will augment the LCS program to fill out the remaining 20-ship small surface combatant requirement for a total of 52 small surface combatants. The ships will be 496 feet in length with a top speed of 29 miles per hour and a range of 6,000 nautical miles. Its purpose is to escort carrier battle groups and high-value convoys. It will accommodate 32 VLS cells to handle high-powered missiles and machine guns. The first ship should be delivered by 2026 and be operational by 2030. The current contract would provide 10 hulls by 2030 with a total of 20 FFG-62 frigates in the fleet. Procurement has been one frigate per fiscal year with the Navy requesting to procure one more in FY 2023. **PROCUREMENT** 4 16 **SPENDING** *($ millions)* $4,560 $16,855	N/A	N/A

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

SSGN Cruise Missile Submarine

PLATFORM	Age Score	Capability Score	MODERNIZATION PROGRAM	Size Score	Health Score
***Ohio*-Class (SSGN-726)** Inventory: **4** Fleet age: **40.4** Date: **1981** The SSGNs provide the Navy with a large stealthy strike and special operations mission capabilities. From 2002–2007, the four oldest *Ohio*-class ballistic missile submarines were converted to guided missile submarines. Each SSGN can carry up to 154 Tomahawk land-attack cruise missiles and up to 66 special operations forces for clandestine insertion and retrieval. All four SSGNs will retire between FY 2026 and FY2028. The Navy tentatively plans to replace the SSGNs with a new Large Payload Submarine beginning in FY 2036, but loss of the SSGN undersea strike capability will be mitigated by the *Virginia*-class Payload Module (VPM). The *Ohio*-class had a planned service life of 42 years, but this may be extended.	1	4	None		

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Attack Submarines

PLATFORM	Age Score	Capability Score
***Seawolf*-Class (SSN-21)** Inventory: **3** Fleet age: **22.9** Date: **1997** The *Seawolf*-class is exceptionally quiet, fast, well-armed, and equipped with advanced sensors. Though lacking a vertical launch system, the *Seawolf*-class has eight torpedo tubes and can hold up to 50 weapons in its torpedo room. The Navy planned to build 29 submarines, but the program was cut to three. The *Seawolf*-class has a 33-year expected service life. They have been succeeded by the *Virginia*-class attack submarine.	2	4
***Los Angeles*–Class (SSN-688)** Inventory: **25** Fleet age: **31** Date: **1976** The *Los Angeles*–class comprises the largest portion of the Navy's attack submarine fleet. They are multi-mission submarines that can perform covert intelligence collection, surveillance, ASW, ASuW and land attack strike. The *Los Angeles*–class has a 33-year expected service life. Between 2022 and 2028, 14 *Los Angeles*–class submarines will be retired and replaced by the *Virginia*-class.	1	3
***Virginia*-Class (SSN-774)** Inventory: **21** Fleet age: **9.1** Date: **2004** The *Virginia*-class is the U.S. Navy's next-generation attack submarine and includes several improvements over previous attack submarine classes that provide increased acoustic stealth, improved SOF support, greater strike payload capacity, and reduced operating costs. With a planned service life of 33 years, the *Virginia*-class is in production and will replace the *Los Angeles*–class and *Seawolf*-class attack submarines as they are decommissioned. Thirty-eight have been procured so far at a rate of two per year.	4	4

REPLACEMENT PROGRAM	Size Score	Health Score
***Virginia*-Class (SSN-774)** Timeline: **2004–2036** The *Virginia*-class is in production and will replace the *Los Angeles*–class and *Seawolf*-class fast attack submarines as they are decommissioned. The Virginia Payload Module (VPM) will be incorporated into eight of the 11 planned Block V submarines beginning in FY 2019. VPM includes four large-diameter, vertical launch tubes that can carry up to 28 additional Tomahawk missiles or other payloads. The *Virginia*-class's planned service is 33 years, and 38 have been procured so far at a rate of two per year. A Government Accountability Office audit found that Block V boats are taking, on average, two years longer to complete. **PROCUREMENT** 38 13 **SPENDING** *($ millions)* $69,938 $41,331	2	3

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

SSBN Ballistic Missile Submarine

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
***Ohio*-Class (SSBN)** Inventory: **14** Fleet age: **32.5** Date: **1981** The *Ohio*-class SSBN is the most survivable leg of the U.S. military's strategic nuclear triad. Its sole mission is strategic nuclear deterrence, for which it carries long-range submarine-launched ballistic missiles, and its expected service life is 42 years. Retirement of the *Ohio*-class fleet will begin in 2027 at an estimated rate of one submarine per year until 2039. The *Ohio*-class fleet will be replaced by 12 *Columbia*-class SSBNs.	1	4	***Columbia*-Class (SSBN–826)** Timeline: **2021–TBD** The 12-boat *Columbia*-class will replace the existing *Ohio*-Class nuclear ballistic submarine force, which provides a credible and survivable sea-based strategic deterrent. The Navy's FY 2024 budget submission estimates the 12 boats' total procurement cost at $112.7 billion. The lead boat, SSBN-826, is expected to be delivered in FY 2027, and its first patrol is scheduled for FY 2031. Due to complications from the pandemic and technical challenges, the program risks being delayed. Despite such issues, construction continues. The *Columbia*-class will have a 42-year life expectancy. **PROCUREMENT** 1 11 **SPENDING** *($ millions)* $50,834		

Amphibious Warfare Ship

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
***Wasp*-Class Amphibious Assault Ship (LHD-1)** Inventory: **7** Fleet age: **26.3** Date: **1989** The *Wasp*-class can support amphibious landing operations with Marine Corps landing craft via its well deck. It can also support Marine Air Combat Element operations with helicopters, tilt-rotor aircraft, and Vertical/Short Take-Off and Landing (V/STOL). This ship has a planned 40-year service life.	2	3	***America*-Class (LHA–6)** Timeline: **2014–2033** LHA Flight 0 (vessels LHA-6 and 7) was designed without a well deck to provide more space for Marine Corps aviation maintenance and storage as well as increased JP-5 fuel capacity. LHA Flight 1 (LHA-8 and beyond) will reincorporate a well deck for increased mission flexibility. The *America*-class is in production, and three LHA 6s have already been procured. Construction of LHA-9 is underway. **PROCUREMENT** 4 1 **SPENDING** *($ millions)* $4,753 $3,479	3	3
***America*-Class Amphibious Assault Ship (LHA-6)** Inventory: **2** Fleet age: **5.8** Date: **2014** This new class of large-deck amphibious assault ships is meant to replace the retiring *Wasp*-class LHD. LHAs are the largest of all amphibious warfare ships, resembling a small aircraft carrier. The *America*-class is designed to accommodate the Marine Corps' F-35Bs. Construction of USS *Fallujah* (LHA 9) is underway.	5	4			

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Amphibious Warfare Ship (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
***San Antonio*–Class Amphibious Transport Dock (LPD-17)** Inventory: **12** Fleet age: **10.9** Date: **2006** The LPDs have well decks that allow the USMC to conduct amphibious operations with its landing craft. The LPD can also carry four CH-46s or two MV-22s. Eleven of the planned 13 Flight I LPD-17-class ships are operational with the remaining two under construction. The class has a 40-year planned service life. As of FY 2023, three of the LPD Flight II-class have been procured.	4	3	***San Antonio*–Class Amphibious Transport Dock (LPD-17)** Timeline: **2006–2024** The 13 LPD-17s are replacements for the San Antonio–class LPDs. Both Flight I and Flight II LPDs are multi-mission ships designed to embark, transport, and land elements of a Marine landing force by helicopters, tilt-rotor aircraft, landing craft, and amphibious vehicles. **PROCUREMENT** 13 **SPENDING** *($ millions)* $13,836	4	4
***Whidbey Island*–Class Dock Landing Ship (LSD-41)** Inventory: **6** Fleet age: **33.4** Date: **1985** LSD-41 *Whidbey Island*–class ships were designed specifically to transport and launch four Marine Corps Landing Craft Air Cushion vehicles. They have an expected service life of 40 years. All eight ships in the class will retire between FY 2026 and FY 2033. LSD-41-class will be replaced by the LPD-17 Flight II program, which began procurement in FY 2018. The Navy plans to retire six of the *Whidbey Island*–class ships before 2026.	2		**LPD-17 Flight II** Timeline: **2025–2029** Previously known as LX(R), the LPD-17 Flight II program will procure 13 ships to replace the Navy's LSD-type ships. The Navy originally planned to procure the first Flight II ship in FY 2020, but accelerated procurement funding enabled procurement of the first LPD-17 Flight II in FY 2018. The Navy delayed the second ship planned for FY 2020 until FY 2021. In its FY 2024 budget submission, the Navy proposed truncating the program by making LPD-32 the final ship. **PROCUREMENT** 3 **SPENDING** *($ millions)* $4,599	3	4
***Harpers Ferry*–Class Dock Landing Ships (LSD-49)** Inventory: **4** Fleet age: **27.1** Date: **1995** The *Harpers Ferry*–class, which reduced LCAC capacity to two while increasing cargo capacity, have an expected service life of 40 years, and all ships will be retired by FY 2038. The LSD-49 will be replaced by the LPD-17 Flight II, which began procurement in FY 2018. The Navy plans to retire four of the *Harpers Ferry*–class ships before 2026.	2				

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Airborne Early Warning

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
E-2C Hawkeye Inventory: **20** Fleet age: **40** Date: **1973** The E-2C Hawkeye is a battle management and airborne early warning aircraft that uses computerized radar and electronic surveillance sensors for threat analysis and early warning. The E-2C fleet received a series of upgrades to mechanical and computer systems around the year 2000. While still operational, the E-2C is nearing the end of its service life and is being replaced by the E-2D Advanced Hawkeye.	1	3	**E-2D Advanced Hawkeye** Timeline: **2014–2023** The E-2D Advanced Hawkeye replaces the legacy E-2C and is in production. The Navy received approval for a five-year multi-year procurement of 24 aircraft beginning in FY 2019 to complete the program of record. An additional five aircraft were requested for procurement in FY 2023. **PROCUREMENT** 119 / 6 **SPENDING** *($ millions)* $15,775 / $1,961	4	4
E-2D Advanced Hawkeye Inventory: **54** Fleet age: **4.5** Date: **2014** The E-2D program is the next-generation, carrier-based early-warning, command and control aircraft that provides improved battle space detection, supports theater air missile defense, and offers improved operational availability. The E-2D AHE is a replacement for the E-2C platform. As of FY 2023, 119 E-2D AHE had been procured, and an additional six aircraft are requested for future procurement.	5	4			

Electronic Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
EA-18G Growler Inventory: **158** Fleet age: **10** Date: **2009** The EA-18G Growler is the U.S. Navy's electronic attack aircraft, providing tactical jamming and suppression of enemy air defenses. The final EA-18G aircraft was delivered in FY 2018, bringing the total to 160 and fulfilling the Navy's requirement. It replaced the legacy EA-6B Prowlers. The Navy proposed to retire 25 EA-18Gs across five land-based expeditionary electronic attack squadrons in its FY 2023 budget request, but the FY 2023 National Defense Authorization Act (NDAA) prevented retirement of the aircraft.	5	4	None		

NOTE: See page 468 for details on fleet ages, dates, timelines, and procurement spending.

NAVY SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Fighter/Attack Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
F/A-18E/F Super Hornet Inventory: **613** Fleet age: **19** Date: **2001** The F/A-18 E/F Super Hornet has longer range, greater weapons payload, and more survivability than the F/A-18A-D Legacy Hornet. The Navy plans to achieve a 50/50 mix of two F-35C squadrons and two F/A-18E/F Block III squadrons per carrier air wing by the mid-2030s. The ongoing service life extension program will extend the life of all Super Hornets to 9,000 flight hours. As of FY 2022, 690 F/A-18 E/F Super Hornets had been procured.	3	3	**F-35C Joint Strike Fighter** Timeline: **2019–2034** The F-35C is the Navy's variant of the Joint Strike Fighter. The Joint Strike Fighter faced many issues during its developmental stages, including engine problems, software development delays, cost overruns incurring a Nunn–McCurdy breach, and structural problems. The Navy declared initial operational capability (IOC) of the F-35C in February 2019. The planned procurement of 273 F-35Cs will replace over 500 Super Hornets. As of FY 2023, 174 of the aircraft had been procured with an additional 19 requested for procurement in FY 2024. **PROCUREMENT** 177 192 **SPENDING** *($ millions)* $27,122 $26,407	2	3
F-35C Joint Strike Fighter Inventory: **52** Fleet age: **2** Date: **2019** The C-variant is the Navy's fifth-generation aircraft, bringing radar-evading technology to the carrier deck for the first time. The F-35C performs a variety of missions including air-to-air combat, air-to-ground strikes, and ISR missions. As of FY 2023, 177 F-35C airframes had been procured, and procurement of an additional 192 is expected to begin in FY 2024.	5	4			

NOTES: See Methodology for descriptions of scores. Fleet age is the average of platform since commissioning. The date for ships is the year of commissioning. Inventory for aircraft is estimated based on the number of squadrons. The date for aircraft is the year of initial operational capability. The timeline for ships is from the year of first commissioning to the year of last delivery. The timeline for aircraft is from the first year of delivery to the last year of delivery. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E). The total program dollar value reflects the full F–35 joint program including engine procurement. The Navy is also procuring 67 F-35Cs for the Marine Corps. Age of fleet is calculated from date of commissioning to January 2016.

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U.S. Air Force

John Venable

The mission of the U.S. Air Force has expanded significantly since 1947 when the USAF became a separate service. Initially, operations were divided among four major components—Strategic Air Command, Tactical Air Command, Air Defense Command, and Military Air Transport Service—that collectively reflected the Air Force's "fly, fight, and win" nature. Space's rise to prominence in the early 1950s brought with it a host of capabilities that would expand the service's portfolio and increase its capabilities in the mission areas of intelligence, surveillance, and reconnaissance (ISR) and command and control (C2).

With the birth of the Space Force in December 2019,[1] the Air Force began to move its space and space-related personnel assets to the new service. The impact of that change, coupled with the lingering effects of the global COVID-19 pandemic that were highlighted in the *2022 Index of Military Strength*,[2] continue to hamper the trajectory of the Air Force.

The creation of the Space Force affected three Air Force mission areas: air and space superiority, ISR, and C2. Each of these mission areas was born from air-breathing assets, and while the loss of the space portfolio has reduced the service's inherent capabilities, they remain within the Department of the Air Force (DAF) and should allow the Air Force to focus the weight of its efforts on core missions in the air and cyber domains.

Today's Air Force has five principal missions:

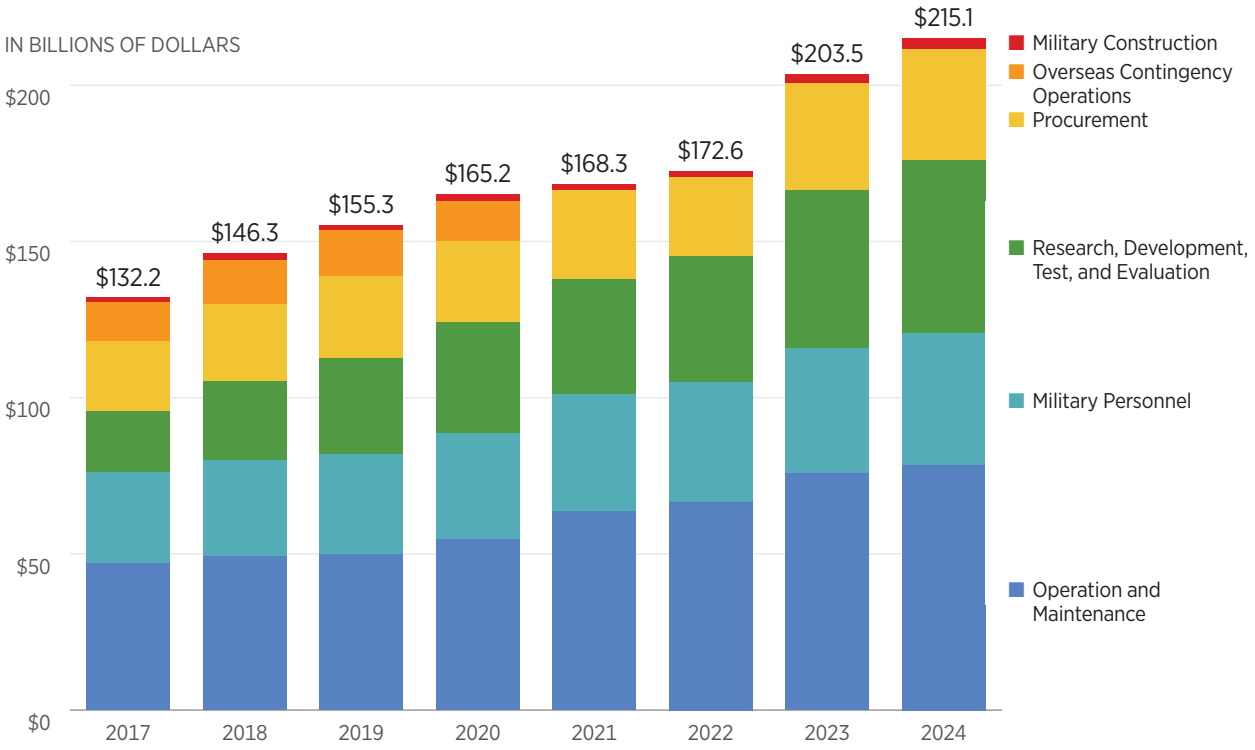
- Air superiority (space superiority is now the responsibility of the Space Force);
- Intelligence, surveillance, and reconnaissance;
- Mobility and lift;
- Global strike; and
- Command and control.

Unlike some of the other services, the Air Force did not grow larger during the post-9/11 buildup. Instead, it grew smaller as acquisitions of new aircraft failed to offset programmed retirements of older aircraft. Following the sequestration debacle in 2012, the Air Force began to trade size for quality.[3] It was forced to make strategic trades in capacity, capability, and readiness to meet the operational demands of the war on terrorism and develop the force it needed for the future. The collective effects left the Air Force of 2016 with just 55 total force fighter squadrons (the aggregate of Active and Reserve Component squadrons), and the readiness levels within those organizations were very low. Only four of the Air Force's 32 active-duty fighter squadrons were ready for conflict with a near-peer competitor, and only 14 others were considered ready even for low-threat combat operations.[4]

Recognizing the threat from a rising China and resurgent Russia, the 2018 National Defense Strategy (NDS) directed the services to prepare for a large-scale, high-intensity conventional conflict with a peer adversary.[5] Later that same year, the Air Force released "The Air Force We Need" (TAFWN), a study of the capacity it would need to fight and help the U.S. win such a war. Based on thousands of war-game simulations, TAFWN found that to execute that strategy, the service needed to grow by 25 percent, from 312 to 386 squadrons. This growth included one additional airlift squadron and seven additional fighter, five additional bomber, and 14

CHART 15

Air Force Budgets, 2017–2024



SOURCES: Extracted from U.S. Air Force budget summaries for FY 2013–FY 2023. For example: U.S. Department of the Air Force, *United States Air Force FY 2013 Budget Overview*, February 2012, p. 12, https://www.saffm.hq.af.mil/Portals/84/documents/FY13/AFD-120209-052.pdf?ver=2016-08-24-090344-023 (accessed September 19, 2023); U.S. *Department of the Air Force, Department of the Air Force FY 2023 Budget Overview*, p. 3, https://www.saffm.hq.af.mil/Portals/84/documents/FY23/SUPPORT_/BOB_28Mar_1125_LoRes.pdf?ver=5nrA8bBfhWoUSrvZ09CeHA%3d%3d (accessed September 19, 2023); and Table 1, "Department of the Air Force Budget Summary," in U.S. Department of the Air Force, FY 2024 *Department of the Air Force Budget Overview*, p. 2, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Budget/FY24%20Budget%20Overview%20Book.pdf?ver=JjFXW89XqB_YsIGx1wx4IA%3d%3d (accessed September 19, 2023).

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additional tanker squadrons,[6] which equates to an additional 182 fighter, 50 bomber, 210 air refueling, and 15 airlift platforms.[7]

During the same period, the service's most senior leaders emphasized the need for more time in the air for aircrews. Secretary of the Air Force Heather Wilson, for example, "noted that even when air crews go abroad and fly combat missions, such as those against violent extremists such as the Islamic State, they're not practicing skills that would be required for a high-end fight against an advanced adversary such as Russia."[8] Those demands required a bigger budget, and from 2017 through 2021, the Trump Administration increased DAF funding by 31 percent.[9]

With the shortfall in aircraft and flying hours, the DAF could have used the surge in funding to support significant increases in Air Force capacity, capability, and readiness, but the service chose instead to use much of the additional funding for research, development, test, and evaluation (RDT&E). In 2023 dollars, the DAF budget for RDT&E went from $19.6 billion in fiscal year (FY) 2017 to $55.4 billion in the Administration's FY 2024 budget, an increase of 226 percent. During that same period, the department's budget for aircraft procurement

increased from $18.9 billion to $20.3 billion, an increase of just 8 percent.[10]

Funding for flying hours has continued to decline. In FY 2013, the year sequestration decimated the Department of Defense (DOD) budget, the Air Force programmed (budgeted) 1.53 million flying hours across all platforms. Overseas contingency operations added another 0.512 million hours, which meant that Air Force aircraft flew 2.04 million hours.[11] In FY 2022, the Air Force budgeted for 1.12 million hours, 27 percent less than the number of hours it flew in 2013, and fell short of executing even that low number by 23,000 hours because of cost fluctuations.[12]

In April 2022, in spite of TAFWN's finding that the Air Force was 25 percent too small for its mission sets, it was revealed that the Air Force was planning to cut 1,468 aircraft from its fleet over the Future Years Defense Program (FYDP), including the accelerated retirement of 646 F-15C, F16C, and A-10 fighter aircraft, and that it planned to procure just 246 aircraft over that period.[13] In July 2023, the Air Force announced that it would add 103 F-15Es to the roster of retirements.[14] This means that a total of 500 of its current fleet of 2,092 fighters will be lost, reducing the fleet by almost 25 percent over the course of the next five years.

Capacity

At the height of the Cold War buildup in 1987, the active-duty Air Force had an inventory of 3,082 fighter, 331 bomber, 576 air refueling, and 331 strategic airlift platforms. When the strategic reserve assets within the Air National Guard and Air Force Reserve are added, the 1987 totals were 4,468 fighter, 331 bomber, 704 air refueling, and 362 strategic airlift platforms. After the fall of the Iron Curtain, the United States shifted from a force-sizing construct centered on great-power competition to one capable of winning two simultaneous or nearly simultaneous major regional conflicts (MRCs). Those numbers for capacity have been reduced significantly over the years.

It is projected that at the end of FY 2023, the Air Force will have a total aircraft inventory (TAI) of 2,092 fighters, 141 bombers, 471 tankers, and 274 strategic airlift platforms. With the rollout of the President's budget for FY 2024, the service announced its plan to eliminate 60 fighters and nine bombers from its inventory, which will bring its total force TAI to 1,932 fighters, 140 bombers, 471 tankers, and 274 strategic airlift platforms.[15] At that point, the Air Force will have a total force that equates to 47 percent of the fighter, 43 percent of the bomber, 67 percent of the tanker, and 76 percent of the airlift assets it possessed the last time the United States was prepared to fight a peer competitor.

The idea that aircraft production lines will somehow surge to come to the rescue in a peer-level crisis might seem plausible to some,[16] but even if Congress were to throw an unlimited amount of funding at production lines, it would take from two to three years for those additional assets to arrive.[17]

The *Index of U.S. Military Strength* uses "combat-coded" fighter aircraft within the Active Component of the U.S. Air Force to assess capacity. Combat-coded aircraft and related squadrons are aircraft and units with an assigned wartime mission, which means that those numbers exclude units and aircraft that are assigned to training, operational test and evaluation (OT&E), and other missions.

The software and munitions carriage and delivery capability of aircraft in units that are not combat-coded renders them incompatible with and/or less survivable than combat-coded versions of the same aircraft. For example, all F-35As may appear to be ready for combat, but training wings and test and evaluation jets have hardware and software limitations that would severely curtail their utility and effectiveness in combat. Even if those jets were slated for upgrades, hardware updates sideline jets for several months, and training wings and certain test organizations are generally the last to receive those upgrades.

Of the 5,154 manned and unmanned aircraft projected to be in the USAF's inventory at the end of FY 2023, 1,432 are active-duty fighters, and 886 of those are combat-coded aircraft.[18] It is important to separate the active-duty fighters and units from the strategic reserve because it would take several months to get elements of the latter up to manning and readiness levels that allowed their first elements to deploy. Unfortunately, other factors also affect the number of fighters the service could actually employ in combat.

Most squadrons will have to pack up and deploy several thousand miles to be able to fight. Because of the additional wartime manning requirements and the fact that most squadrons have several jets

that need repairs at any given time, it takes the resources of approximately three active-duty squadrons to deploy two combat-capable fighter units forward.[19] That effectively reduces the total number of active-duty, combat-coded fighters to 571 jets.

The Air Reserve Component has 608 fighters, approximately 458 of which are combat coded. Because of the additional wartime manning requirements and the fact that Guard and Reserve units generally have just one squadron at each location, it takes two squadrons to deploy one combat-capable unit forward.[20] In terms of capacity, this means that 626 active-duty and 229 strategic reserve fighters, for a total of 885 combat-coded fighters, could be deployed into combat, leaving virtually nothing in reserve. However, recent squadron deployments in response to a request from the Commander of U.S. European Command following Russia's invasion of Ukraine were fulfilled with 12 jets—packages that were referred to as "squadrons," implying that the Air Force has reduced the number of fighter aircraft normally associated with the term "squadron" from 24 to 12.

Capacity also relies on the stockpile of available munitions and the production capacity of the munitions industry. The actual number of munitions within the U.S. stockpile is classified, but there are indicators that make it possible to assess the overall health of this vital area. The inventory for precision-guided munitions (PGM) was severely stressed by nearly 18 years of sustained combat operations in Iraq, Afghanistan, Syria, and elsewhere and by budget actions that limited the service's ability to procure replacements and increase stockpiles. From 2017 through 2021, funding for munitions was significant, and the service, believing the inventory is now sufficiently restocked, has reduced the number of PGMs it will acquire to a total of 9,486 munitions in FY 2024.[21]

However, even though the munitions stockpile may have returned to a level that is high enough to support a surge in expenditures associated with a conflict similar to the global war on terrorism—loosely encompassing operations in Afghanistan and Iraq—it probably would not support a peer-level fight that lasted more than a few weeks. Typically, there is a delay of 24–36 months between funding and delivery of additional munitions, and while the potential exists for a rapid expansion of production, it is hard to envision how such an expansion could be rapid enough to exceed demand before the stockpile is depleted. (See Table 11.)

Advances in the jamming of global navigation satellite systems (GNSS) like GPS have been significant over the past 20 years, and the number, types, and effectiveness of jammers are growing.[22] In the days leading up to its invasion of Ukraine in February 2022 and throughout its combat operations since then, Russia has used its systems to jam signals in the region to hamper the employment of Ukrainian and Allied GNSS guided weapons systems against its troops and equipment, and the areas covered by the effects of those systems can be considerable.[23] The employment of such systems in a war with a peer adversary could significantly diminish the accuracy of weapons like Joint Direct Attack Munitions (JDAMs) and Small Diameter Bombs (SDBs) that rely on reliable Global Positioning System (GPS) guidance to hit their targets.

Although there has been significant research focused on making munitions less susceptible to the effects of GPS jammers, there is little evidence that such munitions would retain their accuracy during a full-up conflict with a peer adversary. Attacking targets in that environment using GPS guidance alone might require many more munitions and sorties than would otherwise be necessary, depleting the inventory of GPS guided munitions much faster and with markedly less effect than is likely contemplated by current war plans.

The only weapons in the U.S. inventory that can fully counter GPS/electronic jammers and reliably hit their targets are those that can track physical targets with laser, optical, or infrared seeker heads. The Air Force has not acquired PaveWay or Maverick missiles for several years, and most GPS guided munitions do not have seeker heads or a secondary capability to track and guide on a target in a degraded GPS environment.

To cover this gap, the Air Force has added a laser guidance capability to its already effective GBU-53 Small Diameter Bomb (SDB I). Known as the SDB II, the improved weapon "uses Link 16 and ultra-high frequency datalinks, along with infrared guidance, to provide course corrections" and hit "both fixed and moving targets."[24] Unfortunately, the service has not yet acquired the SDB II in numbers that would be required for conflict with a peer competitor.

TABLE 11

Precision-Guided Munitions Expenditures and Programmed Acquisitions

TOTAL MUNITIONS EXPENDED

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023*
JDAM	30,664	5,462	7,354	4,004	4,242	4,203	4,250
HELLFIRE	1,536	2,110	2,449	1,019	1,023	132	110
SDB-I/II	4,507	749	1,289	397	98	52	355
APKWS	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	866
JASSM ER/XR	360	19	16	10	8	0	12
LGB	276	373	106	6,078	5,625	4,856	5,265
ARRW	0	0	0	0	0	2	0
LRASM	0	0	0	0	0	0	0
Total	**38,092**	**9,462**	**11,963**	**11,508**	**10,996**	**9,245**	**10,858**

TOTAL MUNITIONS ACQUIRED

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024**
JDAM	35,106	36,000	25,000	16,800	1,919	1,241	2,840
HELLFIRE	3,629	3,734	3,859	4,517	1,176	5,151	1,295
SDB-I/II	7,312	6,254	8,253	3,205	1,983	5,837	
APKWS	10,621	6,879	15,642	1,323	12,801	11,199	4,911
JASSM ER	360	360	390	400	525	390	440
LGB	0	0	0	0	0	0	0
ARRW	0	0	0	0	12	0	0
LRASM						28	6
Total	**57,777**	**53,976**	**53,893**	**26,994**	**18,416**	**23,818**	**9,486**

* Estimates based on programmed expenditures.

** Estimates based on FY 2024 President's Budget.

SOURCES:

- Headquarters U.S. Air Force, Deputy Chief of Staff for Operations, written response to Heritage Foundation request for information, May 24, 2023.
- Table 1, "Department of the Air Force Budget Summary," in U.S. Department of the Air Force, *Department of the Air Force FY 2024 Budget Overview*, p. 2, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Budget/FY24%20Budget%20Overview%20Book.pdf?ver=JjFXW89XqB_YsIGx1wx4IA%3d%3d (accessed September 18, 2023).
- U.S. Department of the Air Force, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Air Force, Justification Book Volume 1 of 1, Procurement of Ammunition, Air Force*, March 2023, pp. 5 and 41, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Procurement/FY24%20Air%20Force%20Ammunition%20Procurement.pdf?ver=EP4kq6Ly9fXnB_sF66NVMA%3D%3D (accessed September 18, 2023).

Capability

The risk assumed in capacity has placed an ever-growing burden on the capability of Air Force assets. The ensuing capability-over-capacity strategy centers on the idea of developing and maintaining a *more* capable force that can win against the advanced fighters and surface-to-air missile systems now being developed by top-tier potential adversaries like China and Russia, which are also increasing their capacity in this area.

Any assessment of capability includes both the incorporation of advanced technologies and 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 fatigue on everything from metal airframe structures to electrical wiring harnesses.

The average age of Air Force aircraft is more than 30 years, and in some fleets, such as the B-52 bomber, it is more than 62 years. In addition, KC-235s comprise 76 percent of the Air Force's 471 tankers and are more than 61 years old on average. By the end of FY 2024, 102 brand-new KC-46s will make up 21 percent of the tanker inventory, but they will not currently be capable of refueling aircraft during combat operations—the jet's primary mission.[25]

The Air Force estimates that the fix for problems in the KC-46's refueling boom and remote vision system (RVS) should be ready by the spring of 2024. Assuming the boom and RVS redesign goes as planned, retrofitting jets that the service has already accepted will take several years, and the operational impact of that process will be significant: 103 strategic air refueling assets will be unusable in real-world operations in 2024. That number will grow to 110 jets in 2025, equating to 23 percent of the fleet that will be unable to fulfill operational taskings reliably.[26]

The average age of the F-15C fleet is 39 years,[27] significantly exceeding the programmed service life of a fleet that still comprises more than half of USAF air superiority platforms.[28] The F-16C fleet is more than 33 years old,[29] and to extend their lives even further, 300 of those jets are undergoing a major service life extension program (SLEP) that will allow them to fly through 2050.[30] These modifications are costly, and the added expense reduces the amount of funding the service has to invest in modernization, which is critical to ensuring future capability. Even with a SLEP, there is a direct correlation between aircraft age and the maintainability of those platforms. (See Table 12.)

The Air Force's ISR and lift capabilities face similar problems in specific areas that affect both capability and capacity. The majority of the Air Force's ISR aircraft are now unmanned aerial vehicles (UAVs). The Air Force will divest 38 MQ-9 Block-1 aircraft in FY 2024, leaving a total of 208 Reapers.[31] The service divested the last of its fleet of EQ-4s and Block 30 RQ-4s in FY 2021 and FY 2022, respectively. The RQ-4 Block 40 fleet remains in service, and the RQ-4 Block 30 mission will be carried on by the 40-year-old U-2, which is scheduled to be divested by the end of the current FYDP.[32]

The E-8 Joint Surveillance Target Attack Radar System (J-STARS) and RC-135 Rivet Joint are ISR platforms built on the Boeing 707 airframe, and the last one came off the production line 44 years ago. The Air Force will divest its last three remaining E-8s in FY 2024.[33]

The Air Force is working on an incremental approach for a J-STARS replacement that focuses on advanced and disaggregated sensors (a system of systems) that would require enhanced and hardened communications links. Known as the Advanced Battle Management System (ABMS), it is envisioned as an all-encompassing approach to both airborne and ground Battle Management Command and Control (BMC2) that would allow the Air Force both to fight and to support joint and coalition partners in high-end engagements.[34]

With respect to air combat, the Air Force will retire 57 more F-15C/Ds in FY 2024, leaving just 92 in its inventory.[35] Concerns about what platform will fill this role when the F-15C is retired are fully justified. Just 186 of 750 planned F-22A stealth air superiority fighters were acquired to replace the F-15C,[36] and the service has announced its intent to retire 33 Block 20 F-22s in FY 2024. If those jets are retired,[37] the fleet will be reduced to just 153 jets.[38]

The service's already low ability to fulfill operational requirements for air superiority fighters will be further strained by a 10-year program, intended to refurbish the low-observable coatings on the F-22's engine inlets and inspect and overhaul the aircraft's flight control system, that will run through 2031.[39] That program, which will take aircraft that are to be refurbished out of operational availability,

TABLE 12

Air Force, Total Aircraft Inventory (Page 1 of 2)

	FY 2023					FY 2024			Mission-Capable Rate			
	Active Duty	Air National Guard	Air Force Reserve	Total	Average Age	Retired	Added	Total	FY 2022 Rate	FY 2021 Rate	Change in Rate	Average Mission-Capable FY 2023
A010C	131	74	55	260	41	–21		239	70%	73%	–3%	167
AC130J	30	0	0	30	4		0	30	81%	84%	–3%	24
B-1B	45	0	0	45	36	–1		44	64%	41%	24%	28
B-2A	20	0	0	20	28			20	53%	59%	–6%	11
B-52H	58	0	18	76	62			76	59%	59%	0%	45
C-130H	0	76	42	118	31	–2		116	68%	69%	–1%	79
C-130J	103	40	10	153	13		2	155	75%	76%	–1%	116
C-5M	36		16	52	36			52	53%	57%	–5%	27
C-17A	146	50	26	222	21			222	78%	80%	–3%	172
CV022B	52	0	0	52	10			52	52%	51%	1%	27
E003G	18	0	0	18	44	–2		16	64%	61%	3%	10
E008C	0	3	0	3	23	–3		0	49%	62%	–13%	0
E11	6			6	12		1	7				
EC130H	6	0	0	6	49	–2		4	69%	67%	2%	3
EC130J	0	4	0	4	23	–4		0	67%	64%	3%	0
F015C	0	135	0	135	39	–49		86	46%	69%	–23%	40
F015D	0	14	0	14	39	–8		6	58%	69%	–11%	3
F015E	218	0	0	218	31	0	0	218	52%	66%	–15%	112
F015EX	8	0	0	8	0.5		10	18	85		n/a	1,530
F016C	408	236	52	696	33	0		696	71%	72%	–1%	494
F016D	98	45	2	145	33	0		145	69%	69%	0%	100
F022A	165	20	0	185	17	–32		153	57%	51%	6%	87
F035A	412	20	0	432	5		45	477	65%	69%	–3%	312
HC130J	21	12	6	39	7			39	76%	76%	0%	30

TABLE 12

Air Force, Total Aircraft Inventory (Page 2 of 2)

	FY 2023					FY 2024			Mission-Capable Rate			
	Active Duty	Air National Guard	Air Force Reserve	Total	Average Age	Retired	Added	Total	FY 2022 Rate	FY 2021 Rate	Change in Rate	Average Mission-Capable FY 2023
HH060G	26	18	16	60	28	–37		23	69%	71%	–2%	16
HH060W	39	0	0	39	0.5		19	58	61%			35
KC010A	24	0	0	24	39	–10		14	80%	79%	1%	11
KC046A	63	12	7	82	2		20	102	70%	71%	–1%	71
KC135R	118	140	62	320	61	0		320	72%	71%	1%	230
KC135T	21	24	0	45	63			45	70%	70%	0%	32
LC130H	0	10	0	10	38			10	55%	43%	12%	6
MC130J	56	0	0	56	7		8	64	79%	79%	0%	51
MQ009A	222	24	0	246	7	–38	0	208	90%	90%	0%	187
RC135S	3	0	0	3	61			3	81%	86%	–5%	2
RC135U	2	0	0	2	59			2	79%	82%	–3%	2
RC135V	8	0	0	8	59			8	70%	73%	–3%	6
RC135W	12	0	0	12	60	0	0	12	68%	66%	2%	8
RQ-4	10	0	0	10	12	–1		9	71%	74%	–3%	6
T001A	127	0	0	127	29	–52		75	76%	74%	2%	57
T006A	444	0	0	444	18			444	71%	71%	0%	315
T007A				5	2			5		71%		0
T038A	53	0	0	53	57			53	69%	72%	–3%	37
T038C	451	0	0	451	57			451	57%	63%	–6%	257
U2	31	0	0	31	41			31	73%	76%	–3%	23
Totals				5,154	29.51	–190		4,964			–1%	

SOURCE: Appendix, "Total Aircraft Inventory (TAI)," in U.S. Department of the Air Force, *FY 2024 Department of the Air Force Budget Overview*, March 2023, p. 43, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Budget/FY24%20Budget%20Overview%20Book.pdf?ver=JjFXW89XqB_YsIGx1wx4IA%3d%3d (accessed September 25, 2023).

coupled with the F-22's low mission capability rate, would significantly hobble the availability of this system in a fight with a peer competitor.

The Air Force continues to acquire the F-35A, and the President's budget for FY 2024 would support acquisition of 48 of these multirole stealth fighters. The jet achieved full operating capability (FOC) in 2018 and flew for the first time with the long-awaited Block 4/Technical Refresh-3 (TR-3) on January 6, 2023.[40] The F-35A's multirole design favors the air-to-ground mission, but its fifth-generation faculties will also be dominant in an air-to-air role, allowing it to augment the F-22A in many scenarios.[41]

The F-35A is programmed to receive $5.8 billion in funding over the FYDP. At that level, it is eighth on the DAF funding priorities list, preceded by Next Generation Air Dominance (NGAD) at $22.06 billion; the Ground Based Strategic Deterrent (GBSD) at $14.9 billion; the B-21 at $10.6 billion; Resilient Missile Warning Missile Tracking-Low Earth Orbit at $9.7 billion; Space Technology Development and Prototyping at $9.3 billion; the Survivable Airborne Operations Center at $8.1 billion; and Evolved Strategic Satellite Communications (SATCOM) at $6.8 billion. In other words, the only fifth-generation U.S. fighter in production has a significantly lower priority than strategic bomber, satellite, and F-22 air dominance replacement programs even though the Air Force is substantially short of the combat-coded aircraft that would be needed to win a war against any peer or near-peer opponent.

NGAD is not expected to begin fielding until 2030 at the earliest, and while the B-21 has yet to fly, the program has completed an Integrated Baseline Review for the overall B-21 development effort as well as the jet's Preliminary Design Review. The Air Force is committed to a minimum of 100 B-21s at an average cost of $639 million per plane in FY 2019 dollars.[42]

With the budget agreement that was reached for FY 2018 and FY 2019, the Secretary of the Air Force announced the USAF's intent to retire all B-1s and B-2s and sustain a fleet comprised of 100 B-21s and 71 B-52s.[43] The B-21 Raider and B-52s "will form a two-bomber fleet that will incrementally replace the aging fleet of B-1 Lancer and the B-2 Spirit bombers," and the B-21 is "slated to hit full operations in the mid-2020s."[44] The Air Force retired 17 B-1s in 2021 and continues to execute a SLEP on the remaining fleet of 44 to restore the bomber's engines to their original specifications. The Air Force had planned to modernize the B-2's Defense Management System but cancelled the plan in 2021 because of a software coding mismatch with its legacy computer system.[45] Stores Management Operational Flight Program and Common Very-Low-Frequency/Low Frequency Receiver Program elements will be fielded to ensure that this penetrating bomber remains viable in highly contested environments, keeping it fully mission-capable until it is replaced by the B-21.[46]

Modernization efforts for the B-52 are also underway. The jet was designed in the 1950s, and the current fleet entered service in the 1960s. The FY 2018 budget funded the re-engineering of this fleet with upgrades that include a new Long-Range Standoff (LRSO) cruise missile, improved radar, new computers, new communication links, and a new suite of electronic warfare countermeasures. The aircraft will remain in the inventory through 2050,[47] which means that a significant portion of the U.S. bomber fleet will be more than 80 years old.

Acquisition of the KC-46A air refueling tanker is another critical enabler for the service. As previously noted, the KC-46 has experienced a series of problems and delays, the most recent of which involves the air refueling system that currently cannot refuel fighters in an operational environment. The Air Force will have 95 KC-46s by the end of FY 2023[48] and will acquire another 84 tankers for a total of 179 by the end of FY 2029. The KC-46 will replace less than half of the current tanker fleet and will leave the Air Force with more than 200 aging KC-135s (already averaging 61 years old) that still need to be recapitalized.[49]

When the Secretary of the Air Force and the Chief of Staff of the Air Force rolled out "The Air Force We Need" in 2018 to expand the number of squadrons from 312 to 386, one of their goals was to fill the ranks of those new squadrons with only the newest generation of aircraft—F-35s, B-21s, and KC-46s—because of the capabilities that those platforms bring to bear.[50] Curiously, the Air Force is now acquiring the fourth-generation F-15EX, based primarily on the ill-conceived notion that it will be cheaper to acquire and operate than the F-35A, instead of buying the country's only fifth-generation aircraft in production.[51] The FY 2024 budget funds 24 more F-15EXs and signals an intent to cap the

purchase at just 80 jets. With the latest cuts in the fighter force, the service has reversed course on its stated intent to use them to replace Air National Guard F-15Cs; instead, approximately half of the F-15EX fleet will be fielded in active-duty units. Although the service will offset some of its fighter fleet retirements with this new hardware, the F-15EX is a step backwards and will not be survivable in anything more than low-threat environments by the time this weapons system reaches initial operating capability (IOC).

Readiness

The 2018 National Defense Strategy's focus on peer-level war was designed to facilitate a clear and rapid paradigm shift away from the tiered levels of readiness the Air Force had adopted because of years of relentless deployments and funding shortfalls. In a move that would refine the service's focus on great-power competition as spelled out by the new NDS, Secretary of Defense James Mattis directed the Air Force to increase the mission-capable (MC) rates of the F-16, F-22, and F-35 aircraft to 80 percent by the end of September 2019.[52] The move was designed to make more of an all-too-small fleet of combat aircraft available to deploy in the numbers required to deter or defeat a peer adversary.

Early in 2019, then-Air Force Chief of Staff General David Goldfein stated that the service would likely not meet the 80 percent MC threshold directive until 2020, and in the spring of 2020, he made it clear that the threshold was no longer a focus for the Air Force. MC rates are a measure of how much of a certain fleet is "ready to go" at a given time, and the general stated in clear terms that he regarded the statistic as an inaccurate portrayal of the service's overall health.

Instead of using that historic marker for readiness, the service moved to highlight how deployable a portion of any fleet was within a short period of time[53] and shifted its focus to the number of "force elements"—fighters, bombers, and tankers—that it has across the Air Force and how quickly those forces need to be ready. One of the examples that Goldfein used was the rapid deployment of a "task force" of four B-52s to the Middle East in May 2019.[54] The bombers, from Barksdale Air Force Base, Louisiana, had two days from notification to deployment, and while the ability to deploy four of 58 operational bombers rapidly is a capability, it is one that is more in line with responding to a regional contingency than it is with taking on a peer adversary.

In the USAF's FY 2020 posture statement, Secretary Wilson and General Goldfein said that "more than 90 percent of our pacing squadrons are ready to 'fight tonight' with their lead force packages" and that "these pacing squadrons are on track to reach 80% readiness before the end of Fiscal Year 2020."[55] A short time later, however, the service abandoned even the illusion that it was working to achieve that goal, and by 2022, a new service chief, General Charles Brown, had abandoned the pacing squadron concept and released an article on the need to redefine readiness.[56]

Unfortunately, the FY 2022 Air Force posture statement offered no more clarity or assurances of readiness; instead, it moved to change the paradigm of readiness into a three-phase force-generation model designed to "articulate readiness impacts and capacity limits."[57] In FY 2023, it morphed again into what is now known as the Air Force Generation (AFFORGEN) model, dividing the deployable combat Air Force into four six-month phases of readiness known as "Ready, Available to Commit, Reset, and Prepare." In theory, the model "builds high-end and sustainable readiness toward future missions by balancing elements of current availability, modernization and risk,"[58] but from the outset, it represents little more than an attempt to change the dialogue surrounding what are perhaps the lowest levels of readiness in Air Force history.

In 2017, Secretary Wilson and General Goldfein informed Congress that "[w]e are at our lowest state of full spectrum readiness in our history."[59] In the six years since their testimony, DOD has stifled open conversation or testimony about readiness, limiting the Air Force's ability to be forthcoming with open-source readiness indicators. Although this makes any assessment of readiness difficult, there are three areas that can support an assessment:

- MC rates,
- Aircrew training, and
- Deployability.

MC Rates. MC rates are defined as the percentage of a unit's aircraft that are capable of executing its mission set. Multiplying MC rates by the actual

number of aircraft within a particular fleet yields the physical operational capacity of a weapons system. Several factors drive MC rates. The two most common to mature systems are operations and maintenance (O&M) funding and qualified manning to generate, fix, and fly those jets. Collectively, they dictate the number of sorties and flight hours that units have available for aircrew training.

The last time the United States was prepared to fight a peer competitor, the Air Force had more than 700 F-15C air superiority fighters with a fleet MC rate of more than 80 percent. If only 500 were combat-coded, more than 400 mission-capable jets were ready to fight the Soviet Union. Conversely, there are 186 F-22As in the total aircraft inventory, but 28 are dedicated trainers and 16 are primary development aircraft inventory used for testing new equipment, which leaves just 142 operational jets. In 2022, the F-22A had an MC rate of 57 percent, which means that just 81 F-22As could be committed to combat at any given time.[60] Although the F-22A is an incredibly capable fighter and 81 F-22s would be a formidable capability against a regional threat, that number would be grossly insufficient for a peer fight.

Similarly, there are 33 operational B-1s in the Lancer fleet.[61] With an MC rate of 55 percent in FY 2022, 18 are available for combat at any given time during the year. The B-2 fleet's small size and 53 percent MC rate mean that, on average, just 10 are combat capable. If the B-52's 58-plane operational fleet and 59 percent mission-capable rate are added, a total of 63 Air Force bombers were capable of executing combat missions on any given day in 2022.[62] (For a summary of the mission-capable rates for combat-coded aircraft of the five fighter weapons systems, see Table 14.)

Maintenance manning remains relatively healthy across the board. (See Table 15.) If funding for flying hours and spare parts were robust, MC rates would rise, giving pilots more sorties and the ability to sharpen their combat mission-capable skills. Unfortunately, funding for flying hours increased only marginally in the years immediately following sequestration, and the number of available sorties falls well short of the minimum number required for pilots to be considered combat mission capable.

Aircrew Training. Unlike maintenance manning, the pilot shortage continues to plague the service. In March 2017, Lieutenant General Gina M. Grosso, Air Force Deputy Chief of Staff for Manpower, Personnel, and Services, testified that at the end of FY 2016, the Air Force had a shortfall of 1,555 pilots. Of that total, the service was short 1,211 fighter pilots: 873 Active and 338 from the Active Reserve Component (ARC).[63] The Total Force shortfall in 2022 was 1,650: 650 Active and 1,000 ARC,[64] and while the Air Force would not provide the 2023 shortfall, it is very unlikely that the shortfall has not decreased.

The Air Force graduated 1,200 pilots in FY 2018 and 1,279 in FY 2019, and despite projections that 1,480 would receive their wings in 2020, COVID-19 reduced the throughput so that just 1,263 graduated from flight school. Another 1,381 graduated in FY 2021. The Air Force would not provide the 2022 graduation rates and estimates for FY 2023.

Those projected numbers rely on a very high annual graduation rate of approximately 94 percent of the candidates that enter flight school during any given year. In 2021, just 0.27 percent of flight school candidates were eliminated based on performance. The vast majority of those who washed out were eliminated for health, discipline, or other reasons that were not specifically related to performance.[65] The Air Force would not provide the 2022 washout rates.

Throughout the pilot shortage, the Air Force has done its best to prioritize operational unit manning instead of placing experienced fighter pilots at staffs and schools. Nevertheless, the currency and qualifications of the pilots in operational units are critically important to readiness. Air Force regulations have set minimum thresholds for sorties based on experience levels, and a series of Air Force regulations, known as the Ready Aircrew Program (RAP), dictate that inexperienced fighter pilots in combat-coded units must fly nine sorties a month and that experienced pilots must fly eight to be considered mission capable.[66] However, those numbers are minimum thresholds, and the tables that follow show that Air Force pilots are not meeting even those requirements. While the quality of sorties is admittedly subjective, a healthy rate of three sorties a week and flying hours averaging more than 200 hours a year have been established as "sufficient" over more than six decades of fighter pilot training.[67] In the words of General Bill Creech, "Higher sortie rates mean increased proficiency for our combat

TABLE 13

Air Force Flying Hours and Weapons System Sustainment (WSS) Funding

Dollar figures are in millions.

Fiscal Year	Flying Hours (Millions)	Flying Hours Budget (Nominal Dollars)	WSS Budget (Nominal Dollars)	Flying Hours Budget (2023 Dollars)	WSS Budget (2023 Dollars)
2013	1.16	$6,200	$11,306	$8,122	$14,811
2014	1.2	$6,900	$11,683	$8,832	$14,954
2015	1.2	$6,900	$12,300	$8,832	$15,744
2016	1.22	$5,400	$13,039	$6,858	$16,560
2017	1.16	$6,100	$14,469	$7,625	$18,086
2018	1.42	$6,200	$14,959	$7,502	$18,100
2019	1.45	$8,700	$14,792	$10,353	$17,602
2020	1.33	$5,790	$15,801	$6,832	$18,645
2021	1.24	$7,800	$15,332	$8,736	$17,172
2022	1.15	$7,600	$15,521	$7,828	$15,987
2023	1.12	$8,900	$16,697	$8,916	$16,697
2024	1.07	$9,000	$18,340	$9,000	$18,340

SOURCES:

- Extracted from U.S. Air Force budget rollout briefs and budget summaries for fiscal years 2014–2024. For example: U.S. Department of the Air Force, *United States Air Force Fiscal Year 2014 Budget Overview*, April 2013, p. 8, https://www.saffm.hq.af.mil/Portals/84/documents/FY14/AFD-130409-028.pdf?ver=2016-08-24-092814-517 (accessed September 19, 2023), and Table 2, "United States Air Force Budget Summary," in U.S. Department of the Air Force, *FY 2024 Department of the Air Force Budget Overview*, p. 4, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Budget/FY24%20Budget%20Overview%20Book.pdf?ver=JjFXW89XqB_YsIGx1wx4IA%3d%3d (accessed September 19, 2023).
- Headquarters U.S. Air Force, A8XC/A5RW, written response to Heritage Foundation request for information, May 24, 2023.

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aircrews,"[68] and given the right number of sorties and quality flight time, it takes seven years beyond mission qualification in a fighter for an individual to maximize his potential as a fighter pilot.[69]

Flying hours and sortie rates across all fighter platforms fell to historic lows during the COVID-19 pandemic, and the average line mission-ready fighter pilot received fewer than 1.4 sorties a week and less than 131 hours of flying time per year.[70] At those levels, pilot competence and confidence drop to the point where excellent pilots begin to question their ability to execute even very basic tasks. In a speech delivered on September 21, 2022, General Mark Kelly, Commander, Air Combat Command, stated that the average fighter pilot received just 6.8 hours of flying time per month (less than two hours per week) for a total of 81.6 hours in 2021.[71] No matter which data point is selected, the numbers reflect an Air Force that would struggle in a fight with a regional competitor and could well founder in a war with a peer adversary.

The last time fighter pilots received an average of 150 hours of flying time and more than two sorties a week for an entire year was in 2015 when the service was beginning to recover from sequestration. In spite of a budget that has increased by more than 75 percent in the years since then, the number of flying hours the Air Force funds has remained very low, and the service has failed to execute the programed number of hours year after year. In other

TABLE 14

Mission-Capable Combat-Coded Fighters in the Active-Duty Air Force

	Combat-Coded Fighters	Average Age in Years	FY 2022 Mission-Capable Rate	Mission-Capable Combat-Coded Fighters
A-10C	109	39	70%	76
F-15E	164	31	52%	85
F-16C	309	33	71%	219
F-22A	110	17	57%	63
F-35A	194	5	65%	127
Total	**886**			**570**

SOURCES:

- Combat-Coded Fighters: U.S. Department of the Air Force, *FY 2024 Department of the Air Force Budget Overview*, https://www.saffm.hq.af.mil/Portals/84/documents/FY24/Budget/FY24%20Budget%20Overview%20Book.pdf?ver=JjFXW89XqB_YsIGx1wx4IA%3d%3d (accessed September 19, 2023), and International Institute for Strategic Studies, *The Military Balance 2023: The Annual Assessment of Global Military Capabilities and Defence Economics* (London: Routledge, 2023), pp. 43–47. Notes: Where the two publications were in conflict for total aircraft inventory, the USAF numbers were generally adopted. Neither document specifies numbers of active-duty combat-coded aircraft. Those figures were derived by tallying the total number of fighters by type and dividing that number by the total number of active-duty squadrons flying those types of aircraft. The numbers and types of aircraft associated with Weapons Instructor Course Squadrons, Adversary Tactics, Test, OT&E, and other units are not standard/de-terminable and could not be assessed. The associated error is minimized by totaling all similar fighter aircraft (F-16, F-15C, etc.), dividing them by the total number of squadrons flying those aircraft, and spreading the error equally across all combat-coded fighter and training units. The total number of fighters associated with non–fighter training unit (FTU) squadrons was counted as combat-coded.
- Table, "Aircraft Total Active Inventory (TAI) (As of Sept. 30, 2022)," in "Air Force & Space Forces Almanac 2023," *Air & Space Forces Magazine*, Vol. 106, Nos. 6 and 7 (June/July 2023), p. 66, https://www.airandspaceforces.com/app/uploads/2023/06/Almanac2023_Fullissue_REV2.pdf (accessed August 25, 2023).

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words, even when funding has been available, the service has failed to use it to improve pilot readiness. Some argue that the lack of hours in the cockpit is being offset by time/sorties in high-fidelity simulators, but this presumes that simulator time is an effective substitute for time in a real aircraft. The Air Force RAP requires inexperienced F-35 pilots to fly a minimum of nine times a month in the jet and a minimum of three times a month in high-fidelity simulators.[72] The average line F-35 pilot received just six sorties and 2.2 simulators a month in 2022, which means that by definition they are not combat mission capable.

Prioritizing readiness and significantly increasing funding for the flying hour program could easily resolve this issue, but the service has been hobbling itself for years. The flying hours funded within the service's budget dropped from 1.33 million in FY 2020 to 1.24 million in FY 2021 to 1.15 million in FY 2022,[73] and even then, the service was able to fly only 1.097 million hours before the account ran out of money. The number of hours funded fell again to 1.13 million in FY 2023 and has declined still more to 1.07 million in the President's budget for FY 2024.[74] It should be noted that the service budgeted for and actually executed more flying hours in 2013, the year sequestration drove draconian cuts in DOD's budget, than it has in any of the past three years.[75] Every reduction has been accompanied by a note stating that the hours were budgeted to "the maximum executable level," but that is at best misleading because the only constraint beyond funding is maintenance manning, which has been healthy since 2019. (See Table 15.)

The current generation of fighter pilots—those who have been actively flying for the last seven years—has never experienced a healthy rate of operational flying. It will take several years of flying

TABLE 15

Air Force Maintenance Manning

Skill Level	Authorized	Assigned	Manning Percentage
3–level (Apprentice)	17,819	16,857	95%
5–level (Journeyman)	36,616	36,387	99%
7–level (Craftsman)	18,632	17,630	95%

SOURCE: Headquarters U.S. Air Force, A8XC/A5RW, written response to Heritage Foundation request for information, May 24, 2023.

three or more sorties a week to regain the level of competence required to dominate a peer competitor, but the Air Force is not moving to make that happen. Readiness as measured by the Air Force's long-standing metrics is incredibly low, and the criteria for the Chief of Staff's "Redefine Readiness or Lose" concept remain undefined.[76] Continuing down this path will further erode combat capability, competency, and flight safety for Air Force pilots.

Deployability. Because long-term inspections and depot-level work affect the availability of support equipment and aircraft, it takes three active-duty squadrons to deploy two squadrons forward. On any given day, units have several aircraft that are not flyable because of long-term inspections, deep maintenance, or the need for spare parts. By using aircraft from one of the three squadrons to "plus up" the other two, the wing could immediately deploy two full-strength units into combat. The handful of fully flyable jets and pilots left at the home station could then be used to train new and inbound pilots up to mission-ready status so that, among other things, they could replace pilots that were lost during combat.[77] Up until the end of the Cold War, the Air Force was organized using a three-squadron wing to handle the associated load.

Normally, active-duty fighter squadron manning levels are based on a ratio of 1.25 aircrew members for every aircraft,[78] which means that a unit with 24 assigned aircraft should have 30 line pilots and five supervisor pilots who are combat mission ready.[79] Flight times, sortie rates, mission planning teams, and flight supervision requirements are significantly higher in combat, and to cover those requirements, the manning ratio normally increases to 1.50 pilots per aircraft, or 36 line pilots per squadron. In other words, every squadron deployed to fight requires six more pilots than it has on its roster.[80] Pilots from "donor" squadrons can fill those slots for the deploying units.

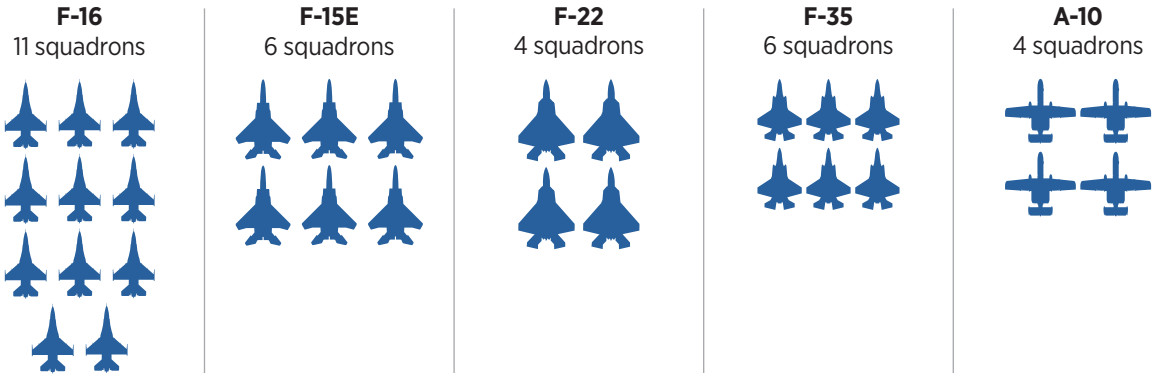
With the downsizing that has taken place since the end of the Cold War and the reduction in the number of fighter squadrons, the Active Air Force has reduced the number of fighter squadrons to two or even one in many wings. All operational Guard and Reserve wings are comprised of a single squadron, which complicates the math behind the total number of deployable fighter squadrons.[81]

Of the 54 operational fighter squadrons on the Air Force roster, 31 are Active and 23 are Guard or Reserve Units. (See Figure 4.) Using the notion that it takes three squadrons to get two active-duty squadrons forward, the airframe disposition of each active-duty wing would allow just 21 active-duty fighter squadron equivalents (with 24 fighter aircraft each) to deploy to a fight. This equates to 480 active-duty fighters that could deploy to meet a crisis situation, which is well short of the 600 it takes to win a single MRC and means that a war with a peer competitor would draw heavily on the service's strategic reserve.

Guard and Reserve units face the same manning and deployment challenges that the active-duty force faces, except that the vast majority of those units have just one fighter squadron per wing, further straining their ability to muster the airframes and manning needed to meet an emergency deployment.[82] Planning for low-threat, low-intensity deployments to Operation Iraqi Freedom and Operation Enduring Freedom took this into consideration by mapping deployments out months (often years) in advance of the required movement, allowing pilots to deconflict their civilian work schedules not just for the deployment, but also to get the training

FIGURE 4

Air Force Active-Duty Combat-Coded Fighter Squadrons (31 Total)



SOURCE: Headquarters U.S. Air Force, Deputy Chief of Staff for Operations, written response to Heritage Foundation request for information, May 24, 2023. The number of squadrons has been adjusted to account for the closure of the last F–15C squadron at Kadena Air Base, Japan.

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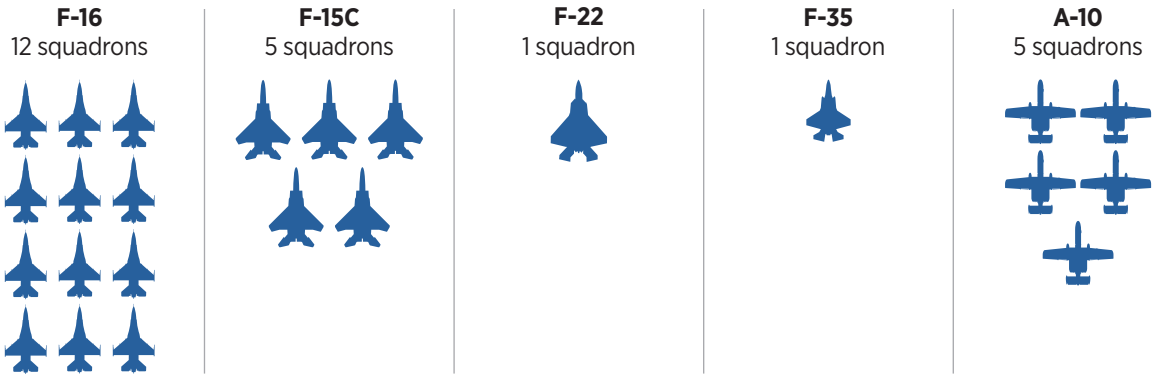
FIGURE 5

Air National Guard and Air Force Reserve Combat-Coded Fighter Squadrons (24 Total)



SOURCE: Headquarters U.S. Air Force, Deputy Chief of Staff for Operations, written response to Heritage Foundation request for information, May 24, 2023.

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and time in the air that they needed to employ successfully in those low-threat combat operations.[83] Nevertheless, it was common for Guard units to pull pilots from other units to fulfill manning requirements for "rainbow" fighter squadrons.[84] In a conflict where there is little time from warning order to deployment, it would likely take two Guard and Reserve squadrons to enable one to deploy forward.[85]

The average Guard and Reserve fighter squadron has one-third fewer jets than similar active-duty units have. By rainbowing units with similar aircraft, the Guard and Reserve could muster 12 squadrons

as a strategic reserve of 288 fighters that could deploy sometime after the active-duty units deploy. In other words, the service could muster just 768 fighters (480 Active and 288 Guard and Reserve) for a peer-level fight. The Guard and Reserve numbers do not just limit deployable airframes. Other factors such as manning levels would also limit the number of sorties and the amount of combat power that those fighters could generate continually in a high-end confrontation with a peer competitor.

The declaration in Air Force posture statements for FY 2020 and FY 2021 that lead force packages within the service's 204 pacing squadrons are ready to fight conveys the fact that only portions of its most capable squadrons have enough mission-capable aircraft and aircrews that are "closer" to the minimum Combat Mission Capable sortie requirements to respond somewhat readily to a crisis. Because of the pilot shortage, actual unit manning levels in fighter squadrons are below peacetime requirements, which is already not enough to meet the increased demands and the tempo required for combat operations. While the Active Component would not release its figures on fighter unit manning, the Air National Guard (ANG) released their manning levels, which *should be* representative for active-duty units as well. Currently, ANG fighter units are manned at 88 percent, which brings the pilot-to-aircraft ratio down to 1.1:1—significantly lower than the planned 1.25:1.

The service has already moved the majority of pilots who were assigned to staff or other non-flying billets back to the cockpit to deal with the most critical aspect of the manning shortfall. Thus, the only way units can meet wartime manning requirements is by pulling pilots from other "donor" squadrons. The complications involved are significant and suggest that the portions of the 54 fighter squadrons that are unable to deploy immediately in a crisis could be combined to create more combat power. Unfortunately, the majority of aircraft and aircrew that are left are needed for homeland defense, to train replacement pilots, or to replace aircraft that are lost through combat attrition.

Scoring the U.S. Air Force

Capacity Score: Marginal

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 squadron, that equates to a requirement of 500 Active Component fighter aircraft to execute one MRC, and adding a planning factor of 20 percent for spares and attrition reserves brings the number to 600 aircraft—aircraft that are an essential element of Air Force combat power.

As part of its overall assessment of capacity, the *2024 Index* looks for 1,200 active-duty, combat-coded fighter aircraft to meet the baseline requirement for two MRCs.[86] That number of fighters lines up well with the fighter requirement from the 2018 TAFWN, which the Commander of Air Combat Command recently reaffirmed is the actual capacity requirement for today's Air Force.[87] The bomber, tanker, and strategic air requirements from that study are also used in this assessment.

- **Two-MRC Fighter—Threshold:** 1,200 combat-coded active-duty fighters / 62 squadrons.
- **Two-MRC Fighter—Actual 2023 Level:** 886 active-duty combat-coded fighters (75 percent) / 54 total force squadrons (88 percent).
- **TAFWN Bomber Squadron—Threshold:** 14 combat-coded bomber squadrons / 140 bombers.
- **TAFWN Bomber Squadron—Actual 2023 Level:** nine combat-coded bomber squadrons (64 percent) / 111 combat-coded bombers (79 percent).
- **TAFWN Tanker Squadron—Threshold:** 54 tanker squadrons / 540 combat-coded tankers.
- **TAFWN Tanker Squadron—Actual 2023 Level:** 43 combat-coded tanker squadrons (80 percent) / 454 combat-coded tankers (84 percent).
- **TAFWN Airlift Squadron—Threshold:** 54 airlift squadrons / 540 combat-coded airlifters.

- **TAFWN Airlift Squadron—Actual 2023 Level:** 53 combat-coded airlift squadrons (99 percent) / 545 combat-coded airlifters (100 percent).

Based on a pure count of combat-coded squadrons and platforms that have achieved IOC, the USAF currently is at 83 percent of the capacity required to meet a two-MRC/TAFWN benchmark. This is 3 percent less than the 86 percent reported in the *2023 Index*, and the disposition of those assets limits the ability of the service to deploy them rapidly to a crisis region. The active fighter and bomber assets that are available might prove adequate to fight and win a single regional conflict, but the time and casualties/losses involved would be much higher. When coupled with the low mission capability rates of those fighter aircraft (see Table 14), this means that it would take global sourcing to field the combat fighter force required for a single MRC and that the rest of the world would be left uncovered.

Nevertheless, the capacity level is well within the methodology's range of "marginal." Programmed aircraft retirements are set to exceed acquisitions over the FYDP, which means that capacity will continue to trend downward.

Capability Score: Marginal

The Air Force's capability score is "marginal," based on scores of "strong" for "Size of Modernization Program," "marginal" for "Age of Equipment" and "Health of Modernization Programs," but "weak" for "Capability of Equipment." These assessments are the same as those in the *2023 Index*. New F-35 and KC-46 aircraft continue to roll off their respective production lines, but these additions are more than offset by aircraft retirements. As a consequence, this score will probably not improve over the next three to five years.

Readiness Score: Very Weak

The Air Force scores "very weak" for readiness, the same grade it received in the *2023 Index and the lowest on the five-grade scale*. The USAF's sustained pilot deficit certainly contributes to this assessment, but the incredibly low sortie rates and flying hours would prevent any Air Force combat-coded fighter squadron from being able to execute all or even most of its wartime mission. Sortie rates improved marginally in 2022, but they are nowhere near what pilots need if they are to rebuild the competencies required to excel in a peer fight.

At best, half of the cadre of pilots within the most capable units will be able to execute only "some" of the unit's wartime missions. Air Force mission-capable rates are hovering around the same low levels where they were in 2021, and the current budget unfortunately will further reduce operational training sorties. This reflects a service that is content with being at the bottom of the readiness ladder. There is not a fighter squadron in the Air Force that holds the readiness levels, competence, and confidence levels that it would need to square off against a peer competitor,[88] and readiness is continuing to spiral downward.

The FY 2023 Air Force statement mentions the word "ready" just four times and never in the context of current readiness levels.[89] The Air Force should be prepared to respond quickly to an emergent crisis not with a "task force" of four bombers, but with the speed and capacity required to stop a peer competitor in its tracks. With the significant curtailment of deployments in support of the global war on terrorism, the Air Force should be much further along in its full-spectrum readiness than we have seen to date.

Overall U.S. Air Force Score: Very Weak

This is a result of the lowest of the USAF's three scores: a capacity score of "marginal," capability score of "marginal," and readiness score of "very weak." As with a three-legged stool, success or failure is determined by the weakest leg. The shortage of pilots and flying time for those pilots degrades the ability of the Air Force to generate the quality of combat air power that would be needed to meet wartime requirements. Fighter pilots should receive an average of three or more sorties a week and 200 hours per year to develop the skill sets needed to survive in combat, but while some readiness issues can be written off to the effects of COVID-19, the service is making a calculated decision not to acquire more aircraft or fund the accounts required for any significant increase in training and numbers of sorties.

Although there is a chance the U.S. would win a single MRC, there is little doubt that the Air Force would struggle in war with a peer competitor. Both the time required to win such a conflict

and the attendant rates of attrition would be much higher than they would be if the service had moved aggressively to increase high-end training and acquire the fifth-generation weapon systems that it so clearly needs.

U.S. Military Power: Air Force

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity			✓		
Capability			✓		
Readiness	✓				
OVERALL	✓				

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Strategic Bomber

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
B-52 Stratofortress Inventory: **76** Fleet age: **62** Date: **1961** The B-52, the oldest of the bombers, provides global strike capabilities with conventional or nuclear payloads. Programmed upgrades for the B-52 include a new communications, avionics, and Multi-Functional Color Displays. The Air Force plans to use this aircraft through the 2050s as a complement to the B-21 Raider.	1	2	The B-21 is an advanced stealth bomber that is currently programmed to replace all B-1s and B-2s in the Air Force bomber fleet beginning in the late 2020s and expand to a fleet of at least 100 aircraft. Flight testing, originally scheduled for late 2022, has been pushed back to 2023 because of unspecified delays. However, the Raider is still projected to enter service in the mid-2020s.		
B-1B Lancer Inventory: **45** Fleet age: **36** Date: **1986** Nicknamed "The Bone," the B-1B Lancer is a long-range, multi-mission, supersonic conventional bomber that has served the United States Air Force since 1985. Originally designed for nuclear capabilities, the B-1 switched to an exclusively conventional combat role in the mid-1990s. In September 2020, the entire Air Force B-1B Lancer fleet completed the Integrated Battle Station upgrade to modernize the jet's datalinks, cockpit displays, and test system. The B-1B is scheduled to be phased out in 2032.	2	2			
B-2 Spirit Inventory: **20** Fleet age: **28** Date: **1997** The B-2 bomber provides the USAF with global strike capabilities for both nuclear and conventional payloads. The stealth bomber's communication suite is currently being upgraded, and efforts are being made to increase its loadout and the ability of its payload to strike hardened and buried targets. The current plan is to begin phasing out the B-2 in 2032.	3	4			

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Ground Attack/Multi-Role Aircraft

PLATFORM	Age Score	Capability Score
A-10 Thunderbolt II Inventory: **239** Fleet age: **41** Date: **1977** The A-10 is the only USAF platform designed specifically for close air support mission using both self-designated precision guided munitions and an internal 30MM cannon. The retirement of the A-10 has been in discussion for years, and in FY 2023, Congress finally allowed the Air Force to retire 18 A-10s. Air Force Chief of Staff General Charles Brown stated that he hopes to retire all A-10s by 2029.	2	2
F-16C/D Falcon Inventory: **841** Fleet age: **33** Date: **1980** The F-16 is a multi-role aircraft that is capable of tactical nuclear delivery, all-weather strike, and Suppression of Enemy Air Defenses (SEAD). Improvements to the F-16's radar, mission computer, cockpit displays, and an ongoing Service Life Extension Program (SLEP) will keep this jet flying through the late 2040s.	2	2
F-35A Lightning Inventory: **477** Fleet age: **5** Date: **2016** See Ground Attack Replacement Program entry. The F-35 is a multi-role stealth fighter that became operational in 2016. By the end of FY 2024, the Air Force will have received 477, but the rate of acquisition has decreased from a planned 80 fighters a year to 48 in FY 2024, putting the original program of record to acquire a total of 1,763 aircraft in doubt.	5	5
F-15E Strike Eagle Inventory: **218** Fleet age: **31** Date: **1989** The F-15E is a multi-role aircraft that is capable of all-weather, deep interdiction/attack, and tactical nuclear weapons delivery. Upgrades include an AESA radar, EPAWSS self-defense suite, a new central computer, and cockpit displays. The Air Force recently announced that it planned to retire more than half of its fleet of F-15Es (119 of 218) to help fund recapitalization of the combat air force (CAF).	2	2

REPLACEMENT PROGRAM	Size Score	Health Score
F-35A Timeline: **2016–2035** The F-35A is a multi-role stealth fighter that achieved IOC on August 2, 2016. The Block 4 version, meant to effect a significant increase in combat capability, remains under development, leading to concerns over rising retrofit costs for existing F-35 aircraft that have led to reduced procurement in recent years. The Block 4 modification will be retrofitted into all Block 3 F-35s. **PROCUREMENT** 543 1,220 **SPENDING** *($ millions)* $59,788 $149,925	4	3

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Fighter Aircraft

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
F-15C/D Eagle Inventory: **92** Fleet age: **39** Date: **1975** The F-15C/D is an air superiority fighter that has been in service since the late 1970s. It is receiving upgrades that include a new AESA radar and self-defenses needed to survive and fight in contested airspace. The F-15C/D inventory is being reduced by the Air Force after determinations that a Service Life Extension Program (SLEP) would not be cost-effective. A divestment of 57 aircraft is planned in FY 2024, and the last F-15 C/D will be retired by the end of the decade.	1	2	**F-15 EX** Timeline: **TBD–2025** The F-15EX is the most advanced Eagle variant based on the F-15QA as a replacement for the legacy F-15C/D. The USAF awarded Boeing a $1.2 billion contract for the first eight of up to 144 new-build F-15EXs on July 13, 2020. Congress funded 12 F-15EXs in FY 2021, 17 in FY 2022, and 24 in FY 2023, and the President's Budget for FY 2024 includes 24 more of these fourth-generation fighters. **PROCUREMENT** 46 48 **SPENDING** *($ millions)* $4,579 $5,266	2	1
F-22A Raptor Inventory: **153** Fleet age: **17** Date: **2005** The F-22 is the preeminent air superiority stealth fighter aircraft, modified to enable delivery of precision-guided weapon. It is currently undergoing a modification called RAAMP that will improve reliability, maintainability and performance. The jet will also begin fielding Link-16 in FY 2022, which will allow it to transmit data with legacy aircraft via the Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS). The Air Force could begin to replace the F-22 as early as the 2030s as it fields the Next Generation Air Dominance (NGAD) fighter that is currently under development.	4	5	None		

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending Through FY 2023 / Pending

Tanker

PLATFORM	Age Score	Capability Score
KC-10 Extender Inventory: **14** Fleet age: **39** Date: **1981** The KC-10 is multi-role tanker and airlift platform that can refuel both boom-compatible and drogue-compatible fighters on the same mission. Recent modifications have enabled a service life extension through 2045. However, the Air Force has determined that the fleet is too costly to sustain, and all KC-10s will be retired by September 2024.	2	5
KC-135 Stratotanker Inventory: **365** Fleet age: **62** Date: **1957** The KC-135 is a multi-role tanker/airlift platform that is capable of simultaneous cargo and AE missions. It has undergone several modifications, mainly engine upgrades to improve performance and reliability. Further planned modifications include Block 45 upgrades (additional glass cockpit display for engine instrumentation, a radar altimeter, advanced autopilot, and modern flight director) at a rate of 38 aircraft per year through 2026. Part of the fleet will be replaced with the KC-46; the remainder are scheduled to be in service through 2050.	1	5
KC-46 Pegasus Inventory: **102** Fleet age: **2** Date: **2020** The Pegasus is a multi-role tanker/airlift platform that can refuel both boom-compatible and drogue-compatible fighters on the same mission. The Air Force accepted the first of 179 programmed aircraft in 2019. The program has significant problems with the remote vision system and boom that currently limit it to refueling fourth-generation jets in non-combat operations.	5	1

REPLACEMENT PROGRAM	Size Score	Health Score
KC-46 Timeline: **TBD–2027** This aircraft is a multi-role tanker/airlift platform that can refuel both boom-compatible and drogue-compatible fighters on the same mission. The Air Force accepted the first of 179 programmed aircraft in 2019. The program has significant problems with the remote vision system and boom that currently limit it to refueling fourth-generation jets in non-combat operations. The Air Force will receive another 15 jets in FY 2024 with this same limitation, bringing the total number of KC-46s in the inventory to 139.	4	3

PROCUREMENT

SPENDING *($ millions)*

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Heavy Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
C–5M Galaxy Inventory: **52** Fleet age: **36** Date: **1970** The C-5 is the USAF's largest mobility aircraft. It can transport 270,000 pounds of cargo over intercontinental ranges and is air refuellable. The "M" models are heavily modified C-5A/Bs that have new engines, avionics, and structural/reliability fixes. Ongoing modifications include a new weather radar and mission computer and improved Large Aircraft IR Countermeasures (LAIRCM).	2	5	None		
C-17 Globemaster III Inventory: **222** Fleet age: **21** Date: **1995** The C-17 is a heavy-lift, strategic transport that is capable of direct tactical delivery of all classes of military cargo. It is the U.S. military's core airlift asset. The C-17 is air refuellable and can operate on small airfields (3,500 feet by 90 feet). Ongoing modifications include next-generation Large Aircraft Infrared Countermeasures (LAIRCM) and structural, safety, and sustainment modifications.	4				

Medium Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
C-130J Super Hercules Inventory: **155** Fleet age: **13** Date: **2006** The C-130J is an upgraded tactical airlift platform with a medium-lift capability and multiple variants that include the C-130J-30, AC-130J gunship, and HC-130J rescue/air refueling platform. The C-130J-30 can carry 92 airborne troops and lift more than 40,000 pounds of cargo. The Air Force Active Component completed its transition to the C-130J in October 2017, and thanks to congressional supplementals, upgrades for units flying the C-130H in the Guard Reserve are still underway.	5	5	**C-130J** Timeline: **2006–2022** The C-130J is an upgraded tactical airlift platform with a medium-lift capability and multiple variants that include the C-130J-30, AC-130J gunship, and HC-130 rescue/air refueling platform. The C-130J-30 can carry 92 airborne troops and lift more than 40,000 pounds of cargo. The Air Force Active Component completed its transition to the C-130J in October 2017, and thanks to congressional supplementals, upgrades for units flying the C-130H in the Guard Reserve are still underway. **PROCUREMENT** 218 **SPENDING** *($ millions)* $20,576 $35	5	5

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending Through FY 2023 / Pending

Intelligence, Surveillance, and Reconnaissance (ISR)

RQ-4 Global Hawk

Inventory: **9**
Fleet age: **12** Date: **2011**

The Global Hawk is a strategic, high-altitude, long-endurance (HALE) "deep look" ISR platform that complements satellite and manned ISR. Unlike the MQ-9, which is a medium-altitude, long-endurance UAV, the RQ-4 flies significantly higher and longer range.

5 1

MQ-9 Reaper

Timeline: **2007–2022**

5 5

The MQ-9 is a hunter/killer unmanned Aerial Vehicle (UAV). The Air Force planned to end procurement of the Reaper in FY 2021, but in FY 2021, Congress decided to procure an additional 16 of these UAVs. With the decline of U.S. counterinsurgency efforts, the Air Force has announced plans to transition the MQ-9 away from counterinsurgency to operating in near contested airspace. The Air Force is planning to replace the Reaper with a more survivable, flexible, and advanced platform as early as 2031.

PROCUREMENT: 4
SPENDING *($ millions)*: $539

RC-135 Rivet Joint

Inventory: **25**
Fleet age: **60** Date: **1972**

The RC-135V/W is tasked with real-time electronic and signals intelligence-gathering, analysis, and dissemination in support of theater- and strategic-level commanders. The extensively modified C-135s detect, identify, and geolocate signals throughout the electromagnetic spectrum. Rivet Joint is used primarily to exploit electronic battlefield intelligence and deliver nearly real-time ISR information to tactical forces, combatant commanders, and National Command Authorities. Ongoing upgrades include new direction-finding COMINT sensors, precision ELINT/SIGINT system integration, wideband SATCOMS, enhanced nearly real-time data dissemination, and new steerable beam antenna. The Air Force's most recent utility assessment projected that the RC-135 would fly through 2050.

1 4

None

U-2 Dragon Lady

Inventory: **31**
Fleet age: **41** Date: **1956**

The U-2S is the Air Force's only manned, strategic, high-altitude, long-endurance ISR platform and is capable of SIGINT, IMINT, and MASINT collection. The aircraft's modular payload systems allow it to carry a wide variety of advanced optical, multispectral, EO/IR, SAR, SIGINT, and other payloads simultaneously. Its open system architecture also permits rapid fielding of new sensors to counter emerging threats and requirements. The Air Force is currently upgrading the U-2 with ASARS-2B/C, which will improve the U-2's high-altitude, deep-look radar ground-mapping, moving-target, and maritime capabilities. The Air Force recently announced that it would retire the fleet of U-2s in 2026.

NOTE: See page 507 for details on fleet ages, dates, timelines, and procurement spending.

AIR FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Armed Reconnaissance

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
MQ-9 A/B Reaper Inventory: **208** Fleet age: **7** Date: **2011** The MQ-9B is a medium-altitude to high-altitude, long-endurance hunter-killer RPA (remotely piloted aircraft) that is tasked primarily with eliminating time-critical and high-value targets in permissive environments. Additional roles include CAS, CSAR, precision strike, armed overwatch, target development/designation, and terminal weapon guidance. The MQ-9 fulfills a secondary tactical ISR role utilizing its Multispectral Targeting System-B (MTS-B), Lynx SAR, and/or Gorgon Stare wide-area surveillance. The USAF is attempting to end MQ-9 procurement and seeks to replace the Reaper with a more survivable, flexible, and advanced platform as early as 2031.	4	2	None		

Command and Control

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
E-3 Sentry Inventory: **16** Fleet age: **44** Date: **1977** The E-3 Airborne Warning and Control System (AWACS) is tasked with all-weather, air and maritime surveillance, command and control, battle management, target, threat, and emitter detection, classification, and tracking. Ongoing upgrades include an urgent operational requirement to shorten kill-chains on time-sensitive targets, modernizing airborne moving target indication, and adding high-speed jam-resistant Link 16. Due to difficulties sustaining the E-3, the Air Force will retire 15 of its fleet of 31 AWACS over FY 2023 and FY 2024. While Boeing's E-7A Wedgetail will likely be selected in FY 2023 to replace the E-3s, the gap between retirement of the E-3 and fielding of the E-7 will be significant.	1	1	None		
E-8 JSTARS Inventory: **0** Fleet age: **23** Date: **2001** E-8C is a ground moving target indication (GMTI), airborne battlefield management/command and control platform. Its primary mission is providing theater commanders with ground surveillance data to support tactical operations. Congress approved the divestiture of the E-8 in 2022, and the Air Force will retire the last three remaining E-8s in FY 2024.					

NOTES: See Methodology for descriptions of scores. The date is the year the platform achieved initial operational capability. The timeline is from the year the platform achieved initial operational capability to its final procurement. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E).

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F-15EX Strike Eagle

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KC-46 Pegasus

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C-130J

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MQ-9 Reaper

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B-52 Stratofortress

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B-1B Lancer

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B-2 Spirit

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A-10 Thunderbolt II

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F-16 Fighting Falcon

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F-35 A Lightning

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F-15C/D Eagle

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KC-46 Pegasus

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C-5M Galaxy

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C-17 Globemaster III

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RQ-4 Global Hawk

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MQ-9 A/B Reaper

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E-3 Sentry

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E-8 JSTARS

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66. Air Force Manual 11-2F-35A, Volume 1, Flying Operations, F-35A—Aircrew Training, October 13, 2022, https://static.e-publishing.af.mil/production/1/af_a3/publication/afman11-2f-35av1/afman11-2f-35av1.pdf (accessed August 25, 2023), and "Table 5a—RAP Sortie/Sim Requirements," F-35A Ready Aircrew Program (RAP) Tasking Memorandum (RTM), hard copy obtained by author through senior Air Force Officer, October 1, 2019.
67. Venable, "Independent Capability Assessment of U.S. Air Force Reveals Readiness Level Below Carter Administration Hollow Force," p. 4.
68. James C. Slife, *Creech Blue: Gen Bill Creech and the Reformation of the Tactical Air Forces, 1978–1984* (Maxwell Air Force Base: Air University Press, October 2004), p. 92, https://www.airuniversity.af.edu/Portals/10/AUPress/Books/B_0095_SLIFE_CREECH_BLUE.pdf (accessed August 25, 2023).
69. John Venable, "A Plan for Keeping the U.S. Air Force's Best Pilots in Service," Heritage Foundation *Commentary*, November 14, 2017, https://www.heritage.org/defense/commentary/plan-keeping-the-us-air-forces-best-pilots-service.
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71. General Mark Kelly, "Air Force Fighter Enterprise," Air & Space Forces Association Air, Space and Cyber Conference, National Harbor, Maryland, September 21, 2022, https://www.airandspaceforces.com/watch-read-gen-mark-kelly-on-the-air-force-fighter-enterprise/ (accessed August 29, 2023).

72. Air Force Manual 11-2F-35A, Volume 1, Flying Operations, F-35A—Aircrew Training, and "Table 5a—RAP Sortie/Sim Requirements," F-35A Ready Aircrew Program (RAP) Tasking Memorandum (RTM).
73. Oriana Pawlyk, "Cuts to Flight Hours Necessary as Aircraft Sustainment Costs Surge, Air Force General Says," Military.com, June 23, 2021, https://www.military.com/daily-news/2021/06/23/cuts-flight-hours-necessary-aircraft-sustainment-costs-surge-air-force-general-says.html (accessed August 25, 2023).
74. Table 2, "United States Air Force Budget Summary," in U.S. Department of the Air Force, FY 2024 *Department of the Air Force Budget Overview*, p. 4.
75. The flying hour budget for FY 2013 was $7.1 billion in then-year dollars. The flying hour budget for FY 2023 is $5.87 billion. Extracted from U.S. Air Force budget summaries for the years 2013 and 2023. U.S. Department of the Air Force, *United States Air Force FY 2013 Budget Overview*, February 2012, p. 12, https://www.saffm.hq.af.mil/Portals/84/documents/FY13/AFD-120209-052.pdf?ver=2016-08-24-090344-023 (accessed August 25, 2023), and U.S. Department of the Air Force, *Department of the Air Force FY 2023 Budget Overview*, p. 3, https://www.saffm.hq.af.mil/Portals/84/documents/FY23/SUPPORT_/BOB_28Mar_1125_LoRes.pdf?ver=5nrA8bBfhWoUSrvZ09CeHA%3d%3d (accessed August 25, 2023).
76. General Charles Q. Brown, Jr., and General David H. Berger, "Redefine Readiness or Lose," War on the Rocks, March 15, 2021, https://warontherocks.com/2021/03/redefine-readiness-or-lose/ (accessed August 25, 2023).
77. Author's experience through 26 years of Air Force operations coupled with senior leader engagements from 2018–2019.
78. See Table A.1, "Calculating Unit Absorption Capacity," in Albert A. Robbert, Anthony D. Rosello, Clarence R. Anderegg, John A. Ausink, James H. Bigelow, William W. Taylor, and James Pita, *Reducing Air Force Fighter Pilot Shortages* (Santa Monica, CA: RAND Corporation, 2015), p. 33, https://www.rand.org/content/dam/rand/pubs/research_reports/RR1100/RR1113/RAND_RR1113.pdf (accessed August 26, 2023).
79. Even though active-duty fighter squadrons have an average of 30 aircraft per squadron, that number includes maintenance spare and attrition reserve platforms. Manning is based on Primary Assigned Aircraft (PAA), which is 24 aircraft for active-duty fighter squadrons.
80. Based on a squadron with 24 Primary Assigned Aircraft. Units with 18 PAA require four additional pilots.
81. Perversely, this reduction of squadrons per wing means that in many wings, a wing staff with its commanding officer (usually a colonel but sometimes a brigadier general) oversees the operation of a single squadron that has its own staff and commander. In such a situation, the question then becomes: Why are both commanders and staffs needed?
82. The very premise of these units is that they are manned with citizen soldiers whose main source of income is a full-time civilian job and who are committed to travel and temporary duty locations that make them unavailable for days or weeks at a time. Those units would likely require several days to assemble the manpower needed to deploy, and once an assessment of their real mission currency was made, they would need some period of intense training before a responsible senior leader could employ them in a fight with a peer competitor.
83. "Deployments most suited to the ARC are those in which there is long lead time (six months or more), and in which the operation is of short duration (six days or less), requiring a small force package (12 aircraft or less), and in which the scheduling is flexible." John T. Correll, "Future Total Force," *Air Force Magazine*, Vol. 82, No. 7 (July 1999), p. 32, https://www.airforcemag.com/PDF/MagazineArchive/Documents/1999/July%201999/0799total.pdf (accessed August 26, 2023).
84. The author commanded the 349th Expeditionary Combat Group at Al Udeid, Qatar, from 2004–2005. During that time, he flew with seven different Air National Guard F-16 squadrons. Every one of those units had some level of rainbow manning, and each performed admirably.
85. Interview with senior Air National Guard leader, November 20, 2019.
86. The number of fighters needed for a two-MRC strategy is based on a Heritage Foundation study of airpower requirements and actual fighter deployments for all major combat operations and conflicts from 1950 through 2021.
87. Kelly, "Air Force Fighter Enterprise."
88. See Venable, "Independent Capability Assessment of U.S. Air Force Reveals Readiness Level Below Carter Administration Hollow Force."
89. The FY 2023 Air Force posture statement does not discuss current posture; it makes declarative allusions as to what the service should or must be ready to do. For example: "[T]o provide effective integrated deterrence, the Department of the Air Force must be fully ready to expeditiously transition to a wartime posture. We must be ready to mobilize against a peer competitor who has spent decades researching and developing the means to attack the systems and infrastructure we depend on to go to war through cyber and non-cyber means." The Honorable Frank Kendall, Secretary of the Air Force; General John W. Raymond, Chief of Space Operations, United States Space Force; and General Charles Q. Brown, Jr., Chief of Staff, United States Air Force, "Department of the Air Force Posture Statement, Fiscal Year 2023," Department of the Air Force Presentation to the Committees and Subcommittees of the United States Senate and the House of Representatives, 2nd Session, 117th Congress, p. 5, https://www.af.mil/Portals/1/documents/2022SAF/FY23_DAF_Posture_Statement.pdf (accessed August 26, 2023).

U.S. Marine Corps

Dakota L. Wood

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 under attack abroad to operating the President's helicopter fleet. But every Marine has always been and remains focused primarily on combat: Every Marine is first a rifleman.

Over the past several decades, the Marine Corps has positioned itself for crisis response, but while the Corps has maintained its historical, institutional, and much of its doctrinal focus on operations in maritime environments, the majority of its operational experience at least since 2003 has been in sustained land operations. This has led to a dramatic decline in the familiarity of most Marines with conventional amphibious operations and other types of employment within a distinctly maritime setting.[1] Even with the conclusion of military operations in Afghanistan in 2021, by which time the U.S. military presence had been reduced to just 2,500 military personnel, the general shortage of amphibious ships[2] and the absence of any necessity to deploy large numbers of Marines on amphibious shipping still presented few opportunities for Marines to gain such experience.[3]

Recognizing this shortfall, the Corps' leadership initiated efforts in 2019 to reorient the service toward enabling and supporting the projection of naval power in heavily contested littoral environments with a particular focus on the Indo-Pacific region and China as the "pacing threat" against which Marine Corps capabilities are being assessed and modified.[4] This reorientation was much more than a simple refocusing on amphibious operations. Following a comprehensive assessment of the operational challenges that the service's operating forces are most likely to face 10 to 15 years in the future, General David H. Berger, 38th Commandant of the Marine Corps, issued Force Design 2030 (FD 2030), his directive to the service to reorganize, reequip, and retrain Marines in ways that will make them relevant and effective in the presumed operating environment of the next several years and into the 2030s.[5]

As necessary an effort as FD 2030 is, however, the force envisioned by the project is in the process of being made[6] and, although showing remarkable capability in exercises and deployments,[7] has not been proven in battle. Consequently, this *Index* can only assess the Corps that exists today, and our assessments of capacity, capability (modernity), and readiness therefore pertain to the Marine Corps' current status, not to what it might be in the future.

As of late March 2023, "more than 32,000 Marines [were] forward-deployed or stationed across 50 countries. There [were] also, on average, 102 Marine Corps fixed-wing aircraft (F-35, F/A-18, and KC-130J) forward-deployed or stationed overseas, a 22% increase since 2018."[8] Numerous experimentation and exercise events undertaken by the Corps during the preceding year, almost all of which were in operational settings rather than in stateside training environments, included elements of II Marine Expeditionary Force working with 6th Fleet to comprise a naval task force (TF 61.2) charged with developing improved capabilities to deal with crises in Europe, the Mediterranean, and northern Africa; a similar effort in the Indo-Pacific (TF 76.3) involving units from 3rd Marine Expeditionary Brigade and ships from 7th Fleet; and using the USS *Tripoli*

(LHA-7) as an independent platform to expand its utility in responding with air, ground, and communications capabilities that are useful across a range of potential crises.[9] As noted by General Berger, these at-sea evolutions also revealed just how few Marines have the opportunity to gain deployed experience in maritime settings, partly because of the lack of readily available amphibious ships.[10]

The Marine Corps has always prized its crisis-response contributions to national security, and senior service leaders have emphasized this point consistently over the years. Maintaining this emphasis, General Berger made it central to the Corps' efforts to remain combat credible as adversary capabilities evolve, even at the expense of force capacity (the size of the service) and existing capabilities that, while still of value, were perceived as less relevant to the maritime environment of the Indo-Pacific.

Marine Corps leadership has emphasized that China serves as the pacing challenge for the Corps, which means that the military capabilities that China currently has and is developing, as well as the severity of the challenge presented by China, are a benchmark against which to measure "the level of capabilities that we will need in order to have a relative advantage now and into the future."[11] These capabilities will be applicable not only in a fight with China, but also in other scenarios and regions involving other enemies of lesser magnitude. In other words, if the Corps can develop tools, tactics, and skills that are effective against the capabilities China is developing, it will also be better equipped to deal with other opponents in other regions.

Service leadership is assuming that defense budgets will not see any appreciable growth in the next several years, so the Corps has retired or reduced assets and such capabilities as tanks, conventional tube artillery, heavy bridging, and some aircraft and has reduced manpower end strength to make related funding available for other purposes.

In general for the Joint Force, this *Index* focuses on the forces required to win two major wars as the baseline force-sizing metric for the Army, Navy, and Air Force, but it adopts a different paradigm—one war plus crisis response—for the Marine Corps. The three large services are sized for global action in more than one theater at a time; the Marines, by virtue of overall size and most recently by direction of the Commandant (and sustained at present by the Assistant Commandant[12]), focus on one major conflict while ensuring that all Fleet Marine Forces are globally deployable for short-notice, smaller-scale actions. Marine Corps officials have emphasized that the results of the FD 2030 redesign will ensure that USMC forces are more capable and relevant in any fight, in any region, but the pacing challenge for Corps planners is China.[13]

In earlier editions of the *Index*, the capacity of the Marine Corps was assessed against a two-war requirement of 36 battalions: a historical average of 15 battalions for a major conflict (30 for two major conflicts) and a 20 percent buffer, bringing the total to 36. The Corps has consistently maintained that it is a one-war force and has no intention of growing to the size needed to fight two wars, and both its annual budget requests and its top-level planning documents reflect this position.

However, with China as the primary threat driving Marine Corps force planning and given China's extraordinary investment in modernizing its forces across all capabilities—including the expansion of various sensors, weapons, and platforms that are essential to the creation of an intensely weaponized, layered defense architecture—this *Index* cannot help but note that the Corps will need greater capacity if it is to succeed in war in the very circumstances for which the Marines believe they must prepare and with which this *Index* concurs.

Capacity

The measures of Marine Corps capacity in this *Index* are similar to those used to assess the Army's: end strength and units (battalions for the Marines and brigades for the Army). The Marine Corps' basic combat unit is the infantry battalion, which is composed of approximately 900 Marines[14] and includes three rifle companies, a weapons company, and a headquarters and service company.[15]

The service has redesignated 3rd Marines, one of its infantry regiments, as 3rd Marine Littoral Regiment (MLR), a new organizational construct it is using to test ideas put forward in FD 2030.[16] Unlike a conventional Marine regiment, the MLR has a single Littoral Combat Team (LCT) based on an infantry battalion but also possessing an anti-ship missile battery, a Littoral Anti-Air Battalion, and a Combat Logistics Battalion. The LCT will focus on employment of platoons, which is radically different from a standard battalion's use of companies.[17]

While a bold move, 3rd MLR will serve as an operational test bed, deriving experience and insights that feed back into the FD 2030 effort. Being operationally employed as a full component of the Corps' operating forces, it is not a standard experimental organization, but because it has not yet been standardized across the Corps, it also cannot yet serve reliably as a reference by which to assess the Corps.

Infantry. A dozen years ago, the Marine Corps maintained 27 infantry battalions in its Active Component at an authorized end strength of 202,100.[18] As budgets declined, the Corps prioritized readiness through managed reductions in capacity, including a drawdown of forces, and delays or reductions in planned procurement levels. After the Marine Corps fell to a low of 23 Active Component infantry battalions in fiscal year (FY) 2015,[19] Congress began to fund gradual increases in end strength, returning the Corps to 24 infantry battalions. The deactivation of 3rd Battalion 8th Marines on May 18, 2021, and 2nd Battalion 3rd Marines on January 21, 2022,[20] left the Corps with 22 infantry battalions. Marine Corps leadership plans to stand down one more battalion, which will bring the number to 21.

There has been a consistent decline in the size of the Corps over the past few years. In FY 2022, the Corps operated with an end strength of 174,577 Marines. In FY 2023, it was funded for 177,000 but is projected to finish the year with 172,147. For FY 2024, the service has requested "$15.6 billion for an active duty end strength of 172,300 Marines and $904 million for 33,600 reservists aligned with Force Design decisions."[21]

Infantry battalions serve as a surrogate measure for the Corps' total force. As the first to respond to many contingencies, the Marine Corps requires a large degree of flexibility and self-sufficiency, and this drives its approach to the organization and deployment of operational formations that, although typically centered on infantry units, are composed of ground, air, and logistics elements. Each of these assets and capabilities is critical to effective deployment of the force, and any one of them can be a limiting factor in the conduct of training and operations.

Aviation. The Corps last published an update to its Aviation Plan (AVPLAN) on May 3, 2022.[22] The AVPLAN notes that several initiatives undertaken in 2014 have led to marked improvements in readiness with the Corps setting an objective of 75 percent aviation readiness for FY 2021. Since 2018, when readiness was 57 percent across all types of aircraft, the rate has increased by 9 percent to 66 percent in 2023 with a high of 68 percent in tactical aviation (F-35s and F/A-18s) and MV-22 readiness "rising from 52% in 2018 to 64% in 2023."[23]

Manning, however, remains a problem for both manned and unmanned aircraft. In 2018, according to General Berger, the Corps "had 88 of the 203 required F-35 pilots (43% of the requirement). At the end of 2022, we had 218 of 498 F-35 pilots (44% of the requirement). At the end of 2022, we had 200 F-35 pilots in flight school and another 62 at our fleet replacement squadrons with FY23 and FY24 completion dates."[24] Today, "half of our total inventory of UAS officers (72 of 148) are not yet trained and qualified to operate the MQ-9."[25]

The Corps maintains 17 squadrons of fixed-wing fighter/attack aircraft in its Active Component, and almost half are equipped with the F-35.[26] The Corps fielded approximately 28 squadrons during Desert Storm.[27] The reduction corresponds with the general shrinking of the U.S. military since the end of the Cold War but is also a consequence of budget restrictions caused by the Budget Control Act of 2011,[28] the costs of operations over the past 20 years without a corresponding increase in funding, and budget ceilings imposed by the White House and Congress. The reorientation of Marine Aviation in its capacity, type of aircraft, and balance among the various platforms is dictated by FD 2030, which itself is informed by both budget and operational threat realities.

Although the Corps is introducing the F-35 platform into the fleet, F/A-18 Hornets will remain in the force until 2030.[29] This primary tactical aviation capability has to be managed carefully as it is no longer in production. Through various programs, the Marines have extended the service life of their F/A-18 fleet to 10,000 flight hours, making it possible to keep them in service until FY 2030.[30] A similar effort will keep the venerable AV-8B Harrier in use until FY 2027.[31] At present, the Marines have acquired 190 F-35B—the STOVL (Short Take-Off and Vertical Landing) variant of the Joint Strike Fighter (JSF)—and 19 F-35C (carrier capable) aircraft of a planned 353 F-35B and 67 F-35C models.[32] This has enabled the service to stand up 11 JSF squadrons: seven operational; two fleet replacement (used to train new pilots); one test for F-35Bs; and one operational F-35C squadron.[33]

In its heavy-lift rotary-wing fleet, the Corps began a reset of the CH-53E in 2016 to bridge the procurement gap between the CH-53E and the CH-53K King Stallion and aimed to "reset…the entire 143-aircraft fleet by FY20."[34] However, reporting in 2020 indicated that the Corps was moving rather slowly in this effort, and it was only one-third of the way through the process toward the close of the fiscal year.[35] Even when the reset is complete, the service will still be 57 aircraft short of the stated heavy-lift requirement of 200 airframes and will not have enough helicopters to meet its heavy-lift requirement without the transition to the CH-53K.[36]

The Corps has reported that the CH-53K heavy-lift helicopter has achieved initial operational capability (IOC),[37] opening the door for full production of operational units. The service procured 29 aircraft through FY 2021, 11 in FY 2022, and 12 in FY 2023 and has requested 15 for FY 2024.[38] Ultimately, it plans to acquire 196 operational aircraft that will equip five active squadrons by FY 2029 and a reserve squadron by FY 2030.[39]

As part of its ongoing search for improvements in its MV-22B Osprey, the Corps has tested a version of an electronic warfare radar jamming pod that it uses on other aircraft.[40] In the absence of conventional pylons on which weapons and sensors can be mounted, new capabilities have to be reconfigured to fit inside the aircraft or mounted on the aircraft fuselage.

The Marines have divested two MV-22 squadrons, standing down VMM-264 in FY 2020 and VMM-166 in FY 2021. The Corps' 2022 AVPLAN still shows the service's intent to stand down a third squadron by the start of FY 2024, although no action appeared to have been taken as of the time this edition of the *Index* was being prepared. FD 2030 originally proposed reducing the number of MV-22 squadrons to 14, but subsequent experimentation led the Commandant to revise his direction to specify retaining 16 squadrons in the Active force while reducing the number of aircraft per squadron from 12 to 10.[41]

Notably, the Corps has moved aggressively to implement aviation-related actions specified or implied by FD 2030. In May 2021, it disestablished HMLA-367, a light-attack helicopter squadron in Hawaii, sending its still relatively new attack and utility helicopters to Davis–Monthan Airbase in Arizona where they will be placed in the "boneyard" for possible use in the future. The 27 AH-1Z Viper attack helicopters and 26 UH-1Y Venom utility helicopters that were decommissioned represented approximately one-fifth of the Marine Corps' inventory of such aircraft.[42] In December 2022, HMLA-367 was reactivated while HMLA-469 was stood down.[43] Earlier that month, HMLA-269 was also disestablished,[44] leaving the Corps with five light/attack helicopter squadrons.

The Corps is also reducing the number of its heavy-lift squadrons of CH-53s. It deactivated HMH-366 in December 2022,[45] deactivated HMH-463 in April 2022,[46] and plans to deactivate one more by FY 2024,[47] leaving five heavy-lift helicopter squadrons in the Active Component to transition to the CH-53K.

Amphibious Ships. Amphibious ships, although driven by the Corps' articulation of what it needs to execute its operational concepts, remain a Navy responsibility. Various documents describe the rationale for and nature of the Marine Corps' thinking about how it plans to contribute to the projection of naval power in highly contested environments such as that found in the Indo-Pacific region if the U.S. were to find itself at war with China. The Corps' most recent update to its Force Design 2030 efforts, for example, says that:

> Warfighting concepts serve as the foundation for our modernization work. Most recently, we added *Global Positioning Network to Distributed Maritime Operations, Littoral Operations in a Contested Environment, Tentative Manual for Expeditionary Advanced Base Operations, A Concept for Stand-in Forces, and Reconnaissance and Counter-Reconnaissance*. To ensure our amphibious operations concepts remain current, together with the Navy, we are also developing a new concept for *21st Century Amphibious Operations*. It will describe how we will execute amphibious operations against future adversaries in this evolving and complex operational environment. It will also articulate the future role of amphibious operations in support of maritime campaigns and will describe new operating methods that incorporate agile platforms to supplement traditional amphibious ships. Examples include long-range, unmanned systems that infiltrate the adversary's weapon engagement

> zone; dispersed formations of manned and unmanned ships that challenge adversary targeting; and the adoption of disruptive technologies.[48]

These documents inform and reinforce Marine Corps and Navy plans to develop and acquire upwards of 35 small amphibious warships—Medium Landing Ship (LSM), previously known as the Light Amphibious Warship (LAWs), new amphibious vessels that would be smaller than those constituting the current fleet and optimized to support naval operations in the contested environments envisioned by Littoral Operations in a Contested Environment (LOCE) and Expeditionary Advance Base Operations (EABO).[49] LSMs would augment the Navy's current fleet of large amphibious warships, the number of which has been a matter of contention between the Navy and the Marine Corps, driven largely by the amount of funding that is available for shipbuilding.

The Marine Corps held 38 amphibious ships as the minimum requirement for many years but stepped away from that as a prelude to redefining its amphibious operations capabilities.[50] Now the Corps is making the case for 31 traditional amphibious ships as the bare minimum needed to execute operations as envisioned in FD 2030, augmented by LSMs.[51] Five companies have been awarded contracts for further concept development of LSMs,[52] but procurement of the first ship has been delayed until FY 2025.[53] Meanwhile, the number of traditional amphibious ships stood at 31 as of August 2023, down one ship from the same time last year.[54]

The USMC continues to invest in the recapitalization of legacy platforms in order to extend platform service life and keep aircraft and amphibious vehicles in the fleet, but as these platforms age, they also become less relevant to the evolving modern operating environment. Thus, although they do help to maintain capacity, programs to extend service life do not provide the capability enhancements that modernization programs provide. The result is an older, less capable fleet of equipment that costs more to maintain.

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, as indicated in the preceding section on capacity, and is covered in the Navy's section of the *Index*. The Marine Corps is four years into a force-wide redesign per FD 2030 with modernization (introducing new weapons and platforms) and divestiture (retiring less relevant counterparts) programs shaped accordingly.

During General Berger's tenure as Commandant, the Corps emphasized that force redesign initiatives were self-funded, meaning that the service had divested itself of some capabilities that were less relevant to expected operational demands and had reduced manpower to redirect that funding to other priorities of greater relevance. In FY 2023, General Berger told Congress that the Corps' ability to maintain such self-funding had been exhausted, and the service would therefore need continued congressional support to sustain FD 2030 initiatives.[55]

Nevertheless, defense funding has not kept pace with inflation, and there are some things for which the Corps needs additional money. On June 15, 2021, for example:

> Making his case before the House Armed Services Committee...for the Marine Corps' $47.86 billion [FY 2022] budget request, Berger said he has reduced headquarters staffing by 15%, cut legacy systems and end strength, and has nothing left to draw from to fund programs and projects.
>
> "We have wrung just about everything we can out of the Marine Corps internally," Berger said. "We're at the limits of what I can do."
>
> The Marine Corps' budget request represents a 6.2% increase from fiscal 2021, even as the service plans to reduce the size of the active-duty force by 2,700, to 178,500 Marines. The service ultimately wants to reach 174,000 by 2030—roughly the size it was in fiscal 2002.
>
> Berger is using the money he has saved by reorganizing the Marine Corps and shedding capabilities such as tanks and artillery to invest in new technologies and platforms.[56]

Programs such as the Amphibious Combat Vehicle (ACV), F-35, CH-53K, Naval Strike Missile, and Light Amphibious Warship continue to top the list

of major equipment and weapons, but the Corps is also pursuing a variety of unmanned systems (air, ground, and sea) and has placed great emphasis on smaller pieces of gear and individual-level weapons that will enable tactical units to be more effective.[57] These latter items are typically small in cost when compared with aircraft and armored vehicles, but they can have a decisive effect when employed in small-unit actions in the field.[58]

Vehicles. 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 more than 50 years old and the LAV averaging 40 years old.[59] The Corps invested in upgrades to the AAV over many years but stepped back from such efforts in 2018 as the ACV program bore fruit. In 2020, the Corps justified this as an acceptable near-term risk:

> [W]e continue to make strategic choices in the divestiture of certain programs to reallocate funds toward building a more lethal, modern, multi-domain, expeditionary force. This has included accepting near-term capacity risk by reducing depot level maintenance for the legacy Amphibious Assault Vehicle (AAV) as we transition to the Amphibious Combat Vehicle (ACV).[60]

The Marine Corps has also been exploring options to replace its aged LAV with a collection of vehicles under the Advanced Reconnaissance Vehicle (ARV) program.[61] It requested $63.585 million in its FY 2024 budget submission, on top of $134 million spent in preceding years (including $70.583 million in FY 2023),[62] for continued research and design work. According to the Navy's FY 2024 budget justification:

> [The ARV] is imperative to realizing Marine Corps requirements for Fleet Marine Force 2030 as the platform that enables the Mobile Reconnaissance Battalion. As part of the portfolio of reconnaissance, surveillance, and target acquisition systems, ARV will be a purpose-built combat vehicle system, highly mobile on land and water, that can sense, communicate, and fight as the manned hub of a robotic and autonomous systems-enhanced team. Equipped with modern command, control, communications and surveillance systems the ARV will transform the ability of Fleet Marine Forces to sense and communicate within the littoral operating environment by providing a persistent and mobile Systems of Systems to augment and sustain effective sensor webs and kill chains. The ARV is critical towards the modernization of Marine Corps reconnaissance capability.[63]

Once prototyping has been completed, and assuming the Corps decides to proceed, the next steps are "a Milestone B decision point in FY 2025" and a period of "competition leading to Milestone C in FY 2028." It is expected that initial operational capability will be reached in FY 2030 and that full operational capability of the initial variant will be achieved in FY 2033.[64] In January 2023, the service began its testing of three competing prototypes with the evaluation to conclude before the end of the fiscal year.[65]

On July 30, 2020, an AAV sank off the California coast near San Clemente Island, claiming the lives of eight Marines and one sailor.[66] This led to the halting of all AAV operations until various investigations were completed and the Corps could install supplementary emergency breathing devices in the vehicle and take other steps to improve its safety and survivability.[67] AAV operations were resumed in April 2021 following inspection and modification of vehicles and related training and certification of AAV crews on the improvements.[68]

Nine months later, however, the Corps permanently restricted water operations for the AAV, effectively making it a land-only armored vehicle.[69] "[G]iven] the current state of the amphibious vehicle program," according to a statement issued by the Corps:

> [T]he Commandant of the Marine Corps has decided the AAV will no longer serve as part of regularly scheduled deployments or train in the water during military exercises; AAVs will only return to operating in the water if needed for crisis response. This decision was made in the interest of the long-term health of the amphibious vehicle programs and future capabilities. The AAV will continue to operate on land; 76 percent of its tasks are land-based. In

> doing so, we reserve the capability to reverse this decision should the need arise.[70]

Recognizing the problems of its AAV fleet and the urgent need to update with a view to capabilities in line with FD 2030, the Corps accelerated procurement of the ACV. It procured 83 in FY 2022, procured another 74 in FY 2023, and has requested funding for 80 in FY 2024.[71] Combined with the 184 vehicles acquired in previous years, the additions bring the number of ACVs in the Corps' inventory to 341 out of a total program objective of 632.[72]

Acquisition of the Joint Light Tactical Vehicle (JLTV) is steady, although both the number of vehicles acquired in FY 2023 (384) and the number requested for FY 2024 (396) are less than half the number purchased in FY 2022 (837). Since 2017, when fielding of the HMMWV replacement began, the Marines have acquired 5,752 vehicles, and budget documents show plans for the Corps to purchase an additional 3,701 vehicles from FY 2025 through FY 2028.[73] The acquisition objective for the JLTV has varied over the years from 5,500 to just over 9,000.[74] Representatives from Marine Corps Systems Command have reported that the objective has been revised again to have the JLTV be a one-for-one replacement for all of the almost 11,000 HMMWVs currently in the inventory.[75]

Aircraft. Fixed-wing fighter-attack aircraft—specifically the AV-8B Harrier and F/A-18 Hornet—continue to age while the Corps pursues delivery of replacement aircraft: the F-35B STOVL variant to replace the AV-8B, in service since 1985, and the F-35C to replace its carrier-capable F/A-18s. To account for a lengthy transition period, the Corps has undertaken various efforts to extend the service life of its Hornets and Harriers to keep them in service until the end of the decade and, to meet the need to train new pilots even as the service retires the aircraft the pilots will fly, has taken such steps as folding the responsibilities of a formal training squadron into an operational unit.[76]

The Corps has acquired 190 of the 353 F-35B aircraft that it plans to purchase and 19 of the 67 F-35Cs, the version designed for use aboard aircraft carriers.[77] Though the F-35 program has been the subject of criticism ever since it began, much of this criticism is misplaced today given the steady decrease in cost per unit and the superior capabilities the aircraft brings to air operations in heavily contested environments featuring peer-level enemies.[78] "As the Commander of United States Indo-Pacific Command (USINDOPACOM) recently noted during testimony," according to General Berger, "'The importance of the F-35 cannot be overstated.'"[79] Additionally, not only is the F-35 "the most advanced fighter, strike, and sensor platform in the world," but "aircraft like the F-35B provide combatant commanders a competitive warfighting advantage," and the Corps "remains focused on accelerated transition to an all F-35 tactical aviation (TACAIR) fleet in order to stay in front of our pacing challenge."[80]

The Corps' current concerns about the aircraft have less to do with its capabilities than they do with the overall cost of modern aircraft in general in the constrained budget environment within which the service is working to redesign its force and its ability to retain a sufficient number of pilots for the aircraft it is buying. As shared by General Berger:

> As the head of personnel for the Air Force stated during testimony in 2017, we cannot compete with the airlines. We could not then and we cannot now. This is an issue that requires your oversight. We are at a competitive disadvantage and risk our reservoir of pilots drying up. As an example, in 2018, the Marine Corps had 88 of the 203 required F-35 pilots (43% of the requirement). At the end of 2022, we had 218 of 498 F-35 pilots (44% of the requirement). At the end of 2022, we had 200 F-35 pilots in flight school and another 62 at our fleet replacement squadrons with FY23 and FY24 completion dates. We are making some progress, but not enough—and certainly not quickly enough. We are exploring various options for structuring aviation bonuses and aviation incentive pay under the new authorities granted in the FY23 NDAA. But ever-larger monetary incentives are neither sustainable nor the appropriate remedy. This is not just a Marine Corps problem. It is a joint force problem, and we will continue to work with the other services and Congress as our understanding of this issue develops.[81]

Today, the USMC MV-22 Osprey program is operating with few problems and has completed the MV-22's full acquisition objective of 360.[82]

The MV-22's capabilities are in high demand from the Combatant Commanders (COCOMS), and the Corps is adding such capabilities as fuel delivery, the use of precision-guided munitions, digital interoperability with other platforms, and an improved ability to land in poor-visibility conditions to the MV-22 to enhance its value to the COCOMs.[83]

The USMC's heavy-lift replacement program, the CH-53K, conducted its first flight on October 27, 2015.[84] The CH-53K will replace the Corps' CH-53E, which is now more than 30 years old. Although "unexpected redesigns to critical components" delayed a low-rate initial production decision,[85] the program achieved Milestone C in April 2017. The Corps has purchased 52 aircraft so far and is requesting 15 in FY 2024, against a total acquisition objective of 196.[86]

Readiness

Riding alongside the Marine Corps' principal Title 10 responsibility to provide "fleet marine forces... for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign"[87] is its contribution as the military's crisis-response force. This aspect of the Corps' contributions to national defense has been reinforced by service leaders who take pains to allay concerns that their focus on China and the Indo-Pacific will distract them from this important role.[88] The Corps' readiness must therefore account for both high-end conflict against a major opponent in the most complex operational settings and pop-up crises against lesser opponents that cannot be predicted, all of which implies a force that is ready to go at a moment's notice.

Marine Corps guidance identifies multiple levels of readiness that can affect the ability to conduct operations:

> *Readiness is the synthesis of two distinct but interrelated levels. a. unit readiness—The ability to provide capabilities required by the combatant commanders to execute their assigned missions. This is derived from the ability of each unit to deliver the outputs for which it was designed. b. joint readiness—The combatant commander's ability to integrate and synchronize ready combat and support forces to execute his or her assigned missions.*[89]

To this General Berger added an expanded perspective that includes force modernization as an essential element to ensure that combat forces remain relevant and therefore ready. As he and Air Force Chief of Staff General Charles Q. Brown, Jr., have argued, only by divesting old capabilities that would not be useful in changed circumstances and investing in new capabilities that account for more capable enemies and the characteristics of key operational theaters can U.S. forces be ready. "To do this," however, "we cannot let our focus on near-term availability consume the resources necessary to generate truly relevant future readiness through adaptive modernization."[90]

Divestiture carries with it some risk unless replacement capabilities are brought into the force as old or legacy capabilities are retired. For example, the Marine Corps' decision to get rid of tanks and a large percentage of its tube artillery means that the service will not have these capabilities should it be called into battle before new items can be fielded in meaningful numbers. Early reports of promising replacement capabilities to compensate for the loss of the Abrams main battle tank, for example, are encouraging, but the Corps now no longer has tanks while the improved replacement remains to be fielded.[91] This has a bearing on readiness to the extent that the force has a *current* ability to win in combat. The force might be ready but in a different posture. For a few years, the Marines could be more light-infantry than the middle-weight "two-fisted fighter" proudly described by a former Commandant a decade ago.[92]

Unfortunately for this *Index*, the Corps reports its current readiness in vague, generalized terms instead of providing data that external audiences could use to form their own conclusions with respect to this important question. It should be noted, however, that this approach is generally used by all of the services: Detailed readiness reports are classified to prevent potential enemies from obtaining sensitive information.

In the past, the services' leaders would report to Congress in formal testimony the various percentages of key equipment that were or were not available, share the status of primary units or types of force capabilities, and perhaps provide insight into maintenance or supply backlogs. The absence of such details from Marine Corps statements during the past few years reveals that the Corps prefers

not to share such information, at least currently. Corps officials have shared very encouraging anecdotal reports of lessons being learned in force-on-force exercises and the testing of new equipment and weapons that appear to validate the direction and objectives of FD 2030, but our assessment of the Corps' readiness must rely on the tone of statements and discussions, inferences derived from the totality of efforts and programs, and the sense one gets from anecdotal evidence of the seriousness with which the service is preparing for current and future employment.

As mentioned, the Marine Corps has undertaken a great reorientation to ready itself for war not just against China, but against any adversary that has the ability to field modern weapons and sensors in a heavily contested maritime environment. The service believes that the changes it is pursuing to this end will be relevant and necessary for combat environments outside of the Indo-Pacific as well, because many countries are acquiring capabilities that are now possible and affordable with modern technologies.[93] With this as the driver, combined with the reiteration of the Corps' role as a force in readiness, the service's words, actions, and policies strongly reinforce a focused commitment to combat readiness and rapid progress[94] in realizing the goals of its great reorientation.[95]

To improve force capabilities from the level of the individual to the most senior operational commands, the service is pushing several initiatives. Among them:

- The Marine Corps School of Infantry has revamped its training for entry-level infantry Marines, extending the eight-week course to 14 weeks and including new coursework and field training intended to sharpen the thinking skills of Marines who will likely find themselves operating more independently than has been the case in the past.[96]

- "In May [2021], the Marine Corps broke ground on a new, state-of-the-art wargaming facility intended to house various capabilities to enhance warfighter preparedness." The Corps intends that the center, planned for use as early as 2024, will "help Marines better visualize the threat environment" and participate in war games of various sizes with a focus on realism and that it will also "provide data to inform decisions affecting force development [and] support existing and developing weapons platforms and capabilities in all regions of the globe."[97]

- Taking this emphasis on thinking, training, and war-gaming scenarios to the field, the Corps and the Navy teamed to execute a two-week Large Scale Exercise 2021—billed as the largest the services have conducted in many years—that involved 25,000 personnel, 36 live units, 50 virtual units, and a half-dozen major commands spread across 17 time zones.[98] LSE 2021 was followed in August 2023 by LSE 2023, which involved 10,000 personnel, "six Navy and Marine Corps component commands and seven U.S. numbered Fleets around the globe" across 22 time zones.[99]

- On the landward side of testing new capabilities, the Marines have conducted a series of force-on-force exercises (free-play exercises employing units with the ability to respond creatively to events rather than being limited to scripted or controlled play); have deployed new force designs in novel ways; and have operationally proved the utility of new force packages in real-world settings, all of which has both validated the initial arguments framing FD 2030 and driven adjustments to the effort.[100]

- The Corps has transitioned its 3rd Marine Regiment, based in Hawaii, into a new organizational construct reflecting FD 2030 initiatives. The 3rd Marine Littoral Regiment is serving as the tactical and operational test bed for the service's many initiatives.[101] This will be followed by the similar transition of 12th Marine Regiment, an artillery unit, into the 12th MLR sometime in FY 2025.[102]

Such efforts, from improvements to infantry training to war gaming to large exercises, are steps that appear to be having a positive effect on currently fielded forces. Although proof at scale has yet to be seen, they do reveal attitudes, priorities, and perspectives that reflect a level of seriousness about warfighting.

Within the Marine Corps, perhaps because it is a smaller service, changes in direction and attitude are conveyed to the force by senior leaders and adopted force-wide more easily than is the case in the larger services. While this does not directly replace hard data on mission-capable rates for equipment used by the Marines or cleanly substitute for unclassified reports about the readiness of units composing the Fleet Marine Force, it can be seen as a surrogate for the Corps' attention to its level of readiness. The extended operational demands of Iraq and Afghanistan having concluded, the force is reconstituting its readiness as it reorients toward the requirements of FD 2030, LOCE, and EABO.

In the absence of any other direct reporting, this *Index*'s assessment of the Corps' readiness for current operations is therefore an optimistic one.

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 major regional contingency (MRC).[103] This requirement is based on the presumption of a rather conventional force using known (current) equipment and capabilities against a similar opponent.

This *Index* acknowledges the service's work to develop new capabilities and approaches to fighting and is certainly aware of the trends in new technologies and associated thinking about how warfare *might* change in the future, but until this happens, one can assess only what can be known at present. Consequently, the Corps' historical need for 15 battalions (and associated enabling elements) for one major conflict translates to a force of approximately 30 battalions to fight two MRCs simultaneously according to the metric used in previous editions of the *Index*. The government force-sizing documents that discuss Marine Corps composition support the larger measure. Though the documents that make such a recommendation count the Marines by divisions rather than 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. However, the Corps has repeatedly made the case that it is a one-war force that must also have the ability to serve as the nation's crisis-response force.[104] It has just as consistently resisted growing in end strength even during the years of high operational demand associated with peak activities in Operation Iraqi Freedom (Iraq) and Operation Enduring Freedom (Afghanistan). Most recently, General Berger has stated flatly that the Corps will trade manpower for modernization and that he intends to shrink the Corps from its current 22 infantry battalions to 21 battalions both to free resources so that they can be applied to new formations and to maintain capability investments in other areas such as Marine Special Operations Command.[105]

Manpower is by far the biggest expense for the Marines. In the Corps' FY 2023 budget, the military personnel account was $16.0 billion (an increase of $500 million over FY 2022),[106] dwarfing both the $10.254 billion allocated for operations and maintenance[107] and the $3.67 billion allocated for the procurement of new equipment.[108] Nevertheless, the historical record with regard to the use of Marine Corps forces in major contingencies argues for the larger number. More than 33,000 Marines, for example, were deployed in Korea, and more than 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 approximately 66,000 were deployed for Operation Iraqi Freedom.

One could reasonably presume that in a war with China—a war in which the Marines would employ many small, highly distributed units—the demand for forces would be similar to the demand during these historical instances of Marine Corps employment. The pacing threat for the Corps is China, the archetype for countries developing new tools and operational concepts that will likely require distribution of the Marine Corps across a large, contested littoral battlespace. The Corps has been refining its sense of what these formations will require, but they have yet to be proven in operational employment at significant scale. Consequently, we can only assess the service's current status against

historical demand. Even a one-major-war Marine Corps should possess a larger end strength and more tactical units (infantry battalions as the surrogate measure for the total Corps) than it currently has, especially with the trend bending downward to even fewer units.

As a one-war force that also needs the ability to provide crisis-response forces, sustain operations in the face of combat losses, and sustain its support for efforts that are not USMC-specific such as its service component contribution to U.S. Special Operations Command, the Corps should have a minimum of 30 battalions.

- **One-MRC-Plus Level:** 30 battalions.
- **Actual 2023 Level:** 22 battalions.

The Corps is operating with 73 percent of the number of battalions it should have relative to the revised benchmark set by this *Index* and has stated its intent to shrink from its current 22 battalions to 21 battalions. Marine Corps capacity is therefore scored as "weak." Reducing operational strength by another battalion would bring it down even more to just 70 percent of the strength it should have.

Capability Score: Strong

The Corps receives scores of "marginal" for "Capability of Equipment," "marginal" for "Age of Equipment," "strong" for "Health of Modernization Programs," and "very strong" for "Size of Modernization Program." This *Index* recognizes that within the Capability and Age portfolios, the old equipment exists mostly in ground combat vehicles. The Marines have modernized their aviation assets almost completely and are moving aggressively to introduce new ground platforms like the ACV and JLTV to offset the deteriorating condition of the AAV and HMMWV fleets, respectively.

In the aggregate, the service's aviation arm and its rapid introduction of new munitions, weapons, and a host of communications equipment, sensors, and unmanned platforms likely compensate for the aged AAV, HMMWV, and AV-8B Harriers, resulting in a score of "strong" for Marine Corps capability.

Readiness Score: Strong

The Marine Corps has exhibited an especially focused and aggressive commitment to ensuring that its forces are ready for action. This is the point of FD 2030. However, the history of military services is littered with the debris of grand vision statements and futuristic concepts that were unrealized in practical implementation.

That the Marine Corps' effort is substantially different from those of other services in the past is evidenced by irrevocable decisions to cashier old equipment and implement significant changes in education and training programs, dramatic investments in experimentation and war gaming, rapid acquisition of new capabilities, and profound redesign of operational units. The real changes in programs and organizations that reflect its published rhetoric are compelling evidence that the Corps means what it has been saying about maintaining readiness. The authors of the *2024 Index* believe it to be a low-risk proposition to apply the evidence of preparing for the future to current forces in terms of their focus on readiness for combat. The force remains encumbered by old primary equipment, but its effort to spend the money needed to keep it serviceable mitigates this problem to a reasonable extent.

The Corps is still too small, but the force it has is fully focused on warfighting. Consequently, the *2024 Index* assesses Marine Corps readiness as "strong," continuing the assessment reached in the *2023 Index*.

Overall U.S. Marine Corps Score: Strong

The score for the Marine Corps was raised to "strong" from "marginal" in the *2022 Index* and remains "strong" in this edition for two reasons: because the *2021 Index* lowered the threshold for capacity from 36 infantry battalions to 30 battalions in acknowledgment of the Corps' argument that it is a one-war force that also stands ready for a broad range of smaller crisis-response tasks and because of the Corps' extraordinary, sustained efforts to modernize (which improves capability) and enhance its readiness during the assessed year.

Of the five services, the Marine Corps is the only one that has a compelling story for change, has a credible and practical plan for change, and is effectively implementing its plan to change. However, in the absence of additional funding in FY 2024, if the Corps retains its intention to reduce the number of its battalions from 22 to 21, this reduction, if implemented, will limit the extent to which it can conduct distributed operations as it envisions and

replace combat losses (thus limiting its ability to sustain operations).

Though the service remains hampered by old equipment in some areas, it has nearly completed modernization of its entire aviation component, is making good progress in fielding a new Amphibious Combat Vehicle, is fast-tracking the acquisition of new anti-ship and anti-air weapons, and is aggressively leveraging developments in unmanned systems and advanced computing and communication technologies. Full realization of its redesign plan will require the acquisition of a new class of amphibious ships, for which the Corps needs support from the Navy.

U.S. Military Power: Marine Corps

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity		✓			
Capability				✓	
Readiness				✓	
OVERALL				✓	

MARINE CORPS SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending Through FY 2023 / Pending

Light Wheeled Vehicle

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
HMMWV Inventory: **10,607** Fleet age: **25** Date: **1983** The HMMWV, commonly known as the "Humvee," is a light wheeled vehicle used to transport troops and various weapons systems. It provides some protection against smalls arms fire, fragmentation, and blast damage. Initially introduced in the 1980s and significantly upgraded in the early 2000s, HMMWVs are being replaced by the Joint Light Tactical Vehicle (JLTV).	2	2	**Joint Light Tactical Vehicle (JLTV)** Timeline: **2017–TBD** The JLTV program is a joint program with the Army, meant eventually to replace all HMMWVs. Full-rate production was achieved in FY 2019. The first set of JLTVs were fielded in March 2019; initial operational capability (IOC) was achieved in mid-summer 2019. **PROCUREMENT** 5,752 / 4,097 **SPENDING** *($ millions)* $2,465 / $3,512	5	5
JLTV Inventory: **3,626** Fleet age: **3** Date: **2019** The Joint Light Tactical Vehicle (JLTV) is replacing the HMMWV as a light wheeled vehicle for troop transport. The vehicle provides stronger protection from IEDs and threats with which the Humvee struggled during the conflicts in Iraq and Afghanistan. The JLTV improves reliability, survivability, and transportability while retaining the capability to be outfitted for specific missions.	5	5			

NOTE: See page 532 for details on fleet ages, dates, timelines, and procurement spending. JLTV spending figures reflect the full joint program spending

MARINE CORPS SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending Through FY 2023 / Pending

Amphibious Assault Vehicle

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
AAV Inventory: **417** Fleet age: **51** Date: **1972** The Amphibious Assault Vehicle (AAV) is an amphibious landing vehicle that is designed to transport Marines from vessels at sea to shore. Though old, the AAV has received numerous upgrades over the years to keep it viable for land combat operations. In 2021, the decision was made to restrict AAVs from amphibious operations because of their age and reduced reliability during water operations. The AAV is being replaced by the Amphibious Combat Vehicle (ACV).	1	1	**Amphibious Combat Vehicle (ACV)** Timeline: **2018–2026** The ACV is replacing the aged AAV. It achieved IOC in November 2020, and full-rate production was ordered in December 2020. In 2022, two ACVs were involved in operational mishaps, and the Marines decided to limit certain ACV amphibious operations until handling characteristics are better understood and operator skills are improved. An improved training program began to graduate students in July 2023. **PROCUREMENT** 341 / 289 **SPENDING** *($ millions)* $2,124 / $2,411	4	4
LAV-25 Inventory: **298** Fleet age: **38** Date: **1983** The Light Armored Vehicle (LAV) is an eight-wheeled armored reconnaissance vehicle. It is designed for off-road and moderate amphibious capabilities. This allows for highly mobile fire support in most terrains. The LAV will be in service until 2035.					

Attack Helicopters

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
AH-1Z Viper Inventory: **134** Fleet age: **12** Date: **2010** The AH-1Z Viper is the Marine Corps' attack helicopter. The Viper has greater speed, payload, and range, as well as upgraded landing gear, advanced weapons systems, and a fully integrated glass cockpit, compared to its predecessor, the AH-1W Super Cobra. The Viper provides Marines with close air support, armed escort/reconnaissance, and anti-armor capabilities. The Viper's expected operational life span is 30 years.	4	5	None		

NOTE: See page 532 for details on fleet ages, dates, timelines, and procurement spending.

MARINE CORPS SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Tactical Aircraft

PLATFORM	Age Score	Capability Score
AV-8B Inventory: **53** Fleet age: **31** Date: **1985** The Harrier is the Marine Corps' ground attack aircraft. It is a subsonic jet capable of hovering as a helicopter hovers. The Harrier has a Vertical/Short Take-Off and Landing (V/STOL) system that is designed to fly from amphibious assault ships and unconventional runways. These unique capabilities allow it to operate in a variety of environments that other jets find inaccessible. The aircraft is being replaced by the F-35B and will be fully retired around 2025.	1	1
F/A-18 C-D Inventory: **213** Fleet age: **32** Date: **1978** The F/A-18 C and D models are all-weather attack aircraft designed for interdiction and close air support. The C-version is a single seat aircraft, and the D-model is a two-seat aircraft that incorporates a Weapons and Sensors Officer who handles a broader range of weapons and expands the aircraft's ability to conduct night attack missions. The Corps will retire the aircraft as the F-35 B and C models are fully fielded, which should be around 2030.	2	1
F-35B/C Lightning II Inventory: **145** Fleet age: **4** Date: **2015** The F-35B is the Marine Corps variant of the Joint Strike Fighter (JSF) Program. It is a fifth-generation, stealth multi-role fighter. Its next-generation technology allows it to dominate combat missions with greatly reduced risk of detection by the enemy. Unique to the other variants, the B-Model is designed with a Short Take-Off Vertical Landing (STOVL) system that allows for operation from short flight decks and unconventional runways. This combines the unique operational capabilities of the AV-8B Harrier with the new technology offered by the JSF program. The F-35C is the Navy's version of the JSF, built to conduct catapult-assisted takeoffs and cable-arrested landings on aircraft carriers. The Marine Corps operates a portion of its F-35 fleet to leverage carrier-based operations.	5	5

REPLACEMENT PROGRAM	Size Score	Health Score
F-35B/C Timeline: **2007–2029** The F-35B (STOVL Variant) is replacing the AV-8B Harrier, providing the Corps with a fifth-generation stealth STOVL aircraft. Specifically designed for the Marine Corps, the B-model achieved IOC in 2015. It is being procured at a much higher quantity than the C-model, and full operational capability is expected in the late 2020s. The F-35C (Carrier Variant) is also being procured by the Marine Corps, replacing the F/A-18. Designed for operations by aircraft carrier, the F-35C is being procured to give Marines the ability to launch from carriers while the F-35B launches from amphibious assault ships. The Marines activated their first F-35C squadron in December 2020. Full operational capability is expected in the late 2020s. **PROCUREMENT** 177 192 **SPENDING** *($ millions)* $27,122 $26,407	5	4

NOTE: See page 532 for details on fleet ages, dates, timelines, and procurement spending.

MARINE CORPS SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Medium Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
MV-22B Osprey Inventory: **273** Fleet age: **9** Date: **2007** The Osprey is a vertical takeoff, tilt-rotor aircraft that combines the vertical capabilities of a helicopter with those of a traditional fixed-wing aircraft, enabling the Osprey to fly much faster and farther than a helicopter. Similar to the AV-8B, this allows the aircraft to take off and land in environments where normal aircraft cannot go. The Osprey provides transport for personnel, cargo lift, and support for expeditionary assaults. The life expectancy of the MV-22B is 23 years.	3	5	**MV-22B** Timeline: **2007–TBD** Fielding of the Osprey was completed in 2019 with the MV-22B replacing the CH-46E helicopter. Production was halted in FY 2023 once the Corps' full acquisition objective was reached. **PROCUREMENT** 359 / 5 **SPENDING** *($ millions)* $30,502 / $23,095	5	5

Heavy Lift

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
CH-53E Super Stallion Inventory: **129** Fleet age: **34** Date: **1981** The CH-53E is a heavy-lift rotary-wing aircraft. The Super Stallion transports heavy equipment and supplies for amphibious assault operations and sustained operations ashore. Able to be aerial refueled, it can enable operations across vast distances. The aircraft will operate through 2025, to be replaced by the more advanced CH-53K.	5	1	**CH-53K** Timeline: **2017–2030** The CH-53K King Stallion program is currently in full-rate production. It will replace the aging CH-53E and provide increased range, survivability, and payload. The King Stallion achieved IOC in April 2022 and is scheduled to deploy in 2024. It is on schedule to declare Full Operational Capability in FY 2029. **PROCUREMENT** 40 / 156 **SPENDING** *($ millions)* $6,397 / $18,428	5	3

Tanker

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
KC-130J Inventory: **46** Fleet age: **13** Date: **2005** The KC-130J is a large multi-role aircraft that is used primarily as a tanker and cargo transport. It can be equipped for various missions including air-to-air refueling, reconnaissance, and medevac operations.	4	5	**KC-130J** Timeline: **2005–2024** The KC-130J is both a tanker and a transport aircraft. The procurement program for the KC-130J is not facing acquisition problems. Procurement is planned to be complete by 2024. **PROCUREMENT** 84 / 27 **SPENDING** *($ millions)* 5,988 / $4,215	4	4

NOTE: See Methodology for descriptions of scores. Fleet age is the average between the last year of procurement and the first year of initial operational capability. The date is when the platform achieved initial operational capability. The timeline is from the start of the platform's program to its budgetary conclusion. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E). Total program dollar value reflects the full F–35 joint program, including engine procurement. As part of the F–35 program, the Navy is purchasing 67 F-35Cs for the U.S. Marine Corps that are included here. The MV-22B program also includes some costs from U.S. Air Force procurement. AH-1Z costs include costs of UH-1 procurement.

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8. General David H. Berger, Commandant of the Marine Corps, statement on "The Posture of the United States Marine Corps" before the Committee on Armed Services, U.S. House of Representatives, April 28, 2023, p. 1, https://docs.house.gov/meetings/AS/AS00/20230428/115769/HHRG-118-AS00-Wstate-BergerD-20230428.pdf (accessed August 29, 2023). Cited hereafter as Berger, statement before House Armed Services Committee, April 28, 2023.
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14. Based on an ongoing series of experiments, it appears that the Corps will settle on an infantry battalion slightly larger than 800 Marines. See Berger, statement before House Armed Services Committee, April 28, 2023, p. 8.
15. To be clear, the Corps has thought of itself in terms of Marine Air Ground Task Forces (MAGTFs), a collection of ground, aviation, and logistics capabilities under a common commander, for nearly six decades, but because its size and composition vary by task, the MAGTF is not helpful as a consistent reference for capacity; thus, we use battalions as a measure that is generally understood by most students of military affairs. For an expanded discussion, see Dakota L. Wood, "Rebuilding America's Military: The United States Marine Corps," Heritage Foundation *Special Report* No. 211, March 21, 2019, pp. 15–16, https://www.heritage.org/defense/report/rebuilding-americas-military-the-united-states-marine-corps. With specific reference to its infantry battalions, the Corps is engaged in a fundamental redesign as a subcomponent of FD 2030, but until the reorganization effort is complete, the force that it would use in an emerging crisis for the foreseeable future will consist of the standard infantry battalions and supporting arms and units that it possesses today. For additional information, see U.S. Marine Corps, "2030 Infantry Battalions," August 2, 2021, https://www.marines.mil/News/News-Display/Article/2708161/2030-infantry-battalions/ (accessed August 29, 2023).
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68. Gidget Fuentes, "Marines: Limited AAV Operations on Water Resume as Vehicle Inspections, Unit Certifications Required in Fatal Sinking Aftermath," U.S. Naval Institute News, April 21, 2021, https://news.usni.org/2021/04/21/marines-limited-aav-operations-on-water-resume-as-vehicle-inspections-unit-certifications-required-in-fatal-sinking-aftermath (accessed August 30, 2023).

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70. Ibid.

71. Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1109N: Procurement, Marine Corps / BA 02: Weapons and Combat Vehicles / BSA 1: Tracked Combat Vehicles, P-1 Line Item Number / Title: 2025 / Amphibious Combat Vehicle Family of Vehicles," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 1, Procurement, Marine Corps*, March 2023, p. 5, https://www.secnav.navy.mil/fmc/fmb/Documents/24pres/PMC_Book.pdf (accessed August 30, 2023).

72. Andrew Feickert, "The Marine Corps' Amphibious Combat Vehicle (ACV)," Congressional Research Service *In Focus* No. IF11755, updated March 13, 2023, https://crsreports.congress.gov/product/pdf/IF/IF11755 (accessed August 30, 2023).

73. Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1109N: Procurement, Marine Corps / BA 05: Support Vehicles / BSA 2: Tactical Vehicles, P-1 Line Item Number / Title: 5095 / Joint Light Tactical Vehicle," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 1, Procurement, Marine Corps*, p. 345.
74. Andrew Feickert, "Joint Light Tactical Vehicle: Background and Issues for Congress," Congressional Research Service Report RS22942, updated July 13, 2020, p. 6, https://crsreports.congress.gov/product/pdf/RS/RS22942 (accessed August 30, 2023).
75. Private correspondence with the author, July 19, 2022.
76. Statement of Lieutenant General Mark R. Wise, Deputy Commandant for Aviation, U.S. Marine Corps, in hearing, *Fiscal Year 2022 Budget Request of the Department of Defense for Fixed-Wing Tactical and Training Aircraft Programs*, Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, U.S. House of Representatives, July 13, 2021, https://www.govinfo.gov/content/pkg/CHRG-117hhrg45620/html/CHRG-117hhrg45620.htm (accessed August 30, 2023), and Annette Weston, "Sundown Ceremony for Harrier Training Squadron Marks End of Nearly 40-Year Era," NewsChannel 12 [New Bern, North Carolina], October 27, 2021, https://wcti12.com/news/local/sundown-ceremony-for-harrier-training-squadron-marks-end-of-nearly-40-year-era (accessed August 30, 2023).
77. Accounting for Marine Corps possession of F-35s is a rather complicated exercise. The service reports how many aircraft it has in its inventory in its Aviation Plan, a public document that is not published every year. On page 51 of the 2022 AVPLAN (the most recent version), the Corps reports an inventory of 116 F-35B and 10 F-35C aircraft with eight F-35Bs listed separately in depot maintenance; it is not clear whether those eight F-35Bs are included in the 116. The data used in the table are taken from a budget document published in November 2021. Thus, when the Corps published its 2022 AVPLAN, F-35Bs in the Corps' inventory could be 116 or 124 depending on how one accounts for those that are in depot maintenance. On page 56 of the AVPLAN, the Corps shows the transition plan by which it is replacing older aircraft with new aircraft; the AV-8B Harrier is being replaced by the F-35B, for example, and the F/A-18 is being replaced by the F-35C. According to this chart, by the end of FY 2021 (roughly accounting for its dataset dated from November 2021), the Corps had approximately 127 F-35B and 10 F-35C aircraft, but these counts do not include aircraft purchased by the Marines in a given year (for example, FY 2021, 2022, or 2023) that might still be in production or in transition between the manufacturer, acceptance by the service, and fielding in a squadron. Department of the Navy budget documents for naval aviation (which covers both U.S. Navy and U.S. Marine Corps aircraft) capture aircraft purchased in a fiscal year; they do not account for aircraft that exist in operational units. Within the budget documents, there is an explanatory footnote clarifying that budget numbers for F-35s purchased by the Department of the Navy for both the Corps and the Navy through FY 2010 did not differentiate between F-35B and F-35C models, nor was there a clear distinction between Navy and Marine Corps F-35Cs. In FY 2011, a separate budget line number was assigned to F-35B models, and greater clarity was given to F-35Cs. Pages 13 and 41 of the Navy's FY-2024 budget activities justification book for aviation procurement includes a note explaining that from FY 2008–FY 2010, the Navy procured 29 F-35Bs. These 29 aircraft are not included in the "Prior Years" amount of 129 F-35B aircraft shown on page 41, a number that captures how many F-35Bs were purchased from FY 2011–FY 2021. Similarly, page 14 shows the breakout between Navy and Marine Corps F-35C models, but even here the numbers are not clear. The USMC AVPLAN shows 10 F-35Cs in inventory and 10 assigned to a squadron in its TACAIR Transition Plan chart (assigned to VMFA-314). But page 13 of the Navy budget document shows 143 F-35Cs procured from FY 2011–FY 2021 and, in Note (1), 340 F-35Cs purchased from the start of the program through FY 2021. Thus, the Navy purchased 483 F-35Cs through FY 2021 but on page 14 accounts for only nine aircraft bought specifically for the Marine Corps: three in FY 2022 and six in FY 2023, long after the Corps fielded its 10 aircraft in a single squadron. Combining all of this information—accounting for Navy budget documents and the Corps' AVPLAN—it appears that the Corps has (whether in operational units or not) 19 F-35Cs and 190 F-35Bs fielded or purchased though FY 2023. For the stout-of-heart researcher, see Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1506N: Aircraft Procurement, Navy / BA 01: Combat Aircraft / BSA 1: Combat Aircraft, P-1 Line Item Number / Title: 0147 / Joint Strike Fighter CV," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 3, Aircraft Procurement, Navy, Budget Activities 01–04*, pp. 13 and 14; Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1506N: Aircraft Procurement, Navy / BA 01: Combat Aircraft / BSA 1: Combat Aircraft, P-1 Line Item Number / Title: 0152 / JSF STOVL," in ibid., p. 41; and U.S. Marine Corps, *2022 United States Marine Corps Aviation Plan*, pp. 51, 56, and 57.
78. For an explanation of current F-35 cost and performance matters, see John Venable, "Swiss Government Purchase of F-35A Fighter Jet Reveals Critical Flaws in U.S. Air Force Decision to Buy F-15EX," Heritage Foundation *Issue Brief* No. 5202, July 12, 2021, https://www.heritage.org/sites/default/files/2021-07/IB5202.pdf.
79. Berger statement, May 9, 2022.
80. Ibid.
81. Berger, statement before House Armed Services Committee, April 28, 2023, p. 4.
82. Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1506N: Aircraft Procurement, Navy / BA 01: Combat Aircraft / BSA 1: Combat Aircraft, P-1 Line Item Number / Title: 0164 / V-22 (Medium Lift)," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 3, Aircraft Procurement, Navy, Budget Activities 01–04*, p. 85.
83. U.S. Marine Corps, *2022 United States Marine Corps Aviation Plan*, pp. 90, 96.

84. Vice Admiral Paul Grosklags, Representing Assistant Secretary of the Navy (Research, Development and Acquisition); Lieutenant General Jon Davis, Deputy Commandant for Aviation; and Rear Admiral Michael C. Manazir, Director Air Warfare, statement on "Department of the Navy's Aviation Programs" before the Subcommittee on Seapower, Committee on Armed Services, U.S. Senate, April 20, 2016, p. 21, http://www.armed-services.senate.gov/imo/media/doc/Grosklags-Davis-Manazir_04-20-16.pdf (accessed August 30, 2023).

85. U.S. Government Accountability Office, *Defense Acquisitions: Assessments of Selected Weapons Programs*, GAO-16-329SP, March 2016, p. 93, http://www.gao.gov/assets/680/676281.pdf (accessed August 29, 2023).

86. Exhibit P-40, "Budget Line Item Justification: PB 2024 Navy, Appropriation / Budget Activity / Budget Sub Activity: 1506N: Aircraft Procurement, Navy / BA 01: Combat Aircraft / BSA 1: Combat Aircraft, P-1 Line Item Number / Title: 0158 / CH-53K (Heavy Lift)," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 3, Aircraft Procurement, Navy, Budget Activities 01-04*, p. 61.

87. 10 U.S. Code § 8063(a), https://www.law.cornell.edu/uscode/text/10/8063 (accessed August 29, 2023).

88. Berger, statement before House Armed Services Committee, April 28, 2023, p. 36.

89. U.S. Marine Corps, *Commander's Readiness Handbook*, May 2014, p. iv, https://www.hqmc.marines.mil/Portals/138/HiRes%20Commanders%20Readiness%20Handbook.pdf (accessed August 29, 2023). Italics in original.

90. General Charles Q. Brown, Jr., and General David H. Berger, "Redefine Readiness or Lose," War on the Rocks, March 15, 2021, https://warontherocks.com/2021/03/redefine-readiness-or-lose/ (accessed August 29, 2023).

91. "[Lieutenant General Eric] Smith used the anti-armor mission as an example of how the service [is] evolving. Before, the Marines would use their own tanks to target enemy tanks. Now, the service is divesting its entire fleet of tanks to free up money to invest in higher priorities. Instead, it can use long-range precision munitions launched from the back of a JLTV to destroy enemy tanks from a more mobile posture and from longer ranges. 'The experimentation that we've done now to date successfully using lightweight mounted fires—think the back of a Joint Light Tactical Vehicle—is killing armor at ranges, rough calculation, about 15, 20 times the range that a main battle tank can kill another main battle tank,' Smith said. He added the Marine Corps didn't get rid of its tanks because they weren't good at taking out adversary tanks, but rather 'we can kill armor formations at longer ranges using additional and other resources without incurring a 74-ton challenge trying to get that to a shore, or to get it from the United States into the fight. You simply can't be there in time.'" Megan Eckstein, "Early Experiments Are Proving out Tank-Free Marine Corps Concept," U.S. Naval Institute News, February 10, 2021, https://news.usni.org/2021/02/10/early-experiments-are-proving-out-tank-free-marine-corps-concept (accessed August 30, 2023). General Berger has built on this point with his annual updates that report progress with FD 2030. For his most recent discussion of divestiture, replacement capabilities, and readiness, see Berger, "Force Design 2030 Annual Update," May 2022, p. 16.

92. J.R. Wilson, "State of the Corps: The Final Interview with Gen. James T. Conway, Commandant of the Marine Corps," Defense Media Network, October 24, 2010, https://www.defensemedianetwork.com/stories/state-of-the-corps/ (accessed August 30, 2023).

93. The ongoing war in Ukraine is a ready example of how modern technologies, once unreachable because of cost, complexity, and rarity, are now ubiquitous and affordable and are being leveraged to support military operations at all levels of war. What was once the preserve of major states, advanced technologies can be adapted from the commercial market to great effect. For various examples, see Jason McGee-Abe, "One Year on: 10 Technologies Used in the War in Ukraine," TechInformed, February 24, 2023, https://techinformed.com/one-year-on-10-technologies-used-in-the-war-in-ukraine/ (accessed August 30, 2023); Robin Fontes and Jorrit Kamminga, "Ukraine a Living Lab for AI Warfare," *National Defense*, March 24, 2023, https://www.nationaldefensemagazine.org/articles/2023/3/24/ukraine-a-living-lab-for-ai-warfare (accessed August 30, 2023), and Annika Burgess, "What Ukraine's Weapons Innovation and Commercial Technologies Tell Us About the Future of War," ABC [Australian Broadcasting Corporation] News, February 3, 2023, https://www.abc.net.au/news/2023-02-04/diy-weapons-innovation-drones-in-ukraine-war-russia/101910506 (accessed August 30, 2023).

94. When questioned about Force Design 2030 initiatives during his confirmation hearing on his nomination to be 39th Commandant of the Marine Corps, Assistant Commandant General Eric Smith said, "So those efforts are on pace and need to go faster, because also as referenced from Ranking Member Wicker, whether the year is '27, '26, '25, for the Marines, we are the fight tonight force. We want to be even more ready than we are every single day. That is our mission when we wake up. ¶ So, Force Design is on track. We need to accelerate those areas where we can...." See stenographic transcript of hearing *To Consider the Nomination of: General Eric M. Smith, USMC for Reappointment to the Grade of General and to be Commandant of the Marine Corps*, Committee on Armed Services, U.S. Senate, June 13, 2023, p. 22, https://www.armed-services.senate.gov/imo/media/doc/transcript_61323.pdf (accessed August 30, 2023).

95. See Berger, "Commandant's Planning Guidance."

96. See Sarah Cammarata, "Infantry Training More Intense as Marine Corps Makes Major Changes, Commandant Tells Senators," *Stars and Stripes*, June 25, 2021, https://www.stripes.com/branches/marine_corps/2021-06-24/Infantry-training-more-intense-as-Marines-Corps-makes-major-changes-commandant-tells-senators-1793441.html (accessed August 30, 2023); Chad Garland, "Marine Corps Seeks to Make 'Smarter' Infantry Force with New Course," *Stars and Stripes*, February 22, 2021, https://www.stripes.com/theaters/us/marine-corps-seeks-to-make-smarter-infantry-force-with-new-course-1.663144 (accessed August 30, 2023); and Gidget Fuentes, "Marines Retooling Infantry Training for Complex Warfare in Pacific," U.S. Naval Institute News, May 6, 2021, https://news.usni.org/2021/05/06/marines-retooling-infantry-training-for-complex-warfare-in-pacific (accessed August 30, 2023).

97. Matt Gonzales, "Breaking New Ground: Corps' Wargaming Center Ready for Construction," U.S. Marines, June 24, 2021, https://www.marines.mil/News/News-Display/Article/2670179/breaking-new-ground-corps-wargaming-center-ready-for-construction/ (accessed August 30, 2023).

98. Diana Stancy Correll, "Navy, Marine Corps Aim to Refine, Test Modern Warfighting Concepts in Large Scale Exercise 2021," *Navy Times*, August 9, 2021, https://www.navytimes.com/news/your-navy/2021/08/09/navy-marine-corps-aim-to-refine-test-modern-warfighting-concepts-in-large-scale-exercise-2021/ (accessed August 30, 2023), and Sam LaGrone, "Large Scale Exercise 2021 Tests How Navy, Marines Could Fight a Future Global Battle," U.S. Naval Institute News, August 9, 2021, https://news.usni.org/2021/08/09/large-scale-exercise-2021-tests-how-navy-marines-could-fight-a-future-global-battle (accessed August 30, 2023).
99. U.S. Navy, U.S. Fleet Forces Command, "Navy and Marine Corps Commence Large Scale Exercise 2023," August 9, 2023, https://www.usff.navy.mil/Press-Room/News-Stories/Article/3488030/navy-and-marine-corps-commence-large-scale-exercise-2023/ (accessed August 30, 2023).
100. Berger, Senate Armed Services Committee testimony, May 12, 2022, pp. 17–19.
101. U.S. Marine Corps, "Redesignated: 3rd Marine Regiment Becomes 3rd Marine Littoral Regiment."
102. Dzirhan Mahadzir, "New Marine Littoral Regiment Key to Expanded Pacific Security Cooperation, U.S., Japanese Leaders Say," U.S. Naval Institute News, January 12, 2023, https://news.usni.org/2023/01/12/new-marine-littoral-regiment-key-to-expanded-pacific-security-cooperation-u-s-japanese-leaders-say (accessed August 27, 2023).
103. This count is based on an average number of 1.5 divisions deployed to major wars (see Table 6, "Historical U.S. Force Allocation," in "An Assessment of U.S. Military Power," *supra*) and an average of 10–11 battalions per division.
104. General David H. Berger and Ryan Evans, "A Chat with the Commandant: Gen. David H. Berger on the Marine Corps' New Direction," War on the Rocks, April 6, 2020, https://warontherocks.com/2020/04/a-chat-with-the-commandant-gen-david-h-berger-on-the-marine-corps-new-direction/ (accessed August 30, 2023), and General David H. Berger, Commandant of the Marine Corps, "The 38th Commandant's Intent," U.S. Marine Corps, July 17, 2019, https://www.cmc.marines.mil/Priorities-Guidance-and-Concepts/Article/Article/2929844/the-38th-commandants-intent/ (accessed August 30, 2023).
105. Berger, "Force Design 2030," pp. 2, 7, 8, and 11.
106. U.S. Department of the Navy, Office of Budget–2023, *Highlights of the Department of the Navy FY 2024 Budget*, DON Budget Card, https://www.secnav.navy.mil/fmc/fmb/Documents/24pres/DON_Budget_Card.pdf (accessed August 30, 2023).
107. Ibid.
108. Exhibit P-1, "FY 2024 President's Budget, Total Obligational Authority, DoD Component Summary," in U.S. Department of the Navy, *Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy, Justification Book Volume 1 of 1, Procurement, Marine Corps*, p. vii.

U.S. Space Force

John Venable

The U.S. Space Force (USSF) was created pursuant to Title IX of the fiscal year (FY) 2020 National Defense Authorization Act (NDAA), which was signed into law on December 20, 2019.[1] It is "responsible for organizing, training, and equipping Guardians [military space professionals] to conduct global space operations that enhance the way our joint and coalition forces fight, while also offering decision makers military options to achieve national objectives."[2]

Almost all civilian and commercial space technologies have direct applicability to military systems or are of dual use. This makes the interwoven efforts of all three U.S. sectors critical to any informed assessment of the Space Force.[3]

Background

More than any other nation, America relies on the technological advantages of space. Banking, commerce, travel, entertainment, the functions of government, and our military all depend on our assets in space.[4] That fact has been recognized by every President since Dwight Eisenhower in the mid-1950s, but various issues kept the United States from developing a single service charged with managing space assets and capabilities until very recently.

In 1961, the Air Force was named executive agent for space research and development, but at that point, the Army and Navy already had well-established programs.[5] This splintered approach remained in place for the next six decades and, although anything but efficient, allowed the U.S. to advance its space capabilities at a stunning pace.

The effectiveness of the space support missions delivered during those developmental decades was on full display during Operation Desert Storm.[6] Our space capabilities allowed our forces to move with incredible speed and accuracy, but a growing U.S. dependence on space was equally evident. U.S. reliance on the Global Positioning System (GPS) for air, land, and sea maneuver, targeting, and engagement has grown to the point where it is nearly universal, exposing a critical vulnerability that our adversaries have moved to exploit.

Both China and Russia have developed doctrine, organizations, and capabilities to challenge U.S. access to and operations in the space domain. Concurrently, their own use of space is expanding significantly. These nations have demonstrated the capability to put American space assets at risk, and until very recently, the United States had not taken overt steps to protect those systems, much less to develop its own warfighting capability in that domain.

The FY 2017 NDAA mandated that the Department of Defense (DOD) conduct a review of the organization and command and control of space assets within the department.[7] Shortly after the FY 2017 NDAA was enacted, President Donald Trump directed that a Space Force be established within the Department of the Air Force (DAF).[8] Congress concurred and created the USSF with enactment of the FY 2020 NDAA.

An important addition to the U.S. warfighting command structure was the reestablishment of U.S. Space Command in 2019 as the 11th Combatant Command within the Department of Defense. Space Command's mission is to conduct "operations in, from, and to space to deter conflict, and if necessary, defeat aggression, deliver space combat power for the joint/combined force, and defend U.S. vital interests with allies and partners."[9]

Organization and Funding

The USSF Headquarters and Office of the Chief of Space Operations (CS) are located in the Pentagon. When Congress authorized the Space Force, it limited its scope to Air Force organizations and personnel located at five major installations:

- The 21st Space Wing at Peterson Air Force Base, Colorado;
- The 30th Space Wing at Vandenberg Air Force Base, California;
- The 45th Space Wing at Patrick Air Force Base, Florida;
- The 50th Space Wing at Schriever Air Force Base, Colorado; and
- The 460th Space Wing at Buckley Air Force Base, Colorado.[10]

Those personnel, organizations, and structures have been restructured and rolled into three major field commands that fall directly under the CSO:

- Space Operations Command (SpOC);
- Space Systems Command (SSC); and
- Space Training and Readiness Command (STARCOM).[11]

These three commands lead the next tier of organizations, called Deltas. The Space Force originally included "Garrisons" in the tier as Deltas but renamed them all Deltas in 2022.[12] Deltas are equivalent to Air Force Groups, are led by a colonel, and are tasked with and responsible for specific missions and operations or are organizations with functions similar to those of Air Force base-level command. Squadrons are the final level of command and fall under Deltas.[13]

Space Operations Command. SpOC was established at Peterson Air Force Base, Colorado, on October 22, 2020, as the first major USSF field command.[14] It is led by a three-star general and is responsible for organizing, training, and equipping space forces assigned to Combatant Commands. The SpOC at Vandenberg Air Force Base, California, was redesignated as SpOC West and continues to conduct operations in support of Combatant Commanders.

Space Systems Command. This command stood up on August 13, 2021, at Los Angeles Air Force Base[15] to oversee the development, acquisition, and maintenance of satellites and ground systems, the procurement of satellite communications (SATCOM) and launch services, and investments in next-generation technologies. SSC is led by a three-star general who oversees the Space Force's approximately $19.2 billion FY 2024 budget for research, development, test, and evaluation (RDT&E) and the acquisition of new systems.[16] SSC absorbed the Space and Missile Systems Center (SMC), located at Los Angeles Air Force Base, California; the Commercial Satellite Communications Office based in Washington, D.C.;[17] and the Space Vehicles Directorate at Kirkland Air Force Base, New Mexico.[18]

In October 2022, the Space Development Agency (SDA) was transferred to the U.S. Space Force as a direct reporting unit. SDA is delivering on its strategy to design a proliferated constellation of small, low Earth orbit (LEO)–based satellites that can be fielded faster and more cheaply than large, geosynchronous orbit (GEO)–based satellites. In April 2023, SDA put the first 10 of 28 communications and space situational awareness satellites within the Proliferated Warfighter Space Architecture (PWSA) into orbit just 30 months after it was given authority to proceed with the contract.[19] Since then, 14 more PWSA satellites have been put into orbit.

Space Training and Readiness Command. STARCOM is the third USSF field organization and stood up on August 23, 2021, at what is now Peterson Space Force Base, Colorado. It is led by a two-star general and is responsible for the education and training of space professionals.[20]

Personnel. The FY 2024 Air Force budget request supports 9,400 military and 4,909 civilian Space Force personnel, respectively, up from 8,600 military and 4,714 civilian personnel in FY 2023, and a total end strength of 14,526, up from 13,527 in FY 2023.[21]

Funding. The President's budget request for FY 2024 lays out a relatively robust level of funding for every aspect of the new service's mission set. The budget for Operations and Maintenance (O&M) is $4.9 billion; the budget for RDT&E is $19.2

billion; and procurement adds another $4.7 billion for a total of $30.0 billion, a 14 percent increase from FY 2023.[22]

Capacity

The classified nature of deployed space assets makes any listing of specific capacity levels within the Space Force portfolio or assessment of the service's capability to execute its mission a challenging exercise. The USSF's position, navigation, and timing (PNT); command and control (C2); communications (Comm); weather satellites; and intelligence, surveillance, and reconnaissance (ISR) satellites are unrivaled by our peer adversaries and provide extraordinary capabilities. The service's space situational awareness (SSA) satellites and terrestrial-based capabilities are also unrivaled, but they are limited and require additional resourcing to meet the expectations of their mission sets. Each satellite, satellite constellation, and terrestrial space surveillance site has its own unique characteristics and expected life span.

In 2018, the Air Force operated 77 satellites.[23] Today, thanks partly to service equipment transfers and additional fielding, the number available to the Space Force has almost doubled to an estimated 147. (See Table 18).

Position, Navigation, and Timing Satellites

Global Positioning System (GPS) (37 Satellites). Perhaps the best-known constellation of satellites under Space Force control, GPS provides PNT for millions of simultaneous users around the world. It takes 24 of these satellites to provide seamless global coverage, and 31 are currently operational.[24] At least six additional satellites have been decommissioned and serve as on-orbit spares, bringing the total number that are available to 37.[25]

GPS III is the latest upgrade to the platform and incorporates a more robust anti-jamming capability. The fifth GPS III satellite was launched into orbit in June 2021,[26] the sixth was launched in January 2023,[27] and the next four have been assembled and are waiting their turn in the launch queue.[28] The fact that GPS III satellites are interoperable with other Global Navigation Satellite Systems (GNSS) such as the European Galileo network and the Japanese Quazi-Zenith Satellite System adds an impressive level of resiliency to the constellation.[29]

Weather Satellites

Defense Meteorological Satellite Program (DMSP) (Four Satellites). Defense weather satellites have been collecting weather data and providing forecasts for U.S. military operations since 1962 through the DMSP.[30] Currently, four DMSP satellites are operational and in polar LEO.[31] The main sensors for these weather satellites are optical, and each provides continuous visual and infrared imagery of cloud cover over an area approximately 1,600 nautical miles wide, enabling complete global coverage of weather features every 14 hours.[32] Launched between 1999 and 2009 with a life expectancy of just five years, they have continued to deliver exceptional data well beyond their expected lifetimes. Space Force officials have warned that the DMSP constellation would become inoperable at some point between 2023 and 2026 and that the proposed replacement system[33] would not begin operation until 2024 at the earliest.[34]

Electro-Optical Infrared Weather System–G (EWS-G) (Two Satellites). Formerly named GOES, the second EWS-G was transferred from the National Oceanic and Atmospheric Administration (NOAA) to the USAF in 2023. The EWS-G is the first geostationary weather satellite owned by the DOD and provides theater weather imagery in the Indian Ocean region.[35]

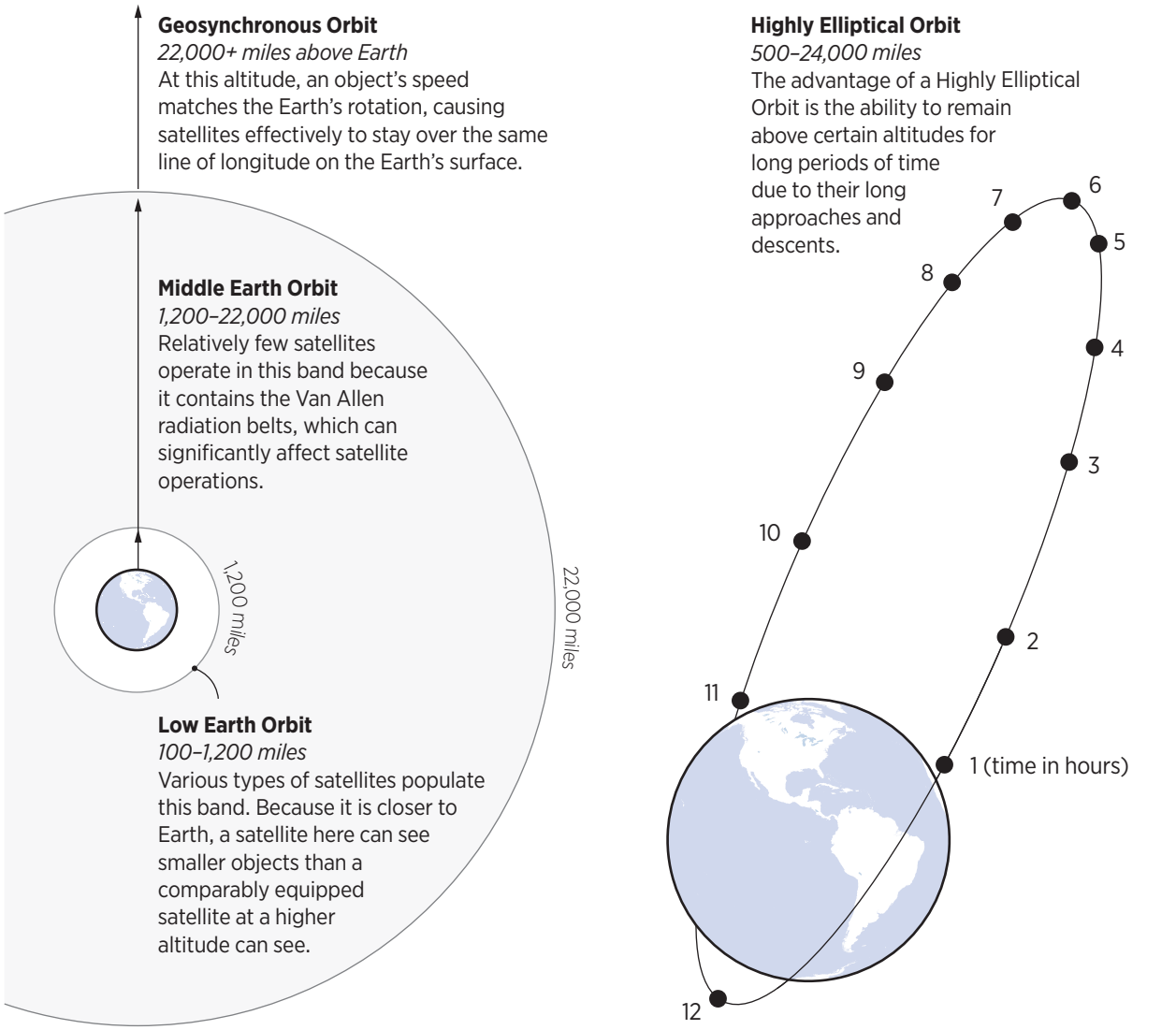
Communications Satellites

Military Strategic and Tactical Relay (Milstar) (Five Satellites). This satellite communications system was designed in the 1980s to ensure that the National Command Authorities (President, Vice President, Secretary of Defense, Joint Chiefs of Staff, and Combatant Commanders) would have access to assured, survivable global communications with a low probability of intercept or detection. Milstar was designed to overcome enemy jamming and nuclear effects and was considered the DOD's most robust and reliable SATCOM system when it was fielded.

The first two satellites (Milstar I) carry a low data rate (LDR) payload that can transmit 75 to 2,400 bits per second (bps) of data over 192 channels in the extremely high frequency (EHF) range. Encryption technology and satellite-to-satellite crosslinks provide secure communications, data exchange, and global coverage. The other three satellites (Milstar II) carry both LDR and medium data

FIGURE 6

Types of Earth Orbits



SOURCE: Heritage Foundation research.

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rate (MDR) payloads and can transmit 4,800 bps to 1.544 megabits per second (Mbps) of data over 32 channels.[36] Milstar was fielded from 1993 through 2003 with a designed life of 10 years.[37]

Advanced Extremely High Frequency System (AEHF) (Six Satellites[38]). Like Milstar, AEHF provides and sustains secure, jam-resistant communications and C2 for high-priority military assets located anywhere in the world. The system, which was launched into geosynchronous orbit from 2010–2020 with a design life of 14 years, "will be integrated into the legacy Milstar...constellation" and "be backward compatible with Milstar's low data rate (LDR) and medium data rate (MDR) capabilities, while providing extreme data rates (XDR) and larger capacity at substantially less cost than the Milstar system."[39]

Defense Satellite Communications System (DSCS) (Six Satellites). These satellites provide nuclear-hardened, global communications to the

DOD, Department of State, and National Command Authorities. The system is capable of high data rates and provides anti-jamming capabilities. In all, the DSCS program successfully launched 14 satellites, six of which are still operational and serve operational communication requirements in Southwest Asia as well as research and development of ground-based support capabilities. These satellites were fielded from 1998 through 2003 into GEO with 10-year life spans.[40]

Wideband Global SATCOM (WGS) (10 Satellites). WGS is a joint-service program funded by the U.S. Air Force and U.S. Army, along with international partners Australia and Canada, and is used by all DOD services as well as National Command Authorities. Once known as the Wideband Gapfiller Satellite, WGS provides Super High Frequency (SHF) wideband communications, using direct broadcast satellite technology to provide C2 for U.S. and allied forces. With solid capabilities that include phased array antennas and digital signal processing technology, this system delivers a flexible architecture with a satellite life span of up to 14 years.[41] WGS-11 is scheduled to launch and join the constellation sometime in 2024.[42]

Fleet Satellite Communications System (FLTSATCOM) (Six Satellites).[43] FLTSATCOM is a constellation of six operational satellites used by the Navy, Air Force, and presidential command network. The system was launched into GEO between 1978 and 1989 to serve as a secure communications link between the three users with a design life of five years.[44] This constellation transferred from the U.S. Navy to the Space Force on June 6, 2022.[45]

Ultra-High Frequency Follow-On (UFO) (10 Satellites). The UFO constellation was designed to replace FLTSATCOM to provide communications for tactical users including aircraft, ships, submarines, and ground forces. UFO provides almost twice the throughput and 10 percent more power per channel than FLTSATCOM. This UFO constellation of satellites was launched into GEO between 1993 and 2003 with a life expectancy of from 14 to 15 years.[46] The system was transferred from the U.S. Navy to the Space Force on June 6, 2022.[47]

Mobile User Objective System (MUOS) (Five Satellites). MUOS is a next-generation narrowband tactical satellite communications system designed for tactical users with the goal of significantly improving ground communications, even for troops in the most remote locations or in buildings with no other satellite access. MUOS satellites were launched into GEO from 2012 through 2016 with a design life of 15 years and provide the ability to transmit 10 times more information volume than can be transmitted with UFO.[48] This constellation was transferred from the U.S. Navy to the Space Force on June 6, 2022.[49]

Continuous Broadcast Augmenting SATCOM (CBAS) (Two Satellites). CBAS is a satellite communications system in GEO that provides communications relay capabilities to support senior leaders and Combatant Commanders, augmenting existing military satcom. CBAS 1 was launched on April 14, 2018, and CBAS-2 was launched on January 15, 2023.[50]

Proliferated Warfighter Space Architecture (PWSA) Transport Layer Tranche 0 (19 Satellites). Once fully fielded, the PWSA Tranche 0 constellation of 19 transport satellites and eight tracking platforms[51] will serve as a warfighter testbed/immersion constellation that will support military exercises and provide low-latency data connectivity and on-orbit fusion.[52] While it is a demonstration testbed for future tranches, the Tranche 0 constellation will no doubt be able to service ongoing operational needs well after the utility of their test function has been served.[53] The PWSA's programmed life span is unknown.

Space Situational Awareness Systems

Knowledge of hostile space systems—their locations, their positional history, and how those satellites and other spacecraft are maneuvering in real time—conveys intent and collectively shapes the protocols and counterspace decisions that follow. Space situational awareness is therefore critical to every aspect of defensive and offensive counterspace operations and forms the foundation for DOD counterspace activities.[54]

In addition to adversary systems, other significant threats are in orbit. Objects in low Earth orbit travel at more than 17,000 miles an hour,[55] and particles as small as a few thousandths of an inch in diameter traveling at those speeds can threaten everything from satellites to the International Space Station.[56]

In June 2023, the European Space Agency estimated that there are at least 36,500 objects that are more than four inches wide, 1 million between 0.4

inches and 4 inches across, and 130 million that are smaller than 0.4 inches but bigger than 0.04 inches.[57] The Space Force is currently tracking nearly 48,000 objects in space. Specifically:

> The number of publicly reported tracked objects has grown from 8,927 in 2000 (2,671 active and inactive satellites, 90 space probes, and 6,096 pieces of debris) to about 47,800 today (7,200 active satellites, 19,600 pieces of debris of known origin, and 21,000 pieces of debris of unknown origin or which cannot be tracked repeatedly). Most of the increase in active satellites is the result of the massive number of small satellites launched to form constellations in low-Earth orbit starting in the 2010s, primarily by private firms. For example, the Starlink constellation of small communications satellites now has over 2,000 spacecraft with several thousand more to be added in the coming years. OneWeb is close to completing its constellation of about 900 small communications satellites. Planet's constellation has around 200 small Earth-observation satellites. In addition to the tracked debris, there are an additional estimated 600,000 to 900,000 fragments between 5 mm and 10 cm in size, and many hundreds of thousands of pieces smaller than 5 mm in size, that cannot be tracked.[58]

Maintaining a high level of situational awareness about satellites and debris orbiting across the vast dimensions of potential Earth orbits requires a robust and seamless network of space and terrestrial-based sensors, the earthbound portion of which is known collectively as the Space Surveillance Network (SSN). Understanding the capabilities and limitations of this network naturally begins with understanding the numbers and types of space-based and ground-based systems.

The SSA satellites, known collectively as the Space-Based Surveillance System (SBSS), operate in concert with ground-based sensors but without limitations such as weather that can obscure and sunlight that can blind ground-based optical sensors. SBSS consists of 11 acknowledged satellites. Some track objects and debris fields from LEO. Others operate from GEO and are capable of maneuvering to perform detailed inspections of orbiting objects that are of especially high interest.

Geosynchronous Space Situational Awareness Program (GSSAP) (Six Satellites). This classified surveillance constellation can accurately track and characterize objects in orbit.[59] Operating near GEO, GSSAP satellites are maneuverable and therefore able to perform rendezvous and proximity operations (RPO) on objects of interest in space.[60] The first two GSSAP satellites were put in orbit on July 28, 2014; the second two were launched on August 19, 2016; and a third pair was launched on January 21, 2022.[61] Each GSSAP satellite has an estimated life span of seven years.[62]

Long Duration Propulsive Evolved Expendable Launch Vehicle (LPDE) (Three Satellites). LPDE is an acronym of acronyms that stands for Long Duration Propulsive Evolved Expendable Launch Vehicle Secondary Payload Adapter. LPDE has been renamed, and future launches will be known as Rapid On-Orbit Space Technology and Evaluation Ring (ROOSTER). These satellites provide power, pointing, telemetry, and command and control for payloads of up to six sensors that remain with and are supported by the vehicle or an equal number of deployable small satellites (SmallSats) to LEO, medium Earth orbit (MEO), GEO, or Super GEO.[63] LPDE's hydrazine propulsion module provides up to 400 meters per second of delta-V, giving it the ability to deploy satellites or to sustain or change its own orbit with precision.[64]

LPDE-1 was launched in December 2021 carrying the Ascent SmallSat and three additional undisclosed payloads.[65] LPDE-2 was launched in November 2022 carrying three SmallSats, including Alpine, and Tetra-1.[66] LPDE-3 was launched in January 2023 carrying a combination of five hosted sensors/payloads and the SmallSat ECP-Lite.[67] Details for those satellites and payloads are provided in the paragraphs that follow.

Wide Area Search Satellite (WASSAT) (One Sensor). WASSAT is a camera/sensor package supported on LPDE-3 that is designed to monitor other satellites and gather data on their trajectories and anomalies like changes in their orbits.[68]

Space-Based Space Surveillance System-1 (SBSS-1) (One Satellite). The SBSS-1 satellite was launched into LEO in 2010 to detect and track space objects such as satellites and orbital debris. This satellite has a seven-year life expectancy.[69]

Space Tracking and Surveillance System Advanced Technology Risk Reduction (STSS-ATR)

(One Satellite). STSS-ATR is an RDT&E satellite placed in a polar LEO on May 5, 2009, for the Missile Defense Agency (MDA) to test an alternate technology for potential application to missile defense.[70]

Space Surveillance Network (SSN) Terrestrial-Based Sensors (24 Sensors).

There are six dedicated, ground-based radar sensors that track satellites and orbital debris, including the Space Fence on Kwajalein Atoll in the South Pacific. Seven collateral radar sensors are part of this network, but their primary mission is to detect and track intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) and to test and evaluate other systems.[71] Another 10 contributing SSN sensors controlled by other organizations or agencies provide space surveillance support upon request from the National Space Defense Center (NSDC).[72] The Space Fence radar emits a very narrow, fan-shaped beam in the north–south direction that "paints" satellites and debris from low Earth orbit as they fly through the radar fan, and it can track objects all the way out to GEO.

Offensive and Defensive Satellites and Sensors

Ascent (One Satellite). Ascent is a 12-unit (12U) miniaturized satellite (CubeSat) that was deployed to evaluate CubeSat operations in GEO.[73] Billed as a developmental SmallSat, its CubeSats likely have the ability to conduct RPO operations, potentially providing a lasting, on-orbit, offensive capability.

Tetra-1 (One Satellite). Tetra-1 is the first of a series of GEO-based SmallSats and was launched on November 1, 2022. The Tetra series is designed to host a variety of payloads and will have interesting maneuverability options[74] that will help to develop on-orbit tactics, techniques, and procedures.[75]

Energetic Charged Particle-Lite (ECP-Lite) (One-Sensor Payload). ECP-Lite is a suite of sensors packaged in a container that is less than half of a cubic foot in size and is designed to be attached to host satellites. This sensor suite detects threats that include space weather and "other" hazards that involve surface impacts, dose, and internal and surface charging.[76] This is very likely a prototype threat warning system, similar to radar warning receivers (RWR) on fighter aircraft, that will be packaged with future spaceborne systems to significantly improve the defensive capabilities of on-orbit platforms.

Catcher (One-Sensor Payload). Catcher is a sensor similar to ECP-Lite that can detect threats near the host's surrounding environment, including mechanical impact threats from the electromagnetic spectrum.[77]

Early Missile Warning/Tracking and Nuclear Detonation Detection

Space-Based Infra-Red System (SBIRS) (10 Satellites). SBIRS is an integrated constellation of satellites that was designed to deliver early missile warning and provide intercept cues for missile defenses. This surveillance network was designed to incorporate three satellites in high elliptical orbit (HEO) and eight others in GEO, each working in concert with ground-based data processing and command and control centers. Because SBIRS HEO is a retaskable orbit, these satellites can be moved to more optimal orbits/viewpoints as mission requirements dictate. Four SIBRS HEO[78] satellites are in orbit,[79] and the sixth and final satellite in this constellation, GEO-6, was launched into orbit on August 4, 2022.[80] Each of these satellites has a programmed life span of 12 years.[81]

The funding that was removed from SBIRS was shifted to a new program, Next-Generation Overhead Persistent Infrared (Next-Gen OPIR), which will include a new ground-control system. The proposed constellation will consist of five satellites, three in geosynchronous orbit and two in polar orbit.[82] Fielding of this strategically survivable constellation of missile warning satellites is scheduled to begin sometime near the end of FY 2023.[83]

Proliferated Warfighter Space Architecture (PWSA) Tranche 0–Tracking (Four Satellites). The PWSA Tranche 0 constellation will serve as a warfighter immersion/support military exercises tranche, including advanced missile tracking tests, with low-latency data connectivity, beyond-line-of-sight targeting, missile warning/missile tracking, on-orbit fusion, and multi-phenomenology ground-based sensor fusion.[84] These are the first Tracking Layer satellites with Wide Field of View (WFOV) infrared sensors. The operational constellation that follows (Tranche 1) will also have Medium Field of View (MFOV) infrared sensors that collectively will provide global, persistent detection, tracking, and queuing data for missile defense systems.

Once fully fielded, the PWSA Tranche 0 constellation of 19 transport satellites and eight tracking platforms[85] will serve as a warfighter testbed/immersion constellation that will support military

TABLE 16

Space Launches by Country

	U.S.	China	Russia	India
2010	15	15	22	1
2011	17	19	21	3
2012	12	19	14	2
2013	19	14	21	3
2014	22	16	26	5
2015	20	19	19	5
2016	26	20	13	7
2017	30	16	14	4
2018	33	38	15	7
2019	27	32	21	6
2020	38	35	12	2
2021	51	54	16	1
2022	79	62	21	4
2023	118	24	18	14
Total	**507**	**383**	**253**	**64**

NOTE: Figures for 2023 include both actual and projected launches.
SOURCE: Space Launch Schedule, https://www.spacelaunchschedule.com/ (accessed September 11, 2023).

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exercises and provide low-latency data connectivity and on-orbit fusion.[86] While it is a demonstration testbed for future tranches, the Tranche 0 constellation will no doubt be able to service ongoing operational needs well after the utility of their test function has been served.[87] The PWSA's programmed life span is unknown.

Defense Support Program (DSP) (Five Satellites). DSP is a classified constellation that was designed to detect launches of ICBMs or SLBMs against the U.S. and its allies. Its secondary missions include detection of space launch missions or nuclear weapons testing and detonations, as well as launches of shorter-range ballistic missiles. The DSP constellation uses infrared sensors to pick up the heat from missile booster plumes against the Earth's background from GEO orbits. Phase 1 placed four satellites in orbit from 1970 through 1973[88] and was followed by Phase 2, which placed six satellites in orbit from 1979–1987.[89] Phase 3 consisted of 10 DSP satellites that were launched from 1989–2007.[90]

Although Phase 3 DSP satellites have long exceeded their five-year design lives,[91] reliability has exceeded expectations. At least five[92] are still operational, providing reliable data, and are now integrated with and controlled by the SBIRS program ground station.[93]

Space Tracking and Surveillance System (STSS) (Two Satellites). Formerly known as SBIRS-Low, the two STSS satellites carry a very capable set of infrared and visible sensors for detecting and tracking ballistic missiles through all phases of their trajectory. These satellites were launched into LEO in 2009 with programmed life spans of two years.[94]

Space Test Program Satellite-6 (STPSat-6) (One Satellite). STPSat-6 hosts nine national security and science mission payloads that deliver operational Nuclear Detonation (NUDET) detection capabilities, high-bandwidth laser communications services, and new technology demonstrations in space domain awareness, weather, and NUDET detection.[95] STPSat-6 has an estimated life span of from eight–10 years.[96]

Reconnaissance and Imaging Satellites (Number Unknown). Although the history of the Air Force is steeped in these reconnaissance systems, the operational details of each constellation are classified. In the late 1990s and early 2000s, the Air Force moved to develop and field a constellation of space-based radar satellites. That program, known as Lacrosse/Onyx, launched five satellites, each carrying a synthetic aperture radar (SAR) as its prime imaging sensor. Because SAR systems can see through clouds with high resolution, they offer the potential to provide a capability from which it is hard to hide.[97]

Ground Control Network

The majority of USSF satellites are controlled by a network of 19 parabolic antennas distributed across seven locations around the world.[98] The antennas are massive, permanent fixtures, which makes them easy targets for adversaries during hostilities. If all seven locations were taken offline, it would sever our ability to communicate with a host of critical spaceborne systems. The USSF should aggressively expand the ground control network with

TABLE 17

U.S. Space Launches by Organization

Company	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Space X	2	0	1	3	6	6	8	18	21	15	28	33	61	97
Northrop Grumman	2	3	1	5	2	0	2	3	2	3	3	4	2	1
United Launch Alliance	9	12	10	11	14	12	12	8	8	5	6	5	8	12
Astra	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Rocket Lab, LTD	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Firefly Aerospace	0	0	0	0	0	0	0	0	0	0	0	0	1	2
NASA	2*	2*	0	0	0	0	0	0	0	1	0	0	1	0
Blue Origin	0	0	0	0	0	2	4	1	2	3	1	6	3	1
Virgin Orbit	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Relatively	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	**15**	**17**	**12**	**19**	**22**	**20**	**26**	**30**	**33**	**27**	**38**	**51**	**79**	**118**

* United Space Alliance.
NOTE: Figures for 2023 include actual and projected launches.
SOURCE: Space Launch Schedule, "USA Launch Schedule," https://www.spacelaunchschedule.com/category/usa/ (accessed September 18, 2023).

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additional fixed and mobile parabolic antenna systems to ensure that connectively remains seamless.

All GPS satellites are controlled by the Master Control Station (MCS) at Schriever Space Force Base in Colorado and an Alternate MCS (AMCS) at Vandenberg Space Force Base in California, "both of which include the ground antenna and monitoring stations."[99]

Space Launch Capacity

The Space Force manages the National Security Space Launch (NSSL) program, a Major Defense Acquisition Program that acquires launch services from private companies to deliver national security satellites into orbit. Currently, the NSSL uses the Atlas V and Delta IV Heavy launch vehicles from United Launch Alliance (ULA) and the Falcon 9 and Falcon Heavy from SpaceX to launch national security payloads.

In 2018, the Air Force awarded three launch services agreements to space launch companies to develop their launch vehicles for a second phase of the NSSL. In 2020, the Space Force awarded two launch services procurement contracts to ULA and SpaceX, and those two vendors will provide space launch services for the Space Force through 2027.[100]

In 2010, four organizations, including NASA, were involved in launching manned and unmanned systems into space. Today, nine private American corporations are engaged in placing satellites into orbit.[101]

In 2023, U.S. companies are scheduled to launch 118 missions into space, and China and Russia are scheduled to conduct 24 and 18 launches, respectively.[102] The numbers for China and Russia are based on launch schedules published for each of those countries and are often misleading. China planned 22 launches in 2022, but it actually launched 62 missions into space, which was just behind the U.S.'s 79 space shots for that same year.[103] America is still outpacing its peers with this vital capability, but the competition appears to be gaining.

TABLE 18

U.S. Satellites in Orbit

System	Function	Satellites
GPS	Positioning, Navigation, and Timing	37
DMSP	Weather	4
Electro-Optical Infrared Weather System – G1	Weather	2
Milstar	Communications	5
AEHF	Communications	6
DSCS	Communications	6
WGS	Communications	10
Continuous Broadcast Augmenting SATCOM (CBAS)	Communications	2
Fleet Satellite Communications System (FLTSAT)	Communications	6
Ultra-Hi Freq Follow-On (UFO)	Communications	10
Mobile User Objective System (MUOS)	Communications	5
Tranche 0 Transport Proliferated Warfighter Space Architecture (PWSA)	Communications	19
SBIRS	Missile Warning	10
DSP	Missile Warning	5
Tranche 0 Tracking Proliferated Warfighter Space Architecture (PWSA)	Missile Warning	4
LPDE	Payload Support and Satellite Delivery	3
Tetra 1 – GEO	Classified	1
Ascent	Cubesat Payload Delivery	1
Space Test Program Satellite 6 (STPSat-6)	Nuclear Detonation Detection	1
GSSAP	Space Surveillance	6
Silent Barker (Space Object Tracking)	Space Surveillance	2
SBSS	Space Surveillance	1
STSS-ATR	Missile Defense and Space Tracking	1
Total		**147**

SOURCES: Heritage Foundation research using data from Gunter's Space Page, https://space.skyrocket.de (accessed September 21, 2023), and U.S. Air Force, *Air & Space Forces Magazine*, Airforce Technology, Los Angeles Air Force Base, GlobalSecurity.org, Space Development Agency, U.S. Department of Defense, *SpaceNews*, *Popular Mechanics*, Air Force Research Laboratory, and Northrop Grumman.

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Capacity

The USSF has increased the number of satellites in its portfolio from an estimated 114 satellites in 2022 to an estimated 144 in 2023, a 24 percent growth in a single year. That space-based portfolio can meet much of the communications, collection, and imagery demand placed on it by the National Command Authorities and the strategic-level intelligence

requirements of the Defense Department. However, getting real-time satellite intelligence to warfighters at the operational and tactical levels is still problematic. The growth in the number of satellites in the Space Force constellation not only delivers more capability and capacity, but also provides additional resilience against a potential adversary.

The position, navigation, and timing services offered by GPS are unrivaled in both capacity and capability. With 31 operational GPS satellites in orbit and seven spaceborne (dormant) spares, the system has enough redundancy and resilience to handle losses associated with normal (not combat-related) space operations.

The current and growing DOD demands for imagery and collection are another thing entirely. The shortfall is projected to be so great that the Departments of the Air Force and Army, the National Reconnaissance Office, and other agencies have invested in and are employing the services of commercial organizations to provide collection and imagery on demand.[104]

Over the past several years, the U.S. Army has conducted a series of exercises called Project Convergence (PC), which are designed to test the capability of DOD and commercial spaceborne systems to provide the intelligence, imagery, and communications linkages for warfighters in the service's "close fight." In PC20, Army Brigade Combat Teams (BCTs), Combat Aviation Brigades (CABs), and Expeditionary Signal Battalion-Enhanced (ESB-E) units had access to 600 commercial SpaceX Starlink satellites in LEO[105] that readily enabled tactical employment.[106] As of August 27, 2023, 4,661 Starlink satellites were in orbit.[107] Systems like Starlink will help to enable the service's concept for a Multi-Domain Operations (MDO)–capable force by 2028 and an MDO-ready force by 2035.[108]

The capabilities and resilience offered by commercial systems like Starlink have been clearly demonstrated in Ukraine, where thousands of deployed Starlink Internet terminals have ensured Ukraine's internal and external connectivity with Western governments, nullifying a significant part of Russia's information campaign.[109] Starlink reportedly also has the ability to provide a very accurate PNT backup for GPS, which will become increasingly important for all of the services as the competition in space intensifies.[110]

Integrating LEO, MEO, and GEO satellite capabilities will continue to increase network resilience for the warfighter.[111] The capabilities demonstrated in the PC exercise series are similar to those sought in the Air Force's Advanced Battle Management System (ABMS) and the Navy's Overmatch C2 development programs.[112]

The USSF's ISR portfolio of satellites has grown from 15 to 19 known satellites that are dedicated to missile launch warning—a 27 percent increase over 2022. The Space Force's 10 SBIRS satellites, five DSP satellites, and four PWSA Tranche 0 satellites provide global coverage and generally excellent response times.

As noted, the current portfolio of reconnaissance satellites, while highly classified, likely meets many of the essential strategic requirements of the National Command Authority (NCA) and the Defense Department. However, Space Force capabilities fall well short of the needs of the services. The Department of the Air Force is therefore investing in and employing the services of commercial organizations to meet the on-demand collection and imagery needs of USSF customers.[113]

The Space Force's acknowledged and unacknowledged SSA satellites, coupled with six dedicated and 17 collateral and contributing ground-based sensors, help to maintain situational awareness of satellites and other objects in space. However, the limited number and inherent limitations of the sensors within the SBSS leave significant gaps in coverage. Those gaps are addressed by prediction, and every time a satellite maneuvers, "the process of initial discovery by a sensor, creation of an initial element set, and refinement of that element set needs to be repeated."[114]

Capability

Defensive systems and operations are designed to protect friendly space capabilities against kinetic anti-satellite (ASAT) weapons, high-powered lasers, laser dazzling or blinding, and high-powered microwave systems.[115]

The first challenge in defense is detecting an attack. The USSF has 14 SSA satellites that are dedicated to detecting the launch of terrestrial-based ASAT weapons. The gaps in the SSA network highlighted earlier make the timely assessment of and response to such an attack on a specific U.S. satellite difficult.

Several years ago, the Space Force fielded a terrestrial-based system called Bounty Hunter that can detect an adversary's attempts to deceive,

disrupt, deny, or degrade satellite communications by monitoring electromagnetic interference across multiple frequency bands. Bounty Hunter operators can locate sources of intentional and unintentional interference and minimize them.[116] This system achieved initial operational capability (IOC) in the summer of 2020 and is a significant addition to the Space Force portfolio, but it has no known capability to detect or counter lasers. Having threat detection payloads like ECP-Lite and Catcher onboard our satellites will help to close that gap and give our systems and their operators the chance to maneuver out of the threat's path.

Cyberattacks present a different challenge to space-based systems. Like other kinetic and non-kinetic attacks, cyber intrusions can cause service disruptions, sensor interference, or the permanent loss of satellite capabilities. Additionally, an effective cyberattack could corrupt the satellite's data stream to reliant elements or systems—or even allow an adversary to seize control of a satellite. According to the Royal Institute of International Affairs, the U.S. is well behind its peer competitors in this area and should assume that its satellite constellations have already been penetrated and compromised.[117]

Defensive measures that the service can take to safeguard its spaceborne portfolio can be separated into two categories of actions: passive and active.

- Passive defense measures increase survivability through asset proliferation, placing spaceborne capabilities in different orbits to complicate an enemy's targeting problem and threat warning sensors on our assets to allow real-time threat detection and enable satellite maneuvering by an operator or artificial intelligence system.[118] The Space Force has made great strides in each of these areas.

- An active defense is actually offensive in nature and includes engagements to destroy, nullify, or reduce enemy systems that put U.S. and allied systems and capabilities at risk.

The FY 2017 Air Force budget included $158 million to develop offensive space capabilities over a period of five years, and this appears to be paying dividends.[119] The only offensive Space Force system of record in open-source literature is a mobile, terrestrial-based, counter-communications system that delivers reversable effects on hostile SATCOM systems in a given area of responsibility (AOR).[120] However, with the fielding of Ascent and Tetra-1, the Space Force appears to be building classic offensive counterspace capabilities. Both satellites can move to engage with and deliver CubeSats with RPO capabilities that attach to enemy systems and lie in wait until their payloads are activated to take those satellites offline. While unconfirmed in literature, the potential for those activities has been confirmed by senior USSF officials.

Readiness

The Space Force was born of a congressionally mandated study that included a plan for the incremental transition of operational Air Force space assets and personnel to the new service. Throughout the plan's execution, the USSF has been deliberate in its hiring and is on a path to developing a solid cadre of personnel and a strong organizational culture.

The operations assumed by the USSF to support strategic and high-end operational-level support have proceeded uninterrupted, and readiness has remained high, but those operations were primarily supportive in nature and did not include robust, nearly real-time support to tactical units. While the service is undoubtedly moving forward on credible defensive and offensive readiness, there is little evidence that it is ready for the threat envisioned by Congress when it authorized creation of the Space Force.

Scoring the U.S. Space Force

Capacity Score: Marginal

The numbers and types of Backbone and ISR assets are sufficient to support global PNT requirements and the majority of strategic-level communications, imagery, and collection requirements of the National Command Authorities and the Department of Defense. While that capacity is growing, the Space Force is not capable of meeting current—much less future—on-demand, operational, and tactical-level warfighter requirements.

As noted in the capability section, the gaps in the SBSS are covered by prediction, and operators of adversarial satellites can time their maneuvers to take advantage of those gaps.

With the fielding of WASSAT sensor payload, the capacity for the Space Force to track hostile space-based threats has improved and will continue to improve significantly. The U.S. had announced plans to build a second, strategically located Space Fence like the one on Kwajalein Atoll in Western Australia in 2021, but that site has yet to be funded.[121] Even if a second Space Fence does eventually materialize, the Space Force will still need more satellites that are dedicated to this mission.[122]

The service doubled its counterspace weapons systems' capabilities with the Ascent and Tetra-1 satellites, adding the first two known offensive systems to the Space Force portfolio. Other counterspace systems are probably being developed or, like cyber, are already in play without public announcement. Nevertheless, the USSF's current visible capacity is not sufficient to support, fight, or weather a war with a peer competitor.

Capability Score: Marginal

SDA's asset modernization plan significantly accelerated the delivery of systems to the Space Force over the past year, significantly elevating USSF capabilities. However, a majority of Backbone and ISR assets have exceeded their designed life spans, and the DAF's willingness to delay and/or defer the acquisition of replacement systems remains a legacy of that department.

The capability of Backbone and ISR satellites is marginal, but the service has narrowed gaps in SSA, defensive, and offensive capabilities. The capability score is therefore "marginal," the result of being scored "strong" in "Size of Modernization Program," "marginal" for "Age of Equipment" and "Health of Modernization Programs," and "marginal" for "Capability of Equipment."

Readiness Score: Marginal

The mission sets, space assets, and personnel that transitioned to the Space Force and those that have been assigned to support the USSF from the other services have not missed an operational beat since the Space Force stood up in 2019. Throughout that period, readiness levels have seamlessly sustained Backbone and ISR support to the NCA, DOD, Combatant Commanders, and warfighters around the world.

However, there is little evidence that the USSF has improved its readiness to provide nearly real-time support to operational and tactical levels of force operations ("marginal") or its readiness to execute defensive and offensive counterspace operations to the degree envisioned by Congress when it authorized creation of the Space Force ("weak").

Overall U.S. Space Force Score: Marginal

This is an unweighted average of the USSF's capacity score of "marginal," capability score of "marginal," and readiness score of "marginal," which is one grade higher than the service was rated in the *2023 Index of Military Strength*. The trend lines for capability and capacity are improving rapidly, and this could bode well for the service in 2024 and beyond.

U.S. Military Power: Space

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity			✓		
Capability			✓		
Readiness			✓		
OVERALL			✓		

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Navigation

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Global Positioning System (GPS) Inventory: **37** Fleet age: **13.5** Date: **1997** GPS satellites provide precise positioning, navigation, and timing (PNT) for millions of simultaneous users around the world. The current constellation of 37 satellites is comprised of Block IIR (launched from 1997–2004); IIR-M (2005–2009); IIF (2010–2016); and III/IIIF (first launch 2018) satellites with steadily increasing capabilities.	5	5	**GPS III** Timeline: **2019–TBD** GPS III is the latest upgrade to the GPS platform and incorporates more robust anti-jamming capabilities. It is interoperable with other countries' Global Navigation Satellite Systems, which adds resilience to the GPS system. **PROCUREMENT** 7 / 12 **SPENDING** *($ millions)* $2,026 / $5,060	5	5

Missile Warning

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Based Infrared System (SBIRS) Inventory: **10** Fleet age: **9** Date: **2006** An integrated constellation of 10 satellites, SBIRS is designed to deliver early missile warning and provide intercept cues for missile defenses. The satellites are retaskable, which means they can be moved to more optimum orbits and viewpoints as mission requirements dictate. The program was ended early because of cost, schedule, and performance issues.	5	5	**Next Generation Persistent Infrared (Next-Gen OPIR)** Timeline: **TBD** When the SBIRS program was ended early, its remaining funding was shifted to its follow-on program, the Next-Gen OPIR. This program's objective is to deliver resilient detection and tracking capability in a contested environment given the advances in adversary rocket propulsion technology.		
Defense Support Program (DSP) Inventory: **5** Fleet age: **34.5** Date: **1970** These satellites were designed to detect intercontinental ballistic missile and sea-launched ballistic missile launches against the U.S. and its allies. They can also detect space launch missions and nuclear weapons testing/detonations. Phase 3 satellites were launched from 1989 to 2007 and have long exceeded their designed lifetimes, but at least five are still providing reliable data and are integrated with the SBIRS program.	1	4			

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Space Surveillance

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Based Surveillance System (SBSS) Inventory: **1** Fleet age: **13** Date: **2010** This single satellite uses multiple types of sensors to track man-made objects and debris fields in orbit.	2	3	None		
Space Test Program Satellite-6 (STPSat-6) Inventory: **1** Fleet age: **2** Date: **2021** STPSat-6 hosts nine national security and science mission payloads that deliver operational nuclear detonation detection capabilities, high-bandwidth laser communications services, and new technology demonstrations in space domain awareness.		3			
Long Duration Propulsive Evolved Expendable Launch Vehicle (LPDE) Inventory: **3** Fleet age: **1** Date: **2021** These satellites provide power, pointing, telemetry, and command and control for up to six sensors payloads that remain with and are supported by the vehicle, or an equal number of deployable SmallSats to low Earth orbit (LEO); medium Earth orbit (MEO); geosynchronous orbit (GEO); or Super GEO.	5	5			

Missile Defense

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Tracking and Surveillance System Advanced Technology Risk Reduction (STSS-ATR) Inventory: **1** Fleet age: **14** Date: **2009** This research, development, test, and evaluation (RDT&E) satellite was originally launched by the Missile Defense Agency to explore different missile launch detection and early warning capabilities and technology but was transferred to the Air Force in 2011.	2	3	None		

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Space Object Tracking

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Geosynchronous Space Situational Awareness Program (GSSAP) Inventory: **6** Fleet age: **5** Date: **2014** This highly classified, six-satellite constellation can accurately track and characterize objects in orbit using electro-optical and emissions sensors. Their maneuverability allows them to conduct rendezvous and proximity operations (RPO) on space objects, giving them the potential to conduct offensive operations against other nations' assets.	5	5	None		

Weather

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Defense Meteorological Satellite Program (DMSP) Inventory: **4** Fleet age: **19** Date: **1999** This three-satellite constellation was launched between 1999 and 2009 with only a five-year life expectancy, but they have continued to provide accurate meteorological data well beyond that time frame and are still in use today. However, Space Force officials have warned that the DMSP constellation will become inoperable at some point between 2023 and 2026 and that the proposed replacement system will not begin operation until 2024 at the earliest.	1	4	**Weather System Follow-on Microwave Satellite (WSF-M)** Timeline: **TBD** This next-generation weather satellite will be capable of mapping both terrestrial and space weather and is scheduled to be fielded in 2023. It covers three gaps in DOD's current weather monitoring capability: ocean surface vector winds, tropical cyclone intensity, and "energetic charged particles" in low Earth orbit.		

Communications

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Milstar Inventory: **5** Fleet age: **24.5** Date: **1994** Milstar is a satellite communications system designed in the 1980s to provide the National Command Authorities with global communications that were assured and survivable and that carried low probability of interception or detection. Designed to overcome nuclear effects and enemy jamming, this five-satellite constellation was considered the most robust and reliable DOD SATCOM system at the time of fielding.	1	3	None		

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

Communications (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Advanced Extremely High Frequency System (AEHF) Inventory: **6** Fleet age: **8** Date: **2010** The AEHF constellation is the follow-on to Milstar. Each of the six satellites provides DOD with more capacity than the entire Milstar constellation provides and with five times the Milstar data rates. The system offers secure, jam-resistant communications and command and control for military ground, sea, and air assets located anywhere in the world.	5	5	None		
Defense Satellite Communications System (DSCS) Inventory: **6** Fleet age: **30.5** Date: **1982** This system of seven satellites provides nuclear-hardened, global communications with anti-jamming capabilities to the Defense Department, State Department, and National Command Authorities.	1	2			
Wideband Global SATCOM (WGS) Inventory: **10** Fleet age: **10** Date: **2007** WGS, formerly known as the Wideband Gapfiller Satellite, is a joint-service program funded by the U.S. Air Force and U.S. Army along with international partners Australia and Canada. The 10-satellite constellation uses direct broadcast satellite technology to provide command and control for U.S. and allied forces.	4	5			
Fleet Satellite Communications System (FLTSATCOM) Inventory: **6** Fleet age: **39.5** Date: **1978** This constellation of six operational satellites is used by the Navy, the Air Force. and the presidential command network. It was transferred from the Navy to the Space Force in June 2022. WGS-11 is scheduled to launch and join the constellation sometime in 2024.	1	3			
Ultra-High Frequency Follow-On (UFO) Inventory: **10** Fleet age: **24** Date: **1993** The 10-satellite UFO constellation was designed to replace FLTSATCOM and provides communications for tactical users including aircraft, ships, submarines, and ground forces. The Navy transferred this system to the Space Force in June 2022.					

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

Communications (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Mobile User Objective System (MUOS) Inventory: **5** Fleet age: **9** Date: **2012** This next-generation narrowband tactical satellite communications system is designed for tactical users, significantly improving ground communications even for troops in highly remote locations or buildings with no other satellite access. The Navy transferred this five-satellite constellation to the Space Force in June 2022.	4	5	None		
Continuous Broadcast Augmenting SATCOM (CBAS) Inventory: **2** Fleet age: **2.5** Date: **2018** CBAS is a satellite communications system in GEO that provides communications relay capabilities to support senior leaders and combatant commanders, augmenting existing military satcom.	5	3			

Multi-Use

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Proliferated Warfighter Space Architecture (PWSA) Tranche 0 - Transport Sep 23 Launch Inventory: **19** Fleet age: **0** Date: **2023** PWSA Tranche 0 satellites serve as a warfighter testbed/immersion constellation that will support military exercises and provide low latency data connectivity and on-orbit fusion. While this is a demonstration testbed for future tranches, the Tranche 0 constellation of 19 planned transport satellites and four planned tracking platforms will no doubt be able to serve ongoing operational needs well after their test function has been served.	5	3	None		
Proliferated Warfighter Space Architecture (PWSA) Tranche 0 - Tracking Sep 23 Launch Inventory: **4** Fleet age: **0** Date: **2023** For description, see entry for Proliferated Warfighter Space Architecture (PWSA) Tranche 0 – Transport Sep 23 Launch.					

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Offensive and Defensive Satellites

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Ascent Inventory: **1** Fleet age: **2** Date: **2021** Ascent is a 12-unit (12U) CubeSat that was deployed to evaluate CubeSat operations in GEO. It has the potential to provide a lasting, on-orbit offensive capability.	5	3	None		
Tetra-1 Inventory: **1** Fleet age: **1** Date: **2022** Tetra-1 is the first of a series of GEO-based SmallSats that was launched on November 1, 2022. The Tetra series is designed to host a variety of payloads and will have interesting maneuverability options that will help develop on-orbit tactics, techniques, and procedures.					

NOTES: See Methodology for descriptions of scores. Fleet age is the average between the last year of procurement and the first year of initial operational capability. The date is when the platform achieved initial operational capability. The timeline is from the start of the platform's program to its budgetary conclusion. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E).

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U.S. Nuclear Weapons

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To assess U.S. nuclear weapons properly, one must understand three things: their essential national security function, the growing nuclear threat posed by adversaries, and the current state of U.S. nuclear forces and their supporting infrastructure. Such an understanding helps to provide a clearer view of the state of America's nuclear capabilities than might otherwise be possible.

The Important Roles of U.S. Nuclear Weapons

U.S nuclear weapons have played a critical role in preventing conflict among major powers in the post–World War II era. Given their ability both to deter large-scale attacks that threaten the U.S. homeland, allies, and forward-deployed troops and to assure allies and partners, nuclear deterrence has remained the number one U.S. national security mission.[1] Operationally, "[s]trategic deterrence is the foundation of our national defense policy and enables every U.S. military operation around the world."[2] It is therefore critical that the United States maintain a modern and flexible nuclear arsenal that can deter a diverse range of threats from a diverse set of potential adversaries.

The more specific roles of U.S. nuclear weapons as outlined in U.S. policy have been adjusted over time. The most up-to-date applicable policy document, the 2022 Nuclear Posture Review (NPR), specifies three roles for nuclear weapons:

- Deter strategic attacks;
- Assure Allies and partners; and
- Achieve U.S. objectives if deterrence fails.[3]

These roles have been consistent across U.S. post–Cold War Administrations until the Biden Administration chose to drop "Capacity to hedge against an uncertain future"[4] as one of the formal roles for U.S. nuclear weapons. This omission is puzzling, particularly given the global security environment's degradation following the 2018 NPR. The Biden Administration has not clarified whether this omission will have practical implications for U.S. nuclear operations and posture, but it is critical that the United States retain the capability to respond flexibly to negative developments in the international environment in a timely manner—a capability the nation has been struggling to sustain since the end of the Cold War.

Given the rapid evolution of a range of capabilities fielded by China, Russia, and North Korea—and increasingly by Iran—the Administration's decision to cancel the sea-launched cruise missile (SLCM-N) program is similarly puzzling. The Administration's retention of the W76-2 low-yield submarine-launched nuclear warhead would seem to indicate that it recognizes the gap in regional nuclear capabilities that has left the United States at a major disadvantage against its adversaries. Adversaries have developed an array of smaller-yield weapons that provide a range of employment options, whereas the U.S. must rely almost exclusively on large-yield warheads. The SLCM-N would provide a more relevant option to U.S. leaders and thus likely serve as a more effective deterrent in these settings.

The Biden Administration emphasizes "[m]utual, verifiable nuclear arms control" as "the most effective, durable and responsible path to reduce the role of nuclear weapons in our strategy and prevent their use,"[5] but as former Deputy Assistant Secretary of Defense for Forces Policy Keith Payne points out, "[t]o claim that arms control rather than deterrence is the 'most effective,

durable and responsible path' to preventing the employment of nuclear weapons is manifestly problematic and suggests a distorted prioritization."[6] The Biden Administration also canceled the B83 nuclear bomb, the most powerful nuclear weapon in the U.S. arsenal with a specific mission of targeting hard and deeply buried targets and an especially important capability in light of adversaries' efforts to protect what they value.[7]

On the positive side, the Biden Administration refrained from implementing the "no first use" or "sole purpose" nuclear declaratory policy despite then-candidate Biden's interest in doing so,[8] reportedly because of significant objections from U.S. allies. Another positive development is the Administration's commitment to "tailored" deterrence, or the effort to use a specific understanding of what different antagonists value and threatening those valued targets during deterrence messaging.[9] As deterrence expert Greg Weaver has cogently observed, "[i]n a deterrence relationship, the adversary doesn't just have 'a' vote, they have *the only vote*."[10] That places a premium on understanding what adversaries value and threatening it in ways that are most likely to cause them to choose restraint. The Administration also endorsed the modernization of all three legs of the nuclear triad (bombers, intercontinental-range ballistic missiles, and submarines) that was started under the Obama Administration and continued by the Trump Administration.

To achieve the objectives spelled out in the NPR, the U.S. nuclear portfolio must balance the appropriate levels of capacity, capability, variety, flexibility, and readiness. What matters most in deterrence is not what the United States thinks will be effective, but the psychological perceptions—among both adversaries *and* allies—of America's willingness to use nuclear forces to defend its interests and intervene on behalf of allies. If an adversary believes it can fight and win a limited nuclear war, for instance, U.S. leaders must devise a posture that will convince that adversary that this is not possible. In addition, as the 2022 NPR appropriately recognizes, military roles and requirements for nuclear weapons will differ from adversary to adversary based on each country's values, strategy, force posture, and goals.

The United States also extends its nuclear umbrella to 33 allies that rely on America to defend them from large-scale attacks and existential threats from adversaries. This additional responsibility imposes requirements for the U.S. nuclear force posture that go beyond defense of the U.S. homeland.

U.S. nuclear forces underpin the broad nonproliferation regime by assuring allies—including NATO, Japan, South Korea, and Australia—that they can forgo development of their own nuclear weapons. Erosion of America's nuclear credibility could lead a country like Japan or South Korea to pursue an independent nuclear option, in which case the result could be a negative impact on stability across the region. Regrettably, there are signs that the credibility of U.S. assurances is in fact eroding. For example, South Korean President Yoon Suk Yeol recently stated that if the nuclear threat from North Korea continues to grow, his country "would consider building nuclear weapons of its own" and could do so "pretty quickly, given our scientific and technological capabilities."[11]

In addition to deterrence and assurance, the United States historically has committed to achieving its political and military objectives if nuclear deterrence fails by having the will to use its nuclear weapons in war. This also contributes to deterrence both by convincing an adversary that it could not start and win a nuclear war and by minimizing U.S. subjection to nuclear coercion by peer nuclear adversaries. U.S. forces must therefore be survivable and postured to engage their targets successfully if deterrence fails and it becomes necessary to use nuclear weapons.

Understanding Today's Multipolar Global Threat Environment

Any assessment of nuclear capabilities requires an understanding of the threat environment, as any U.S. strategy or force posture must account for the threat it is meant to deter or defeat. For the first time in its history, the United States faces two nuclear peer competitors at once—Russia and China.[12] This differs drastically from the paradigm based on the bilateral U.S.–Soviet deterrence relationship during the Cold War. Although China also possessed nuclear weapons, its security interests were largely domestic rather than global. It maintained a limited nuclear capability, but the nature of U.S.–China relations was much different from the global contest between the U.S. and the Soviet Union.

This situation has changed with China's rise as an economic power with global influence and

interests and its corresponding investments in power projection capabilities that include a modern nuclear weapons portfolio of increasing size. Unfortunately, China was not party to the gradual evolution of nuclear deterrence theory shaped by the U.S.–Soviet dynamic, nor has it ever been party to the various agreements governing nuclear matters between the Cold War competitors. Consequently, China operates with a different paradigm and introduces a third, unknown element into nuclear deterrence calculations.

A multipolar nuclear threat environment presents new and complex challenges. As a result, the assessment in this *Index* must be weighed against this emerging nuclear threat.

Russia is engaged in an aggressive nuclear expansion, having added several new nuclear systems to its arsenal since 2010. The United States is only beginning to modernize its existing nuclear systems, but Russia's modernization effort is about 89 percent complete.[13] Russia also is developing such "novel technologies" as a nuclear-powered and nuclear-armed cruise missile, as well as a nuclear-armed unmanned underwater vehicle, and is arming delivery platforms with nuclear-tipped hypersonic glide vehicles.[14] Russia suspended the New Strategic Arms Reduction Treaty (New START) in February 2023, and the State Department reports that it is unable to verify that Russia is in compliance with the Treaty.[15]

In addition, Russia maintains a stockpile of at least 2,000 non-strategic nuclear weapons, unconstrained by any arms control agreement.[16] Defense Intelligence Agency Director Lieutenant General Robert Ashley has said that Russia is expected to increase this category of nuclear weapons—a category in which it "potentially outnumber[s]" the United States by 10 to 1.[17] This disparity is of special concern because Russia's recent nuclear doctrine indicates a lower threshold for use of these tactical nuclear weapons. Russia has also been engaging in nuclear saber-rattling over its war on Ukraine, issuing both subtle and blatant nuclear threats in an attempt to coerce the West into not providing Ukraine with certain weapons systems and not engaging directly in the conflict.[18]

China is engaged in what Admiral Charles A. Richard, former Commander of U.S. Strategic Command (STRATCOM), has described as a "breathtaking expansion" of its nuclear capabilities as part of a strategic breakout that will require immediate and significant shifts in Department of Defense (DOD) capabilities and force posture.[19] According to Assistant Secretary of Defense for Space Policy John Plumb, China has established "a nascent nuclear triad" and, if its nuclear weapons modernization continues at its current pace, "could field an arsenal of about 1,500 warheads by 2035,"[20] which would be more than three times as large as its current estimated inventory of more than 400 warheads. In February 2023, current STRATCOM Commander General Anthony J. Cotton notified Congress that China now has more intercontinental ballistic missile (ICBM) launchers than the United States has.[21]

China is deploying hundreds of theater-range ballistic missiles that can strike U.S. bases and allied territory with precision, and many of these missiles can be fitted with either conventional or nuclear warheads. Beijing is also testing nuclear-capable hypersonic weapons including one that orbited the globe on a fractional orbital bombardment system (FOBS) before being released to glide to its target.[22] The DOD reports that "[t]he PLA is implementing a launch-on-warning posture, called 'early warning counterstrike'...where warning of a missile strike leads to a counterstrike before an enemy first strike can detonate."[23]

Combined with China's refusal to discuss its forces or intent with the United States, this shift in posture increases the potential for mistakes and miscalculations.[24] Unlike the United States and Russia, which share a long history of communicating through arms control discussions and military-to-military contacts to reduce these types of risks, China has not participated in these measures. In fact, China refused to answer U.S. Secretary of Defense Lloyd Austin's telephone call following the U.S. shootdown of China's spy balloon in February 2023.[25] The magnitude of China's nuclear expansion and qualitative upgrades has led senior U.S. leaders to conclude that China has become a nuclear peer to the United States and Russia and eventually could surpass U.S. nuclear capabilities.[26] China no longer has a minimum deterrence capability; instead, it "possesses the capability to employ any coercive nuclear strategy today."[27]

In addition to having to contend with two nuclear peers, the United States must account for the nuclear threats posed by smaller state adversaries. North Korea is advancing its nuclear weapons and missile

capabilities. It continues to produce fissile material to build new nuclear weapons and has developed a new "monster" ICBM that allegedly is able to carry multiple warheads.[28] North Korea conducted an ICBM test in February 2023 in addition to testing what it claimed was a hypersonic missile during the past year.[29] It also revealed what appear to be tactical nuclear weapons that could be mounted on short-range missiles and used to threaten South Korea.[30]

In addition to being the world's principal state sponsor of terrorism, Iran has managed to produce "high enriched uranium (HEU) particles containing up to 83.7% U-235"[31] and reportedly has acquired enough fissile material to produce a nuclear bomb.[32] A nuclear-armed Iran would have significant implications both for stability in the Middle East and for U.S. nonproliferation goals.

Finally, given the role of U.S. nuclear weapons in deterring strategic attacks (for example, attacks featuring the massive use of conventional, chemical, or biological weapons), it is important to consider non-nuclear threats posed by adversaries.

- Both Russia and China are deploying advanced conventional capabilities like conventionally armed hypersonic missiles and even conventionally armed cruise missiles that are capable of striking the U.S. homeland.[33]

- The United States "cannot certify" that China is in compliance with the Chemical Weapons Convention (CWC) and has certified that both Iran and Russia are in noncompliance with the CWC.[34]

- The United States has similar compliance concerns regarding the PRC's and Iran's adherence to the Biological Weapons Convention (BWC) and has found Russia to be in noncompliance with its BWC obligations.[35]

- North Korea also is in noncompliance with the BWC and "probably is capable of weaponizing BW agents with unconventional systems such as sprayers and poison pen injection devices, which have been deployed by North Korea for delivery of chemical weapons."[36] It also is one of four states that "have neither ratified nor acceded to the CWC and, therefore, are not States Parties to the Convention."[37]

Since the effects of these types of attacks can be strategic in nature and the United States does not possess chemical or biological weapons of its own, U.S. nuclear weapons will continue to play a role in deterring these threats.

Current U.S. Nuclear Capabilities and Maintenance Challenges

To assess U.S. nuclear weapons capabilities, one needs to understand the current state of those capabilities and the challenges associated with maintaining them. The United States maintains a force posture based on the guidelines set forth by the New Strategic Arms Reduction Treaty signed with Russia in 2010.

To abide by New START limits, the United States maintains 14 nuclear-armed *Ohio*–class ballistic missile submarines (SSBNs), each of which can be armed with as many as 20 Trident II D5 submarine-launched ballistic missiles (SLBMs); 400 single-warhead Minuteman III ICBMs deployed among 450 silos; and about 60 nuclear-capable B-52 and B-2 bombers that can be armed with gravity bombs or air-launched cruise missiles (ALCMs).[38] As of May 12, 2023, the United States was deploying 1,419 warheads under New START counting rules, which count each nuclear-capable bomber as one warhead.[39] Additionally, the United States maintains about 200 B61 tactical gravity bombs. About 100 of these bombs are deployed in Europe, and the remaining 100 are in central storage in the United States as backup, including for contingency missions not in Europe.[40]

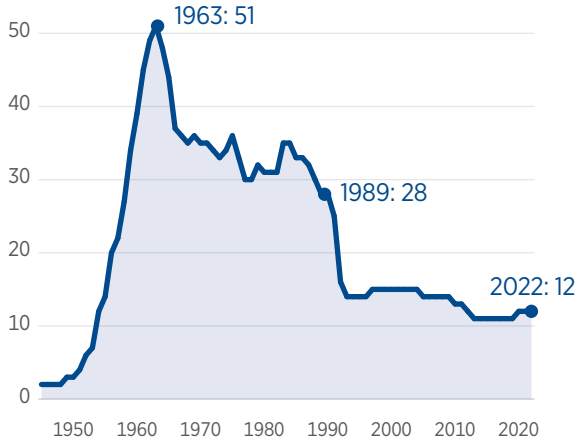
The United States is working to modernize these nuclear forces, which are aged far beyond their original design lifetimes. U.S. nuclear delivery systems, warheads, and supporting infrastructure were all developed during the Cold War and have very little if any margin for further life extension or modernization delays. As summed up by Admiral Richards:

> We are at a point where end-of-life limitations and the cumulative effects of underinvestment in our nuclear deterrent and supporting infrastructure leave us with no operational margin. The Nation simply cannot attempt to indefinitely life-extend leftover Cold War weapon systems and successfully support our National strategy. Pacing the threat requires dedicated and sustained funding for the entire nuclear enterprise and NC3 Next Generation modernization must be a priority.[41]

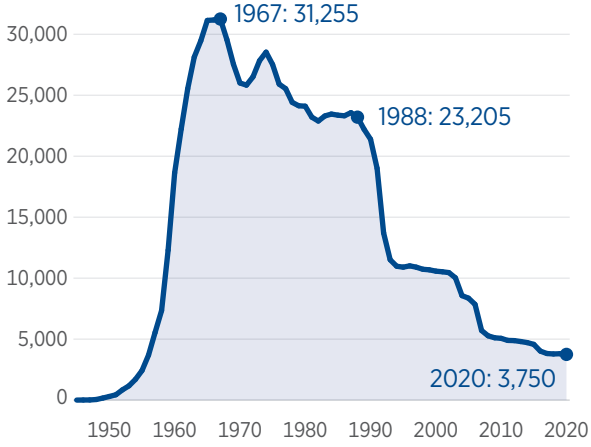
CHART 16

A Smaller and Less Diverse Nuclear Arsenal

TYPES OF WARHEADS IN THE U.S. NUCLEAR STOCKPILE



TOTAL WARHEADS IN THE U.S. NUCLEAR STOCKPILE



NOTE: Quantities include deployed warheads and warheads in reserve, but the U.S. is limited by New START to only 1,550 deployed warheads.
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Faced with this set of circumstances, the United States must contend with three overarching challenges:

- The need to modernize its delivery systems and sustain the viability of its nuclear warheads,
- The need to refurbish an aging nuclear weapons infrastructure, and
- The need to recruit and train talented personnel to replace an aging workforce.

The current nuclear modernization program dates from 2010. The assumptions then were that

Russia was no longer an adversary and that the potential for great-power conflict was low.[42] Events over the past decade have proved these assumptions wrong. The extraordinary technical and geopolitical developments being realized today—China's nuclear breakout and Russia's demonstrated aggression, nuclear expansion, and nuclear coercion—were generally not anticipated as the Obama Administration went about finalizing the planned U.S. nuclear force structure for the coming decades.[43]

The United States is planning to replace its nuclear forces largely on a one-to-one basis instead of expanding or diversifying the current arsenal. In some cases, the current modernization program reduces potential capacity. The *Columbia*–class nuclear submarine, for example, will have eight fewer missile tubes than its predecessor, the *Ohio*–class—not to mention two fewer submarines.[44] The only significant change proposed in the 2010 nuclear modernization plans were the Trump Administration's decisions to deploy W76-2 low-yield warheads for the SLBMs in 2020 (endorsed by the Biden Administration) and the proposed nuclear-armed sea-launched cruise missile (SLCM-N), the latter of which the Biden Administration has attempted to defund despite congressional support for the project.

To provide a hedge against adverse changes in a geopolitical situation like today's, as well as against failures in the U.S. stockpile, the United States preserves an upload capability that allows it to increase the number of nuclear warheads on each type of its delivery vehicles. The U.S. Minuteman III ICBM, for example, is currently deployed with only one Mk12A/W78 warhead, but it can carry as many as three; the Trident II SLBM can carry several warheads at once; and the B-52 bomber can carry additional cruise missiles.[45]

The reduced number of missile tubes on the future *Columbia*–class SSBN will in turn reduce the strategic submarine force's upload capacity unless more submarines are procured. Overall, U.S. hedge capacity is limited as uploading warheads onto the Minuteman III missiles would prove to be both time-consuming and costly. Exploiting the bomber upload capacity during peacetime would present a difficult challenge because bombers currently do not remain on alert. Uncertainty as to whether the United States will have enough deployable warheads or air-launched cruise missiles will remain another potential impediment to upload capacity.

The United States also maintains an inactive stockpile that includes near-term hedge warheads that "can serve as active ready warheads within prescribed activation timelines" and reserve warheads that can provide "a long-term response to risk mitigation for technical failures in the stockpile."[46]

The United States has not designed or built a nuclear warhead since the end of the Cold War. Instead, the Department of Energy's National Nuclear Security Administration (NNSA) uses life-extension programs (LEPs) to extend the service lives of existing nuclear warheads in the stockpile, some of which date back to the 1960s. While LEPs replace or upgrade most components in a nuclear warhead, all warheads will eventually need to be replaced because their nuclear components—specifically, plutonium pits that comprise the cores of warheads—are also subject to aging.[47] The United States is the only nuclear state that lacks the capability to produce plutonium pits in quantity. The NNSA's fiscal year (FY) 2024 budget request notes a 10 percent increase for "Weapons Activities" to "continue restoring production capability, including the capability to produce 80 plutonium pits per year (ppy) as close to 2030 as possible."[48]

Demographic challenges within the nuclear weapons labs also affect the ability of the U.S. to modernize its warhead stockpile. Because most scientists and engineers with practical hands-on experience in nuclear weapons design and testing are retired, the certification of weapons that were designed and tested as far back as the 1960s depends on the scientific judgment of designers and engineers who have never been involved in either the testing or the design and development of nuclear weapons. In recent years, the NNSA has invested in enabling its workforce to exercise critical nuclear weapons design and development skills—skills that have not been fully exercised since the end of the Cold War—through the Stockpile Readiness Program. These skills must be available when needed to support modern warhead development programs for SLBMs and ICBMs.

The shift in emphasis away from the nuclear weapons mission after the end of the Cold War led to a diminished ability to conduct key activities at the nuclear laboratories. According to NNSA Administrator Jill Hruby, "workforce recruiting and retention programs have helped us turn the tide of attrition post-Covid," and the budget request

reflects the Administration's commitment to a "safe, secure, and reliable stockpile."[49] The NNSA continues to struggle with infrastructure recapitalization, as "[m]ore than 60 percent [of its facilities] are beyond their life expectancy, with some of the most important dating back to the Manhattan Project."[50] Because of this neglect, NNSA must now recapitalize the nuclear weapons complex at the same time the nation faces the need to modernize its aging nuclear warheads.

In recent years, bipartisan congressional support for the nuclear mission has been strong, and nuclear modernization has received additional funding. Preservation of that bipartisan consensus will be critical as these programs mature and begin to introduce modern nuclear systems to the force.

In FY 2023, the Biden Administration, supported by Congress, advanced the comprehensive modernization program for nuclear forces that was initiated by President Barack Obama and continued by the Trump Administration. Despite some opposition, Congress funded the two previous Presidents' budget requests for these programs as well. Because such modernization activities require consistent, stable, long-term funding commitments, this continued bipartisan support has been critical.

The NNSA received $22.2 billion in FY 2023, which was about $1.5 billion more than it received in FY 2022 and included full funding for major efforts like modernization of plutonium pit production and five warhead modernization programs. The FY 2024 budget would continue these efforts with an NNSA topline of $23.8 billion.[51] The FY 2024 budget also supports modernization programs to replace the triad, including the Sentinel ICBM weapon system; Long Range Stand Off Weapon cruise missile (LRSO); *Columbia*–class nuclear submarine; and B-21 Raider bomber.

In FY 2023, Congress also provided funding to begin research and development on a nuclear-armed, sea-launched cruise missile (SLCM-N), which, driven by the worsened security environment with Russia and China, had been proposed in the 2018 NPR.[52] However, the Biden Administration removed funding for this capability in its FY 2023 and FY 2024 budget requests. Despite the Administration's opposition, the Congress authorized $25 million for the program on a bipartisan basis in the FY 2023 defense budget.[53]

Assessing U.S. Nuclear Force Capacity

To assess the military services, other sections in this *Index* use a combination of government strategies or assessments and historical data based on capacity and capabilities that the United States has needed to fight wars in the past. For example, using data from four previous wars and strategies over time, this *Index* assesses Army Brigade Combat Team (BCT) capacity based on a total of 50 BCTs required to deal with two major regional conflicts.[54]

Assessing the capacity of U.S. nuclear weapons, however, presents several serious difficulties. Because a nuclear war has never been fought, there are no historical data that can be used to determine a baseline for how much nuclear capability the United States needs. The only time nuclear weapons have been used was in 1945 when the U.S. bombed Hiroshima and Nagasaki, but that does not provide any information on how much nuclear capability is needed because the United States was the only nuclear-weapon state and did not yet maintain a functioning nuclear arsenal.

Moreover, since deterrence depends on an adversary's perception of a threat as credible, it is very difficult to quantify how many warheads, and on how many and what types of platforms, the United States needs to *deter* an adversary. Deterrence requires (1) an understanding of what an adversary values and (2) the ability to threaten that adversary so credibly that he refrains from acting against U.S. interests, thereby jeopardizing what he values. The size of the nuclear force that the U.S. needed to deter the Soviet Union during the Cold War is not a good approximate metric because today's environment is much different and there are more nuclear-armed powers than there were then.[55]

Nevertheless, it is possible to draw some conclusions about the adequacy of the current U.S. nuclear force's size and structure. A force that is sized to deter only one nuclear peer is not likely to be sufficient to deter two nuclear peers—in this case, both Russia and China, particularly given their emerging cooperative relationship. Consensus during the early years of the Obama Administration centered around the assessment that Russia was the primary nuclear threat, that China would likely not alter its minimum deterrence posture, and that nuclear proliferation in Iran or an India–Pakistan nuclear conflict would dominate future nuclear threats.[56] Then-STRATCOM Commander General Kevin

Chilton testified in 2010 that "the arsenal that we have is exactly what is needed today to provide the deterrent."[57] Given the changes of the past 10 years, however, a nuclear force that was capable of countering the threats we faced in 2010 is not likely to be capable of countering the threats we will face in the near future.

There is a direct relationship between adversary capabilities and what the U.S. needs for deterrence. Fundamental to the concept of deterrence is the ability to hold at risk the assets that our adversaries value most, including their nuclear forces and accompanying infrastructure. For deterrence to be credible, the United States must maintain the numbers and types of survivable nuclear weapons it needs to convince adversaries that it can strike valued targets if necessary. Given the increase in targets resulting from China's, Russia's, and North Korea's nuclear expansion and their potentially cooperative relationship against U.S. and allied interests, the United States will likely have to increase the number of its operationally deployed nuclear weapons.

This deficiency in capacity is particularly acute in the category of non-strategic nuclear weapons: short-range, typically lower-yield nuclear weapons that can be deployed to a region of conflict as opposed to ICBMs launched from the homeland or SSBNs that remain at sea. Russia maintains an arsenal of about 2,000 non-strategic nuclear weapons. China maintains an arsenal of hundreds of nuclear-capable medium-range to intermediate-range missiles deployed in the Indo-Pacific. Reportedly, the United States deploys about 100 tactical weapons in NATO states and no nuclear weapons in the Indo-Pacific.

The 2018 NPR studied these disparities and assessed that the United States needed two supplemental capabilities—the W76-2 and SLCM-N—to rectify this imbalance. The United States fielded the W76-2, but the future of the SLCM-N remains uncertain. Meanwhile, this disparity has worsened since the 2018 NPR. In April 2022, Admiral Richard wrote in a letter to Congress that "the current situation in Ukraine and China's nuclear trajectory convinces me a deterrence and assurance gap exists."[58]

Despite this assessment, however, current STRATCOM Commander General Anthony Cotton has stated only that an SLCM-N "is one of several possible nuclear or conventional capabilities the U.S. could develop to enhance strategic deterrence."[59] Other Biden Administration officials, including Secretary of Defense Lloyd Austin and Secretary of the Navy Admiral Carlos Del Toro, have testified in favor of cancelling the program.[60] On the other hand, the SLCM-N has won support from:

- Admiral Charles A. Richard, former Commander, U.S. Strategic Command;
- General Mark A. Milley, Chairman, Joint Chiefs of Staff;
- Admiral Christopher W. Grady, Vice Chairman, Joint Chiefs of Staff;
- General Tod D. Wolters, former Commander, U.S. European Command; and
- Admiral Michael M. Gilday, Chief of Naval Operations.[61]

The combination of what Admiral Richard calls a "deterrence and assurance gap" and the sheer numerical difference between the United States and its adversaries in non-strategic and intermediate-range forces would certainly seem to justify a poor score for the capacity of America's nuclear force, but there is a question that remains unanswered: How much more does the United States need to account for the drastic change in the Chinese nuclear threat, Russia's continuing expansion, and a growing nuclear arsenal in North Korea? In addition to the inherent constraints on determining a baseline for nuclear weapons capacity, it would be hard to determine what an ideal force posture would look like in a three-party nuclear dynamic.

For now, according to Admiral Richard, the United States is "furiously" rewriting deterrence theory to account for this dynamic—a difficult exercise because "[e]ven our operational deterrence expertise is just not what it was at the end of the Cold War. So we have to reinvigorate this intellectual effort."[62] The process is ongoing, but at a minimum, the United States should retain one of its primary sizing metrics for its force posture: being able to withstand an adversary's first strike and still respond in a way the adversary would deem unacceptable. In an environment that includes two peer competitors rather than just one, the United States will need to decide

whether the planned nuclear force can still meet that requirement, especially given the possibility of Russian and Chinese cooperation or coordination.

This *Index* therefore concludes that U.S. nuclear weapons capacity is insufficient to face two nuclear peers at once but does not assign a score in this category. This may change in future editions.

U.S. Nuclear Weapons Assessment

In rating America's military services, this *Index* focuses on capacity, capability, and readiness. In assessing our nuclear forces, however, this *Index* focuses on several components of the existing nuclear weapons enterprise. This enterprise includes warheads, delivery systems, and the physical infrastructure that maintains U.S. nuclear weapons. It also includes the talent of people—the nuclear designers, engineers, manufacturing personnel, planners, maintainers, and operators who help to ensure the U.S. nuclear deterrent—and additional elements like nuclear command and control; intelligence, surveillance, and reconnaissance (ISR); and aerial refueling, all of which also play a major role in conventional operations.

Many factors make such an assessment difficult, but two stand out.

- There is a lack of detailed publicly available data about the readiness of nuclear forces, their capabilities, and the reliability of the warheads that delivery systems carry.

- Many components that comprise the nuclear enterprise are also involved in supporting conventional missions. For example, U.S. strategic bombers perform a significant conventional mission and do not fly airborne alert with nuclear weapons today as they did routinely during the 1960s. Thus, it is hard to assess whether any one piece of the nuclear enterprise is sufficiently funded, focused, and/or effective with regard to the nuclear mission.

An additional challenge is the nature of media coverage. When information surfaces in the media, it is usually news of problems and mishaps; excellence is par for the course and therefore apparently not worth the effort it would take to report on it.

With these difficulties in mind, this assessment considers seven factors that are deemed the most important elements of the nuclear weapons enterprise:

- Reliability of the current U.S. nuclear stockpile,
- Reliability of current U.S. delivery systems,
- Nuclear warhead modernization,
- Nuclear delivery systems modernization,
- Nuclear weapons complex,
- Personnel challenges within the national nuclear laboratories, and
- Allied assurance.

These factors are judged on a five-grade scale that ranges from "very strong" (defined as meeting U.S. national security requirements or having a sustainable, viable, and funded plan in place to do so) to "very weak" (defined as not meeting current security requirements and with no program in place to redress the shortfall). The other three possible scores are "strong," "marginal," and "weak."

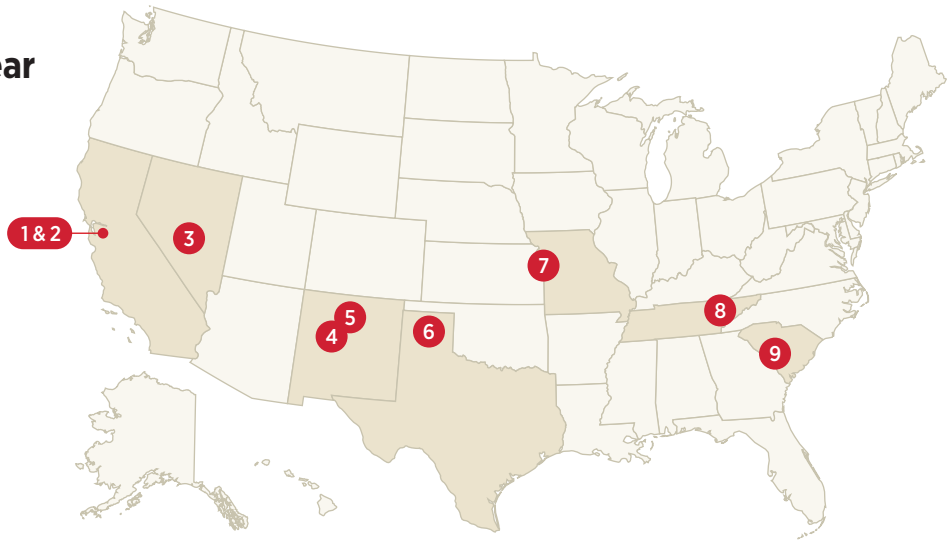
Reliability of Current U.S. Nuclear Stockpile Score: Strong

U.S. warheads must be safe, secure, effective, and reliable. The Department of Defense defines reliability as "the probability that a weapon will perform in accordance with its design intent or military requirements."[63] Since the cessation of nuclear testing in 1992 and the follow-on debate about the Comprehensive Test Ban Treaty (rejected by the Senate in 1999), reliability has been assessed and maintained through the NNSA's Stockpile Stewardship Program (SSP), which consists of an intensive warhead surveillance program; non-nuclear experiments (experiments that do not produce a nuclear yield); sophisticated calculations using high-performance computing; and related annual assessments and evaluations. America and its allies must have high confidence that U.S. nuclear warheads will perform as expected.

Over time, the number and diversity of nuclear weapons in the stockpile have decreased. The result is a smaller margin of error if all of one type are affected by a technical problem that might cause a

MAP 16

U.S. Nuclear Weapons Complex



1 **Lawrence Livermore National Laboratory**
Livermore, CA
Nuclear weapons R&D

2 **Sandia National Laboratories**
Livermore, CA
Nuclear weapons R&D and systems engineering

3 **Nevada National Security Site**
Nye County, NV
Subcritical experiments and test readiness

4 **Sandia National Laboratories**
Albuquerque, NM
Nuclear weapons R&D and systems engineering

5 **Los Alamos National Laboratory**
Los Alamos, NM
Nuclear weapons R&D and plutonium pit production

6 **Pantex Plant**
Panhandle, TX
Assembly of nuclear warheads

7 **Kansas City Plant**
Kansas City, MO
Production of non-nuclear components for nuclear warheads

8 **Y-12 National Security Complex**
Oak Ridge, TN
Manufacture of highly enriched uranium parts for nuclear warheads

9 **Savannah River Site**
Aiken, SC
Pit production and tritium production

SOURCE: Heritage Foundation research.

heritage.org

weapon type or its delivery system to be sidelined for repair or decommissioned. Despite generating impressive amounts of knowledge about nuclear weapons physics and materials chemistry, the United States could find itself surprised by unanticipated long-term effects on a nuclear weapon's aging components. "The scientific foundation of assessments of the nuclear performance of US weapons is eroding as a result of the moratorium on nuclear testing," argue John Hopkins, nuclear physicist and a former leader of the Los Alamos National Laboratory's nuclear weapons program, and David Sharp, former Laboratory Fellow and a guest scientist at the Los Alamos National Laboratory.[64]

The United States currently has a safe and secure stockpile, but concerns about overseas storage sites, potential problems introduced by improper handling, or unanticipated effects of aging could compromise the integrity or reliability of U.S. warheads. The nuclear warheads themselves contain security systems that are designed to make it difficult if not impossible to detonate a weapon without proper authorization. Some U.S. warheads have modern safety features that provide additional protection against accidental detonation; others do not because those safety features could not be incorporated absent yield-producing experiments.

Grade: Absent an ability to conduct yield-producing experiments, the national laboratories' assessment of weapons reliability, based on the full range of surveillance, scientific, and technical activities carried out in the NNSA Stockpile Stewardship Program, depends on the expert judgment of the laboratories' directors and the weapons scientists

and engineers on their staffs. This judgment is based on experience, non-nuclear experimentation, and extensive modeling and simulation. It does not benefit from data that could be obtained through yield-producing experiments or nuclear weapons testing, which was used in the past to validate that warheads performed as designed and to certify potential fixes to any problem identified by such testing.

The United States maintains the world's most advanced Stockpile Stewardship Program and continues to make scientific and technical advances that help to certify the stockpile. The FY 2024 budget request for the Stockpile Research, Technology, and Engineering program is $3.2 billion, approximately $100 million of which "is for the Z-pinch Experimental Underground System (Zeus) Test Bed Facilities Improvement Project and the Advanced Sources and Detectors Scorpius radiography capability, which provide the main capabilities within Enhanced Capabilities for Subcritical Experiments at the Nevada National Security Site (NNSS)."[65]

Such advanced capabilities can help the NNSA to certify the stockpile more accurately and without testing, but according to Admiral Richard, confidence in the stockpile requires two other components in addition to the Stockpile Stewardship Program:

> [Y]ou have to have a flexible and modern stockpile, which means we need to move past life extensions, which we have been doing for 30 years, and move into refurbishments, which is where NNSA is about to go. And…[y]ou have to have a modern, responsive, and resilient infrastructure, and we have delayed too long, in my opinion, giving NNSA the resources necessary to do that piece.[66]

To assess the reliability of the nuclear stockpile annually, each of the three nuclear weapons labs (the Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratory) reports its findings with respect to the safety, security, and reliability of the nation's nuclear warheads to the Secretary of Energy and the Secretary of Defense, who then brief the President. Detailed classified reports are provided to Congress as well. The Commander of U.S. Strategic Command also assesses overall nuclear weapons system reliability, including the reliability of both warhead and delivery platforms.

In spite of concerns about aging warheads, according to the NNSA's Stockpile Stewardship and Management Plan (SSMP) for FY 2023:

> In 2021, DOE/NNSA…conducted surveillance activities for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability without explosive nuclear testing, which culminated in completion of all annual assessment reports and generation of laboratory director letters to the President.[67]

Additionally, when asked in a congressional hearing whether she "agree[s] that there is not a current or foreseeable need for the United States to resume explosive nuclear testing that produces nuclear yields," Administrator Hruby responded, "Yes…I do. And I would just go further to say our entire Stockpile Stewardship Program is designed around the principal [sic] that we will make sure we understand weapons enough so that we do not have to test."[68]

Based on the results of the existing method used to certify the stockpile's effectiveness, we grade the U.S. stockpile conditionally as "strong." This grade, however, will depend on whether support for an adequate stockpile, both in Congress and in the Administration, remains strong.

Reliability of Current U.S. Delivery Systems Score: Marginal

Reliability encompasses strategic delivery vehicles in addition to the warhead. For ICBMs, SLBMs, and ALCMs, this requires a successful missile launch, including the separation of missile boost stages, performance of the missile guidance system, separation of the reentry vehicles from the missile post-boost vehicle, and accuracy of the final reentry vehicle in reaching its target.[69] It also entails the ability of weapons systems (cruise missiles, aircraft carrying bombs, and reentry vehicles) to penetrate adversary defensive systems and reach their targets.

The United States conducts flight tests of ICBMs and SLBMs every year to ensure the reliability of its delivery systems with high-fidelity "mock" warheads. Anything from faulty electrical wiring to booster separations could degrade the reliability

and safety of the U.S. strategic deterrent. U.S. strategic long-range bombers also regularly conduct exercises and receive upgrades to sustain a demonstrated high level of combat readiness. The Air Force tested the AGM-86B ALCM, launched from the B-52H bomber, most recently in 2017.[70] The DOD must upgrade existing platforms and develop their replacement programs simultaneously, sometimes in concurrence with the NNSA's work on nuclear warheads.

Grade: In July 2018, the Air Force conducted its first unsuccessful ICBM test since 2011,[71] but it has conducted several successful tests since then, including a test in August 2020 that launched a missile armed with three reentry vehicles[72] and its most recent test, which was conducted in April 2023.[73] The May 2021 test was marred by a ground abort before launch, and this has provoked speculation about the reliability of the Minuteman III missile as it approaches its retirement, which is scheduled to begin in 2029.[74] Additionally, the DOD canceled a Minuteman III test scheduled for March 2022 "in a bid to lower nuclear tensions with Russia." An SLBM test in 2022 was successful.[75]

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. allies and adversaries alike that U.S. systems work and that the U.S. nuclear deterrent is ready if needed. The aged systems, however, occasionally have problems, as evidenced by the failed July 2018 and May 2020 Minuteman III launches.

The evidence indicates that some U.S. delivery systems may have difficulty penetrating an adversary's advanced defensive systems. Because of its obsolescence against Russian air defense systems, for example, the B-52H bomber already no longer carries gravity bombs.[76] Despite the fact that the ALCM passed its most recent public test in 2017, then-STRATCOM Commander General John Hyten has stated that because of its age, "it's a miracle that [the missile] can even fly" and that the current ALCMs "do meet the mission, but it is a challenge each and every day."[77] Other U.S. systems suffer from similar challenges. Admiral Richard has stated that "I need a weapon that can fly and make it to the target. Minuteman-III is increasingly challenged in its ability to do that."[78]

As Russian and Chinese air and missile defenses and other anti-platform capabilities advance, the challenge for U.S. offensive systems will become greater unless the United States deploys modernized delivery systems. In addition to advanced air defense systems like the S-400, which contributed to the decision that the B-52H bomber should no longer carry gravity bombs, both Russia and China are placing a greater emphasis on long-range ballistic missile defense. Russia is modernizing its long-range interceptors—and reportedly has dozens more than the United States has—and China's missile defense capabilities, while mostly focused on regional threats, "appear to be developing towards countering long-range missiles."[79] As U.S. delivery systems approach obsolescence, adversary air and missile defense increasingly calls into question the ability of U.S. weapons to strike their targets. The Biden Administration's decision to retire the B83 nuclear warhead potentially leaves the United States with a gap in its ability to reach adversaries' hard and deeply buried targets.

Both adversary defenses and system aging will continue to affect delivery platform reliability until platforms are replaced. Adversary improvements in defensive systems and decisions by the current Administration to cancel, curtail, or delay delivery platform modernization programs combine to lower the score for delivery systems reliability in this year's edition of the *Index* from "strong" to "marginal."

Nuclear Warhead Modernization
Score: Marginal

During the Cold War, the United States focused on designing and developing modern nuclear warheads to counter Soviet advances and modernization efforts and to leverage advances in our understanding of the physics, chemistry, and design of nuclear weapons. Today, the United States focuses on extending the life of its aging stockpile rather than on fielding modern warheads while trying to retain the skills and capabilities needed to design, develop, and produce such warheads. Relying only on sustaining the aging stockpile could increase the risk of failure caused both by aging components and by not exercising critical skills. It also could signal to adversaries that the United States is less committed to nuclear deterrence.

Adversaries and current and future proliferators are not limited to updating Cold War designs and can seek designs outside of U.S. experiences, taking

advantage of more advanced computing technologies and scientific developments that have evolved since the end of the Cold War. Other nations can maintain their levels of proficiency by developing new nuclear warheads.[80] In 2020, the Department of State reported that "Russia has conducted nuclear weapons experiments that have created nuclear yield and are not consistent with the U.S. 'zero-yield' standard" and that there is evidence of China's potential lack of adherence to this standard as well.[81] In 2023, the department noted that "concerns remain about the nature of both China and Russia's adherence to their respective moratoria."[82]

Fortunately, the NNSA has made noticeable improvements in this category in recent years. Since 2016, Congress has funded the Stockpile Responsiveness Program (SRP) to "exercise all capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons."[83] Congress funded the SRP at $70 million in FY 2020, FY 2021, and FY 2022.[84] The FY 2023 enacted level was $63.7 million, and the Administration is requesting $69.8 million (an increase of $6.1 million) for FY 2024.[85] The SRP has demonstrated some important accomplishments in ensuring critical skills retention, and scientists at the national labs have responded to it with enthusiasm.

Ongoing work at the national labs to design nuclear warheads could build on the SRP's success. Starting in FY 2021, Congress has appropriated funding for the W93/Mark 7 warhead program, which will replace the W76-1 and W88 warheads carried by the Trident II D5 SLBMs.[86] The final amount enacted for FY 2021 was $53,000,000.[87] The program was funded at a level of $241 million in FY 2023 and entered its second phase (Feasibility Study and Design Options) in February 2022. The FY 2024 request for $390 million reflects the activities associated with Phase 2 and "improved cost estimates."[88] The NNSA is also developing the W87-1 warhead for the Sentinel missile, which is a modification of the existing W87-0 design.

These programs may allow American engineers and scientists to improve previous designs, including meeting evolving military requirements (for example, adaptability to emerging threats and the ability to hold hard and deeply buried targets at risk). Future warheads could improve reliability while also enhancing the safety and security of American weapons, but the question remains: How much of this work can be done without yield-producing experiments? The nuclear enterprise displayed improved flexibility when it produced the W76-2 warhead, a low-yield version of the W76 warhead. The W76 warhead was modified within a year to counter Russia's perception of an exploitable gap in the U.S. nuclear force posture.

The ability to produce plutonium pits, which compose the core of all nuclear weapons, will be critical to warhead modernization efforts. The NNSA currently cannot produce plutonium pits at scale and is undergoing an effort to restore this capability with a statutory requirement to produce 80 pits per year by 2030—a requirement that the NNSA will not be able to meet. The new goal has shifted to somewhere from the first quarter of FY 2032 to the fourth quarter of FY 2035.[89] It is planned that "the W87-1 program and subsequent modernization programs" will use these new pits.[90]

Grade: Before the score for this category can move up to "strong," the NNSA, with support from Congress, will need to achieve enough progress with the W93/Mk 7 and W87-1 and minimize delays in pit production. Delays in pit production could require modern warheads to use older pits, further jeopardizing both the functioning of those systems and the credibility of the U.S. deterrent. The NNSA eventually will also need to begin programs for future land-based, sea-based, and air-delivered warheads, all of which currently remain notional, to succeed the current programs beyond 2030.[91]

Moreover, future assessments will need to examine whether the NNSA's current warhead modernization effort is sufficient to address the increasing threat. For instance, despite Russian progress in hardening and deeply burying facilities to withstand strikes by current U.S. weapons, an earth-penetrating warhead is not part of the NNSA's warhead modernization plan.[92] The Biden Administration's proposal to cancel the plan, which would keep the B83 gravity bomb (currently the only warhead capable of striking hard and deeply buried targets) beyond its planned retirement, could create a capability gap.[93]

For now, the score for this category remains at "marginal."

Nuclear Delivery Systems Modernization Score: Strong but Trending Toward Marginal

All U.S. delivery systems were built during the Cold War and are overdue for replacement. The

Obama Administration, in consultation with Congress, initiated a plan to replace current triad delivery systems. President Donald Trump advanced this modernization program with bipartisan support from Congress. Under this program:

- The Navy is fully funding the *Columbia*–class submarine to replace the *Ohio*–class submarine;
- The Air Force is funding the B-21 Raider Long-Range bomber, which will replace conventionally armed bombers before the new aircraft is certified to replace nuclear-capable bombers;
- The Long-Range Standoff weapon will replace the aging ALCM;
- Existing Minuteman III ICBMs are expected to remain in service beyond the end of the decade—50 years after their intended lifetime—and to be replaced by the Sentinel weapon system beginning in 2029;
- Existing Trident II D5 SLBMs have been life-extended to remain in service until 2042 through the end of the last *Ohio*–class submarine's lifetime; and
- The F-35 will replace the existing F-15E Dual Capable Aircraft that will carry the B61-12 gravity bomb.[94]

These programs face high risks of delay. The U.S. Government Accountability Office (GAO) has reported that the "Sentinel is behind schedule due to staffing shortfalls, delays with clearance processing, and classified information technology infrastructure challenges" and "is experiencing supply chain disruptions, leading to further schedule delays."[95] Moreover, these programs are entering a new phase of risk as they move from initial research and development to testing[96] and then procurement.

These scheduling risks are especially dangerous because years of deferred recapitalization have left modernization programs with no margin for delay. For instance, although the *Columbia*–class SSBN currently remains on schedule, the transition from the *Ohio* to the *Columbia* is so fragile that, according to Admiral Johnny Wolfe, "[d]elays to the Navy's SSBN modernization plan are not an option."[97] In an effort to keep the program on track, the shipbuilder reassigned workers from the *Virginia*–class attack submarine to the *Columbia*–class program, causing delays in the former.[98]

The effects of failing to replace current systems before their planned retirement dates are significant. As systems like the Minuteman III, ALCM, and *Ohio*–class submarines continue to age, efforts to sustain their required levels of performance become increasingly difficult and expensive. Age degrades reliability by increasing the potential for systems to break down or fail to perform correctly. Defects can have serious implications for U.S. deterrence and assurance. Should Sentinel fail to reach initial operating capability by 2029, the United States will be left with a less capable ICBM fleet, which will also begin to dip below 400 missiles as the Air Force continues to use missiles for annual testing. With respect to the Navy, the GAO has reported that if the first *Columbia*–class submarine is not delivered on time, "the Navy will have insufficient submarines available to meet the additional USSTRATCOM force-generation operational requirement of a total of 10 submarines,"[99] which means less presence at sea.

Grade: U.S. nuclear platforms are in dire need of recapitalization. Plans for modernization of the nuclear triad are in place, and Congress and the services have largely sustained funding for these programs. The Sentinel ICBM remains on track for a flight test in 2023.[100] In July 2021, the Air Force awarded Raytheon an engineering and manufacturing development contract for the LRSO, which also appears to remain on schedule.[101] However, the fragility of these programs keeps them at risk of technical or funding delays, including appropriations through continuing resolutions.

The rapid modernization and expansion of nuclear forces underway in Russia and China clearly signal that U.S. efforts should receive similar attention and be undertaken with a commensurate sense of urgency. Growth in adversary forces has a direct impact on the required size of U.S. forces, including nuclear forces. The United States should consider procuring more of these modern systems than originally planned.

The United States will also need to consider acquiring additional capabilities to ensure that deterrence is tailored to the evolving Russian threat and

the new Chinese threat. The SLCM-N, if it continues to receive funding from Congress, would begin to meet this challenge by providing the President with an option to respond more proportionally to—and therefore help deter—an adversary's limited employment of nuclear weapons in a theater of conflict.

For now, replacing current systems remains the top priority, and while the commitment to nuclear weapons modernization demonstrated by Congress and the Administration is commendable, this category is trending toward "marginal" because of threat developments and delays (or the strong potential for delays) in U.S. modernization programs.

Nuclear Weapons Complex Score: Marginal

Maintaining a reliable and effective nuclear stockpile depends in large part 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 (nuclear weapons research and development, or R&D, and plutonium pit production);
- The Lawrence Livermore National Laboratories (nuclear weapons R&D);
- The Sandia National Laboratory (nuclear weapons R&D and systems engineering);
- The Nevada National Security Site (subcritical experiments, test readiness);
- The Pantex Plant (assembly of nuclear warheads);
- The Kansas City Plant (production of non-nuclear components for nuclear warheads);
- The Savannah River Site (second site for pit production and tritium production); and
- The Y-12 National Security Complex (manufacture of highly enriched uranium parts for nuclear warheads).

These complexes design, develop, test, and produce the weapons in the U.S. nuclear arsenal, and their maintenance is therefore of critical importance. In the words of NNSA Administrator Jill Hruby, "A well-organized, well-maintained, and modern infrastructure system is the bedrock of a flexible and resilient nuclear security enterprise."[102] It contributes to deterrence by enabling the United States to adapt its nuclear arsenal to shifting requirements, signaling to adversaries that the United States can adjust its warhead capacity or capabilities when needed. 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 when they are needed.

The existing nuclear weapons complex, however, is not capable of producing some of the nuclear components needed to maintain and modernize the stockpile on timelines that would be required for flexibility and resilience.[103] Significantly, the United States has not had a substantial plutonium pit production capability since 1993. The U.S. currently retains more than 5,000 old plutonium pits in strategic reserve in addition to pits for use in future LEPs, but uncertainties regarding the effect of aging on plutonium pits and how long the United States will be able to depend on them before replacement remain unresolved. In 2006, a JASON Group study of NNSA assessments of plutonium aging estimated that, depending on pit type, the minimum pit life was in the range of 100 years.[104] A work program was recommended to address additional uncertainties in pit aging but did not reach fruition. In addition to the pits needed for warheads like the W87-1 and W93, numerous pits have been in the stockpile for decades—some for more than 50 years—and will need to be replaced.

Today, the production rate is too low to meet the need to replace aging pits. The United States manufactured 10 W87-1 development pits in 2022.[105] Statutory law requires the United States to produce no fewer than 80 pits per year (ppy) by 2030. In April 2021, the NNSA reached the first critical milestone for pit production at the Los Alamos National Laboratory.[106] A second plutonium pit production facility is being planned to exploit the now-cancelled Mixed Oxide Fuel (MOX) facility that was being constructed at the Savannah River Site in South Carolina. Savannah River has a required production of no fewer than 50 ppy by 2030. It is already clear

that the NNSA will not be able to meet the required deadline; rather, the organization states that it "remains firmly committed to achieving 80 ppy as close to 2030 as possible."[107]

The GAO recently found that the "NNSA has not developed either a comprehensive schedule or a cost estimate" for the nation's plan to reestablish plutonium pit production.[108] These tools would improve the management of an already delayed program.[109]

Aside from plutonium, the NNSA must maintain production of several other key materials and components that are used to build and maintain nuclear weapons. For instance, it plans to increase the supply of tritium as demand increases. Because tritium is always decaying at a half-life of 12 years, delays in tritium production only increase the need to produce a timely replacement.[110] The site preparations for the Tritium Finishing Facility began in FY 2023.[111] Other projects currently underway include a new lithium processing facility and the new Uranium Processing Facility at Y-12.

Added to these considerations is the fact that 58 percent of the NNSA's 5,000 facilities are more than 40 years old, and more than half are in poor condition.[112] As a consequence, the NNSA had accumulated about $6.1 billion in deferred maintenance as of FY 2021.[113]

The NNSA has described high deferred maintenance as "a sign that infrastructure is in poor condition and in need of modernization" because of a lack of "significant, sustained, and timely funding."[114] Aging facilities also have become a safety hazard: In some buildings, for example, chunks of concrete have fallen from the ceiling.[115] Moreover, without modern and functioning NNSA facilities, the U.S. will gradually lose the ability to conduct the high-quality experiments that are needed to ensure the reliability of the stockpile without nuclear testing.

Finally, despite the self-imposed nuclear testing moratorium that the United States has had in place since 1992, a functioning nuclear weapons complex requires a low level of nuclear test readiness. "Test readiness" refers to a single test or a very short series of tests, not a sustained nuclear testing program, reestablishment of which would require significant additional resources.

Since 1993, the NNSA has been mandated to maintain a capability to conduct a nuclear test within 24 to 36 months of a presidential decision to do so.[116] Whether this approach can assure that the United States has the timely ability to conduct instrumented yield-producing experiments to correct a flaw in one or more types of its nuclear warheads is open to question. The United States might need to test to assure certain warhead characteristics that only nuclear testing can validate, or it might desire to conduct a nuclear weapon test for policy reasons.

However, the NNSA has been unable to achieve even this goal. According to the FY 2018 SSMP, it would take 60 months to conduct "a test to develop a new capability."[117] And according to the FY 2022 SSMP, "Assuring full compliance with domestic regulations, agreements, and laws related to worker and public safety and the environment, as well as international treaties would significantly extend the time required for execution of a nuclear test."[118] Because the United States is rapidly losing its remaining real-life nuclear testing experience, including instrumentation of very sensitive equipment, the process would likely have to be reinvented.[119]

Test readiness has not been funded as a separate program since FY 2010 and is instead supported by the Stockpile Stewardship Program that exercises testing elements at the Nevada National Security Site and conducts zero-yield nuclear laboratory experiments.[120]

Grade: Modernizing U.S. nuclear facilities is of critical importance because the NNSA's warhead modernization plans depend on the ability to produce certain components like plutonium pits. The importance of a functioning nuclear weapons complex also has increased as the threat posed by adversaries has worsened. Given the change to a three-party nuclear peer dynamic and both Russia's and China's active nuclear production capabilities, the United States must maintain the ability to adapt its nuclear posture and hedge against an uncertain future.

The United States maintains some of the world's most advanced nuclear facilities. Significant progress has been made over the past decade in getting funded plans in place to recapitalize plutonium pit production capacity and uranium component manufacturing in particular as well as construction projects for new facilities. Nevertheless, these programs face challenges and delays.

Some parts of the complex have not been modernized since the 1950s, and plans for long-term

infrastructure recapitalization remain essential, especially as the NNSA embarks on an aggressive warhead life-extension effort. The weak state of U.S. test readiness is also of great concern. In a dynamic threat environment combined with an aging nuclear arsenal, the lack of this capability becomes more worrisome even as the NNSA improves its stockpile stewardship capabilities. Efforts to restore critical functions of the complex like pit production face great technical challenges and need stable funding. The recent shift in deadline for plutonium pit production at the Savannah River Site from 2030 to "as close to 2030 as possible" is one example. After years of deferred modernization, any unexpected failure or disruption at a critical facility could significantly affect schedules for nuclear warhead modernization.[121]

Until demonstrable progress has been made toward completion of infrastructure modernization, the grade for this category will therefore remain at "marginal."

Personnel Challenges Within the National Nuclear Laboratories Score: Marginal

U.S. nuclear weapons scientists and engineers are critical to the health of the complex and the stockpile. According to the FY 2023 SSMP, the National Nuclear Security Administration's "greatest asset" is its "highly qualified and skilled world-class scientific and engineering workforce, without which DOE/NNSA could not meet its vital national security missions."[122]

The ability to maintain and attract a high-quality workforce is critical to ensuring the future of the American nuclear deterrent, especially when a strong employment atmosphere adds to the challenge of hiring the best and brightest. 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 of experts. This is a challenge because "[r]oughly a quarter of the current enterprise workforce is eligible to retire, and there will likely remain a significant retirement-eligible population for the near future."[123]

The NNSA also needs to retain talent among "early-career employees (age 35 and under)" and those with five or fewer years of experience.[124] Young designers need meaningful and challenging warhead design and development tasks to hone their skills and remain engaged. The NNSA and its weapons labs understand this problem and, with the support of Congress, are beginning to take the necessary steps to invest in the next generation.

The judgment of experienced nuclear scientists and engineers is critical to assessing the safety, security, effectiveness, and reliability of the U.S. nuclear deterrent. Without their experience, the nuclear weapons complex could not function. Few of today's remaining scientists or engineers at the NNSA weapons labs have had the experience of taking a warhead from initial concept to "clean sheet" design, engineering development, production, and fielding. The SRP is remedying some of these shortfalls by having its workforce exercise many of the nuclear weapon design and engineering skills that are needed. To continue this progress, SRP funding should be maintained if not increased.

According to the SSMP, "[n]early half of the total [NNSA] workforce have 5 years of service or fewer."[125] Given the length of time required to train new hires, the long timelines of warhead production cycles, and the time it takes to transfer technical knowledge and skills, both recruiting and retaining needed talent remain challenging for the NNSA.[126]

Grade: In addition to employing world-class experts, the NNSA labs have had good success in attracting and retaining talent (for example, through improved college graduate recruitment efforts and NNSA Academic Programs).[127] As many scientists and engineers with practical nuclear weapon design and testing experience retire, continued annual assessments and certifications of nuclear warheads will rely increasingly on the judgments of people who have never participated in yield-producing experiments on their weapon designs. Moreover:

> As NNSA mission scope increases, so does the demand for increased personnel to support new facilities and capabilities being brought on-line, and to support moving to 24/7 operations at many sites across the complex. These individuals are essential to minimizing unplanned outages and to supporting safe and secure operations, particularly in high hazard operations.[128]

Hazardous NNSA infrastructure and facilities can also be a hindrance to recruitment and retainment, so modernizing the nuclear weapons complex

will be essential.[129] Admiral Richard has emphasized the importance of investing in the workforce now: "If we lose those talent bases, you can't buy it back. It will take 5 to 10 years to either retrain and redevelop the people or rebuild the infrastructure."[130]

In light of these issues, the NNSA workforce earns a score of "marginal."

Allied Assurance Score: Strong but Trending Toward Marginal

The credibility of U.S. nuclear deterrence is one of the most important components of allied assurance. The United States extends nuclear assurances to more than 30 allies that have forgone nuclear weapon programs of their own. If allies were to resort to building their own nuclear weapons because their confidence in U.S. extended deterrence had been degraded, the consequences for nonproliferation and stability could become dire.

Unfortunately, there are indications that such weakening is already taking place.[131] According to a recent poll, for example, "more than 70% of South Koreans would support developing their own nuclear weapons or the return of nuclear weapons to their country."[132] Japan is openly discussing the possibility of eventually developing its own nuclear weapons, a topic considered taboo in the relatively recent past.[133]

In Europe, France and the United Kingdom deploy their own nuclear weapons independently of the United States. The United States also deploys B-61 nuclear gravity bombs in Europe as a visible manifestation of its commitment to its NATO allies and retains dual-capable aircraft that can deliver those gravity bombs. The United States provides nuclear assurances to Japan, South Korea, and Australia, all of which face increasingly aggressive nuclear-armed regional adversaries.

Continued U.S. nuclear deterrence assurances must be perceived as credible by adversaries and allies alike. Both Japan and South Korea have the capability and basic know-how to build their own nuclear weapons quickly, and Australia has had nuclear ambitions in the past. A decision by allies to build their own nuclear weapons would be a major setback for U.S. nonproliferation policies and could increase regional instability.

Grade: Not unlike deterrence, assurance and extended deterrence are about allies' and adversaries' perceptions of the U.S. nuclear umbrella's credibility rather than what the United States thinks is a credible extended deterrent.

A worsening security environment appears to be causing U.S. allies to be more cautious when it comes to relying solely on U.S. extended deterrence commitments, and public debates about developing their own nuclear weapons appear to be more common than in the past. China continues to advance its capability to hold the U.S. homeland at risk with its strategic forces and to execute nuclear operations in the region. China has hundreds of nuclear-capable missiles in the region, and the United States deploys none. Both South Korean and Japanese leaders have recently discussed with President Biden the need to ensure that extended deterrence remains strong in light of these threats.[134]

European members of NATO continue to express their commitment to and appreciation of NATO as a U.S.-led nuclear alliance even as they worry about the impact of Russia's growing non-strategic nuclear capabilities and nuclear saber-rattling over Western military support to Ukraine.[135] According to the 2022 NPR, allied assurance remains one of the primary goals of U.S. nuclear forces,[136] but while official statements remain positive, unofficial sentiment could indicate concern about U.S. extended deterrence commitments.

The 2018 NPR had proposed and allies had expressed support for two supplements to existing capabilities—a low-yield SLBM warhead and a new nuclear sea-launched cruise missile—as important initiatives to strengthen allied assurance.[137] The low-yield SLBM warhead, deployed in 2020, is an important component of America's ability to deter regional aggression against its Asian and NATO allies and remains deployed under the current Administration. However, the Biden Administration has proposed canceling the SLCM-N, a capability that could be deployed directly to regional theaters of conflict to help assure our allies.[138]

The score for allied assurance remains "strong" but is trending toward "marginal" as the United States continues to implement a "business-as-usual" approach in the face of significant negative regional developments. The United States will need to make concerted efforts to strengthen its commitments to extended deterrence to reflect the change in threat, both through its capabilities and by communicating resolve, if this score is to remain unchanged in future editions of this *Index*.

Overall U.S. Nuclear Weapons Capability Score: Marginal

The scoring for U.S. nuclear weapons must be considered in the context of a threat environment that is significantly more dangerous than it was in previous years. Until recently, U.S. nuclear forces needed to address one nuclear peer rather than two. Given a U.S. failure to adapt rapidly enough to these developments and the Biden Administration's decision to cancel or delay various programs that affect the nuclear portfolio, this year's *Index* changes the grade for overall U.S. nuclear weapons capability to "marginal."

U.S. nuclear forces face many risks that without the continued bipartisan commitment to a strong deterrent could warrant an eventual decline to an overall score of "weak" or "very weak." The reliability of current U.S. delivery systems and warheads is at risk as they continue to age and threats continue to advance. The fragility of "just in time" replacement programs only exacerbates this risk. In fact, nearly all components of the nuclear enterprise are at a tipping point with respect to replacement or modernization and have no margin left for delays in schedule; delays that are appearing to occur despite the best efforts of the enterprise. Since every other military operation—and therefore overall national defense—relies on a strong nuclear deterrent, the United States cannot afford to fall short in fulfilling this imperative mission.

Future assessments will need to consider plans to adjust America's nuclear forces to account for the doubling of peer nuclear threats. It is clear that the change in threat warrants a reexamination of U.S. force posture and the adequacy of our current modernization plans.

Therefore, the score for this portfolio was changed from "strong" to "marginal." Failure to keep modernization programs on track while planning for a three-party nuclear peer dynamic could lead to a further decline in the strength of U.S. nuclear deterrence in future years.

U.S. Military Power: Nuclear

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Nuclear Stockpile				✓	
Delivery Platform Reliability			✓		
Warhead Modernization			✓		
Delivery Systems Modernization				✓	
Nuclear Weapons Complex			✓		
National Labs Talent			✓		
Allied Assurance				✓	
OVERALL			✓		

Endnotes

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Missile Defense

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Missile defense is a critical part of the national security architecture that enables U.S. military efforts, deters attacks, and protects such critical infrastructure as population, industrial centers, and politically and historically important sites. It can strengthen U.S. diplomatic and deterrence efforts and give senior decision-makers the time and options they need to respond effectively during crises involving missiles that fly on ballistic and non-ballistic trajectories.

The Growing Missile Threat

Missiles remain a weapon of choice for adversaries who view them as cost-effective coercive tools and symbols of power.[1] Both the number of states that possess missiles and the sophistication of those missiles will continue to increase as modern technologies become cheaper and more widely available. North Korea, Iran, China, and Russia all possess missile arsenals that threaten U.S. interests, forces deployed abroad, and allies and partners.

As one example of the growing threat, General Glen VanHerck, Commander, U.S. Northern Command and North American Aerospace Defense Command, testified in March 2023 that North Korea had "tested at least 65 conventional theater and long-range nuclear capabilities over the last year."[2] These tests enable Pyongyang to improve and adapt its missile program, adding to an already formidable threat. North Korea has stated that it tested its "most powerful" missile to date in April 2023,[3] and two short-range missiles that it test fired appear to have landed within Japan's exclusive economic maritime zone.[4] Pyongyang will likely continue its aggressive development and testing as it seeks to make its missile forces more survivable before and after launch.[5]

In similar fashion, Iran continues to modernize and proliferate its regional missile systems. It says it recently successfully tested a missile with a range of 2,000 kilometers.[6] It also displayed its first hypersonic missile and has provided Russia with hundreds of loitering munitions for Russia's war in Ukraine.[7] Tehran's continued pursuit of "space launch vehicles (SLVs)—including its Simorgh—shortens the timeline to an ICBM if it decided to develop one because SLVs and ICBMs use similar technologies."[8]

According to Assistant Secretary of Defense for Space Policy John Plumb, China "has accelerated its efforts to develop, test, and field advanced missile systems of all classes and ranges, including ballistic, cruise, and hypersonic glide vehicles."[9] The U.S. Department of Defense (DOD) has noted that in 2021, China "launched approximately 135 ballistic missiles for testing and training, more than the rest of the world combined excluding ballistic missile employment in conflict zones."[10] China also launched 11 missiles into waters near Taiwan in August 2022.[11] Beijing is rapidly building hundreds of new missiles, including modern ICBMs that can carry multiple warheads and theater-range missiles that can strike U.S. assets, and "[t]he number of warheads on the PRC's land-based ICBMs capable of threatening the United States is expected to grow to roughly 200 in the next five years."[12] In 2021, China tested a fractional orbital bombardment system (FOBS) that deployed a hypersonic glide.[13]

Russia has launched thousands of air and missile platforms against Ukraine to "terrorize the Ukrainian people while degrading Ukraine's warfighting capability."[14] According to General VanHerck, Russia's invasion of Ukraine in 2022 "proved that [it] has the capability and capacity to inflict

significant damage to infrastructure and other critical targets with its all-domain long-range strike capabilities." Capabilities that Russia "has showcased in Ukraine" include "air- and sea-launched cruise missiles capable of striking North America, cyber activities, and economic coercion." Russia also has "continued to conduct major military exercises and test developmental capabilities that will compound the threat to North America once fielded" and "is testing its special mission Belgorod nuclear submarine, a modern platform capable of carrying the nuclear-capable Poseidon torpedo, designed to hold the homeland at risk by striking coastal targets from thousands of miles away."[15]

The Strategic Role of Missile Defense

Missile defense plays a critical role both in deterring an attack and in mitigating the damage to U.S. forces, infrastructure, and population centers in the event deterrence fails. The ability to deter an attack depends on the ability to convince an adversary that the attack will fail, that the cost of carrying out a successful attack is prohibitively high, or that the consequences will outweigh the perceived benefit.

A U.S. missile defense system strengthens deterrence by offering a degree of protection to U.S. populations, military forces, and allies that makes it harder for an adversary to threaten them with missiles.[16] By raising the threshold for missile attack, missile defense can complicate an adversary's planning, remove the option for a "cheap shot" against the United States and its allies, and perhaps make an adversary think twice before launching an attack, especially a larger-scale attack that would certainly prompt a robust U.S. response. By protecting key U.S. assets, missile defense also mitigates an adversary's ability to intimidate or coerce the United States into making concessions.

Missile defense systems help to enable U.S. and allied conventional operations. During a regional conflict, adversaries could deny the United States the ability to conduct offensive operations by targeting U.S. and allied forward-deployed personnel or military assets. In addition, they might try to decouple the United States from defense of its allies by threatening to strike U.S. forces or the U.S. homeland if the United States intervenes on behalf of others in a regional conflict. Missile defenses can therefore strengthen the credibility of U.S. extended deterrence by making it easier for the U.S. military to introduce reinforcements that can move more freely through a region.

A missile defense system gives decision-makers more time to choose the best course of action. Without the ability to defend against an impending attack, U.S. authorities would be limited to an unappealing set of responses that could range from preemptive attacks to acceding to an enemy's demands or actions. By providing some level of protection, robust missile defense systems could affect the dynamics of decision-making by removing the need to take immediate action—an especially critical consideration in the event of an unauthorized or accidental missile launch by an adversary. Missile defense can therefore be profoundly stabilizing.

Finally, in both nuclear and conventional missile attack scenarios, missile defense minimizes damage if deterrence fails. A strong missile defense system would not only help to protect countless American lives; it would also help to keep U.S. forces available during a fight. During a campaign against China in the Indo-Pacific, for example, missile defenses deployed in the region could lower the loss rate for U.S. forces compared to the rate of replacement, thereby extending the war effort and giving U.S. forces more time to prevail.[17]

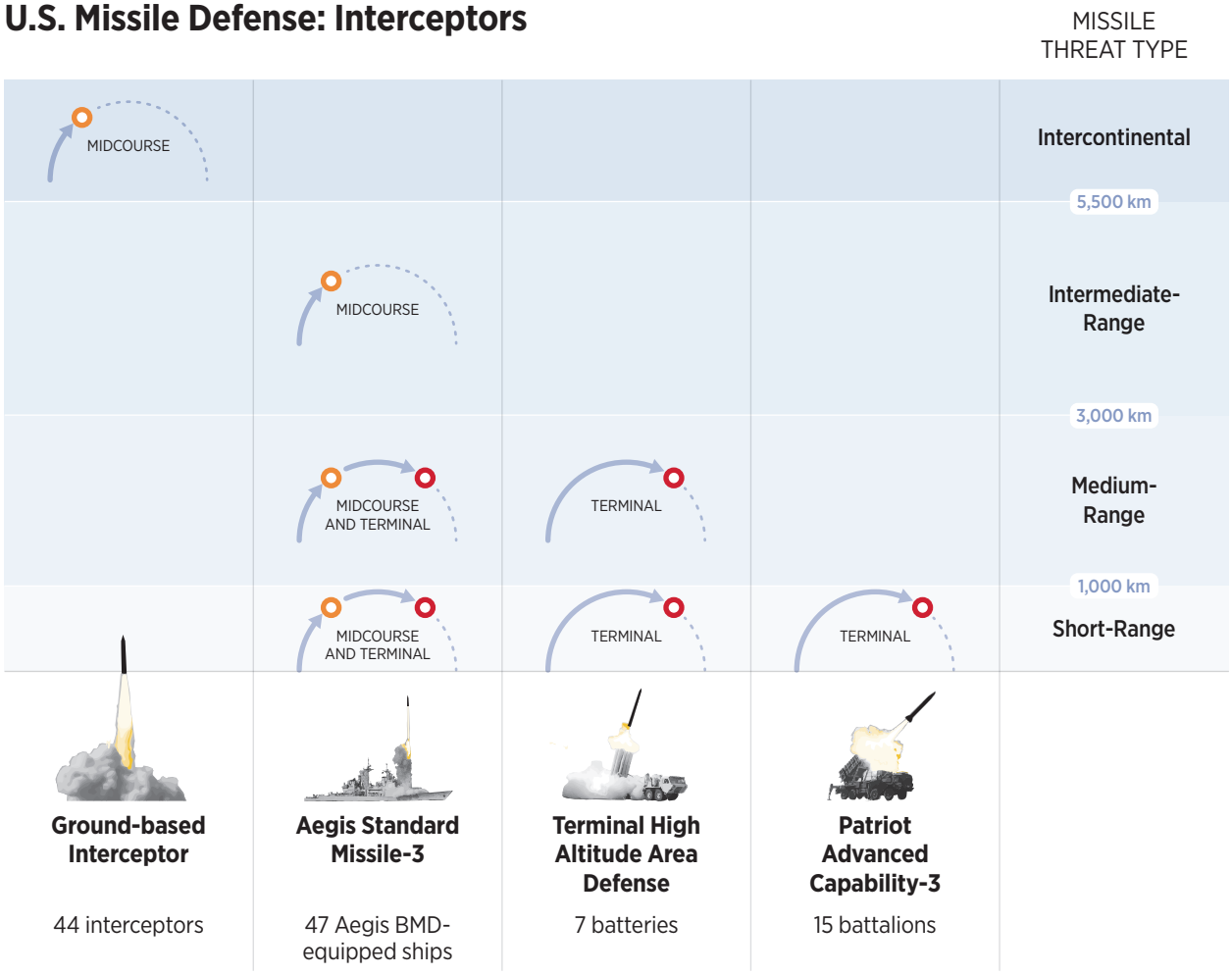
Since the end of the Cold War, Congress has supported the development of a regional missile defense system, but it has not supported the development of a comprehensive layered system to protect the homeland. The reason: a lingering Cold War–era view that U.S. missile defenses would be "destabilizing" vis-à-vis the Soviet Union. Skeptics argued that the Soviets would be incentivized to strike first before defenses could be deployed or more likely to strike first in a crisis for fear that a U.S. missile defense system would undermine their retaliatory capability after a U.S. first strike. The notion of long-range missile defenses as destabilizing was codified in the 1972 Anti-Ballistic Missile (ABM) Treaty, from which the United States withdrew in 2002 citing the need to develop such defenses against North Korea's and Iran's evolving missile capabilities.

The U.S. Missile Defense System

The U.S. missile defense system has three critical physical components:

FIGURE 7

U.S. Missile Defense: Interceptors



SOURCES: Center for Strategic and International Studies, Missile Defense Project, "Aegis Ballistic Missile Defense," *Missile Threat*, last updated August 4, 2021, https://missilethreat.csis.org/system/aegis/ (accessed September 14, 2023), and U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller)/Chief Financial Officer, *United States Department of Defense Fiscal Year 2023 Budget Request, Program Acquisition Cost by Weapon System*, April 2022, pp. 4–5, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2023/FY2023_Weapons.pdf (accessed September 14, 2023).

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- Sensors,
- Interceptors, and
- Command and control infrastructure that provides data from sensors to interceptors.

Of these, interceptors receive much of the public's attention because of their visible and kinetic nature. Components of missile defense systems can be classified based on the phase of flight during which intercept occurs, although some—for example, the command and control infrastructure or radars—can support intercepts in various phases of flight. Interceptors can shoot down an adversary ballistic missile in the boost, ascent, midcourse, or terminal phase of its flight. As cruise missiles and hypersonic glide vehicles continue to proliferate, the Missile Defense Agency (MDA) and the military services must therefore consider intercepts in all four phases of flight.

Another way to classify missile defense systems is by the range of an incoming missile (short-range, medium-range, intermediate-range, or intercontinental-range). An interceptor's flight time determines both the time available to conduct an intercept and the optimal interceptor placement to improve intercept probability. With an intercontinental ballistic missile (ICBM), the United States has "30 minutes or less"[18] to detect the missile, track it, provide the information to the missile defense system, find the optimal firing solution, launch an interceptor, and shoot down the incoming missile, ideally with enough time to fire another interceptor if the first attempt fails—a tactic known as "shoot-look-shoot." The time needed to intercept short-range, medium-range, and intermediate-range ballistic missiles is shorter.

Finally, missile defense can be framed by the origin of interceptor launch. At present, U.S. interceptors are launched from the ground or from the sea. In the past, the United States explored possible ways to intercept ballistic missiles from the air or in space,[19] but such efforts have been limited since the U.S. withdrawal from the ABM Treaty in 2002.

The current U.S. missile defense system is a result of investments made by successive U.S. Administrations with the support of Congress. President Ronald Reagan envisioned a defensive shield—the Strategic Defense Initiative (SDI)—as a layered ballistic missile defense (BMD) system that ultimately would render nuclear missiles "impotent and obsolete."[20] These layers would have boost, ascent, midcourse, and terminal interceptors, including directed-energy interceptors, providing the United States with more than one opportunity to shoot down an incoming missile.

The United States stopped far short of this goal even though the SDI program generated tremendous technological advances and benefits.[21] Instead of a comprehensive layered system, the United States has no boost-phase BMD systems and extremely limited midcourse defense against the advanced ballistic missile threats from China and Russia. The volatility and inconsistency of priority and funding for missile defense by successive Administrations and Congresses—controlled by *both* major political parties—have yielded a system that is limited both numerically and technologically and is extremely limited in defending against more sophisticated or more numerous long-range missile attacks.

The National Missile Defense Act of 1999 made it U.S. policy to protect the homeland only from a "limited ballistic missile attack."[22] The National Defense Authorization Act (NDAA) for Fiscal Year 2017 dropped the word "limited" even as it continued to focus on ballistic missiles.[23] Then the 2020 NDAA made it a matter of policy to rely on nuclear deterrence to defend against "near-peer intercontinental missile threats" and focus on improving missile defense against "rogue states."[24] In the future, as technological trends progress and modern technologies become cheaper and more widely available, North Korean or Iranian ballistic missiles and countermeasures may rival—in sophistication if not in numbers—those of Russia or China. Consequently, the United States must remain aware of how such threats are evolving and be prepared to alter its missile defense posture accordingly.

In January 2019, the Trump Administration published its congressionally mandated Missile Defense Review (MDR), a statement of policy intended to guide the Administration's missile defense programs. The 2019 MDR addressed the dangerous threat environment that had evolved since the previous MDR in 2010 and recognized that future missile defense systems will have to defend against cruise and hypersonic missiles in addition to ballistic missiles.[25]

The Biden Administration's 2022 Missile Defense Review recognizes that the "evolution of offensive air and missile threats has accelerated greatly since the United States began developing its first ballistic missile defense systems over fifty years ago" and that "[t]his trend represents a growing national security challenge expected to multiply in scope and complexity over the coming decade."[26] However, it does not include any major new initiatives or any reference to the Trump Administration's nascent proposal for building a "layered" missile defense for the U.S. homeland.

For fiscal year (FY) 2024, the Biden Administration has requested $10.9 billion for the MDA,[27] $1 billion more than the $9.6 billion it requested in FY 2023.[28]

Interceptors

Interceptors are one major component of the U.S. missile defense system. Different types of

interceptors that respond to different missile threats have been emphasized over the years, and the composition of today's U.S. missile defense reflects these choices.

While the United States is working to improve its ability to strike down cruise missiles and hypersonic glide vehicles, its fully operational missile defense systems are best suited to the interception of ballistic missiles. Missile defense interceptors can potentially intercept ballistic missiles in three different phases of flight.

- **The boost phase** extends from the time a missile is launched from its platform until its engines stop thrusting.

- **The midcourse phase** is the longest and thus offers an optimal opportunity to intercept an incoming threat and, depending on other circumstances like the trajectory of the incoming threat and quality of U.S. tracking data, enables more shots if the first intercept attempt fails.

- **The terminal phase,** typically less than one minute long, occurs as the missile plummets through the atmosphere toward the target and offers a very limited opportunity to intercept a ballistic missile threat.

Boost-Phase Interceptors. The United States currently has no capability to shoot down missiles in their boost phase. Technologically, boost-phase intercept is the most challenging option because of the very short time during which a missile is boosting, the missile's extraordinary rate of acceleration during this brief window of time, and the need to have the interceptor close to the launch site.[29] This is also, however, the most beneficial time to strike. A boosting ballistic missile is at its slowest speed compared to other phases; it is therefore not yet able to maneuver evasively and has not yet deployed countermeasures or multiple warheads that complicate the targeting and intercept problem.

In the past, the United States pursued several boost-phase programs, including the Airborne Laser, the Network Centric Air Defense Element, the Kinetic Energy Interceptor, and the Air Launched Hit-to-Kill missile. Eventually, each of these programs was cancelled because of technical, operational, or cost challenges, and other boost-phase programs have not progressed significantly.

Midcourse-Phase Interceptors. Intercepting missiles in their midcourse phase offers more time for intercept attempts and presents relatively fewer technological challenges than intercepts in the boost phase present, but it also allows the missile time to deploy decoys and countermeasures that can complicate interception by overwhelming sensors and radars. The United States deploys two systems that can shoot down incoming missiles in the midcourse phase of flight:

- The Ground-Based Midcourse Defense (GMD) system and

- The Aegis defense system.

The GMD system is the only operational system that is designed to shoot down a long-range ballistic missile headed for the U.S. homeland. It consists of 40 Ground-Based Interceptors (GBIs) at Fort Greeley, Alaska, and four at Vandenberg Air Force Base, California. A GBI consists of a multi-staged rocket booster and an Exoatmospheric Kill Vehicle (EKV) that intercepts the incoming missile with hit-to-kill technology. In FY 2023, the MDA "increased US Northern Command Ground Based Interceptor capacity in the most advanced configuration with Capability Enhanced-II Block 1 Exo-atmospheric Kill Vehicles integrated on new Configuration 2 boost vehicles."[30]

To increase the probability of an intercept, the United States can launch multiple interceptors at each incoming ballistic missile. At present, because the inventory of interceptors is limited, the United States can intercept only a handful of ballistic missiles that have relatively unsophisticated countermeasures.

In 2017, Congress approved a White House request to increase the number of GBIs from 44 to 64 to keep up with the advancing ballistic missile threat, particularly from North Korea.[31] The MDA intended to produce a Redesigned Kill Vehicle (RKV) to top 20 additional GBIs that would fill the new silos, but this program was canceled in 2019 because of technological difficulties.[32] The MDA instead initiated the Next Generation Interceptor (NGI) program to build an entirely new interceptor that would add both capacity and capability to the

GMD system. The MDA plans to field NGIs "no later than the end of 2028,"[33] and they could eventually replace some or all of the existing 44 GBIs. Unlike the GBIs, the NGIs will feature multiple kill vehicles, giving a single NGI multiple opportunities to intercept an incoming threat.[34]

Contracts to develop the NGI were awarded to Lockheed Martin and a Northrop Grumman–Raytheon team in March 2021.[35] The FY 2024 presidential budget request includes $2.1 billion for NGI to support these two competing contracts.[36]

The Aegis defense system is a sea-based component of the U.S. missile defense system. It is designed to address the threat of short-range, medium-range (1,000–3,000 kilometers), and intermediate-range (3,000–5,500 kilometers) ballistic missiles. It utilizes different versions of the Standard Missile-3 (SM-3) and SM-6 depending on the threat and other considerations like ship location and quality of tracking data. The Aegis system also has capability against aerial threats (aircraft and unmanned aerial systems) and cruise missiles.[37] According to the FY 2024 MDA budget submission, "[b]y the end of FY 2024, there will be 53 total BMD capable ships requiring maintenance support."[38] Japan has several Aegis BMD-capable destroyers and cooperated with the United States to develop the latest SM-3 missile, the SM-3 Block IIA.[39]

The United States also deploys a land-based version of Aegis, the Aegis Ashore system, in Romania and another in Poland. The site in Poland experienced repeated delays in achieving initial operational capability but "is expected to be delivered" in FY 2023.[40] Aegis Ashore sites relieve some of the requirements on the naval fleet because BMD-capable cruisers and destroyers are multi-mission and are used for other purposes, such as wartime fleet operations and even anti-piracy operations. These Aegis Ashore sites help to protect U.S. allies and forces in Europe from the Iranian ballistic missile threat.

Aegis BMD will also play a significant role in the development of a missile defense system on the U.S. territory of Guam, one of the MDA's priorities in the FY 2024 budget request. Former Commander of U.S. Indo-Pacific Command (INDOPACOM) Admiral Philip Davidson has testified that "the most important action we can take to increase the joint force's lethality [in the region] is to introduce **a 360-degree, persistent, air and missile defense capability on Guam (Guam Defense System (GDS))**."[41] Current INDOPACOM Commander Admiral John Aquilino testified in March 2022 that "Guam's strategic importance is difficult to overstate" and emphasized "the importance of the island for sustaining the joint force as our main operating base and home to 130,000 Americans."[42]

The FY 2024 budget request includes a total of $1.5 billion to continue development of an architecture for Guam defense and to begin procurement of needed components, including SM-3, SM-6, and Aegis fire control components.[43]

In November 2020, the U.S. Navy and the MDA shot down an ICBM-type target using the SM-3 Block IIA.[44] The test, FTM-44, was the first step in a plan to use SM-3 Block IIAs as an "underlay" to the GMD system to defend the homeland with GBIs taking the first shots at an incoming target and SM-3 interceptors taking shots if the GBIs miss.[45] The MDA had planned to test the SM-3 IIA against a more sophisticated ICBM countermeasure set as the next step, but the budget request for FY 2023 eliminated funds to pursue the SM-3 IIA as a homeland underlay.[46] According to the Government Accountability Office, the MDA "did not complete its fiscal year 2022 flight, ground, and cyber baseline test program" and did not meet its annual goals for fielding the systems, leaving the warfighter with "less fielded capability than planned."[47]

Terminal-Phase Interceptors. The United States currently deploys three terminal-phase missile defense systems:

- Terminal High Altitude Area Defense (THAAD);
- The Patriot missile defense system; and
- Aegis BMD.

A THAAD battery can "intercept and destroy ballistic missiles inside or outside the atmosphere during their final, or terminal, phase of flight"[48] and consists of a launcher, interceptors, the Army Navy/Transportable Radar Surveillance and Control Model 2 (AN/TPY-2) radar, and fire control.[49] The system is transportable and rapidly deployable. THAAD batteries have been deployed to such countries as Japan, South Korea, Israel, and the United Arab Emirates (UAE), and the U.S. signed a deal in

2020 to deliver THAAD to Saudi Arabia.[50] In February 2022, THAAD was "employed successfully by the UAE in the first two combat employments of that system."[51]

Patriot is an air-defense and short-range ballistic missile defense system. A battery includes a launcher, interceptors, AN/MPQ-53/65 radar, an engagement control station, and diesel-powered generator units. The Patriot family of missile defense interceptors has been upgraded over time from the initial Patriot Advanced Capability-1 (PAC-1) deployed in Europe in 1988 to the PAC-3 configuration deployed around the world today. The most recent Patriot upgrade, the PAC-3 Missile Segment Enhancement, "expands the lethal battlespace with a two-pulse solid rocket motor."[52] The system is transportable and "is currently deployed in multiple theaters around the world with daily operational activities."[53] Particularly notable is the system's combat performance in Ukraine, where it has intercepted Russian Kinzhal hypersonic missiles among others.[54]

To increase the defended battlespace, the MDA is pursuing the Patriot Launch-on-Remote (THAAD) capability, which integrates the PAC-3 and THAAD systems by enabling a PAC-3 interceptor to utilize targeting data from a THAAD AN/TPY-2 radar. Launch-on-Remote is a significant capability that can increase the defended area by spreading out missiles.[55] After two failed tests in 2020, the MDA, in conjunction with the Army, conducted two successful tests early in 2022.[56] The MDA, in coordination with the Army, "will begin global fielding this fiscal year."[57]

Progress on building a Guam defense system has moved slowly despite the urgency of the Chinese threat.[58] Even though this missile defense system first appeared on the INDOPACOM Unfunded Priorities List in 2019, the President requested and Congress first provided funding for the system only in FY 2022.[59] The $192 million that was appropriated fell far short of the $350 million requested by INDOPACOM for that year,[60] but the FY 2024 budget request includes $1.5 billion to strengthen the island's missile defense.[61]

General VanHerck recently testified that he remains "confident in our current capability to defend the homeland against a limited DPRK [Democratic People's Republic of Korea] ballistic missile threat" but is "concerned about future capacity and capability to respond to advancing DPRK ballistic missile threats, making it crucial to field the Next Generation Interceptor (NGI) as funded in the FY23 Consolidated Appropriations Act (P.L. 117-328)."[62]

The first NGI flight tests are scheduled for "the 2027 timeframe."[63] NGI will add needed capacity and capability to the GMD system, which some see as in danger of being overwhelmed by the increasing capacity of North Korea's ballistic missiles to strike the U.S. homeland and by North Korea's ability to deploy countermeasures.[64]

The MDA and Congress also continue to support a GMD service life extension program (SLEP) that is intended to maintain the existing fleet through this decade and beyond 2030. Given that NGI will not replace the existing GBI fleet—at least not initially—it is critical that the existing interceptors remain in service. The GMD system was largely built in the early 2000s, and many parts—including the GBI kill vehicles, boosters, and ground systems—are subject to degradation from aging. The MDA will need to consider additional NGI purchases after the initial 20 to begin replacing existing GBIs in the 2030s.

In 2019, to strengthen homeland missile defense after the RKV was canceled and before NGI comes online, the Trump Administration proposed the development of an underlay using SM-3 Block IIA and THAAD interceptors. General VanHerck agreed that "an underlayer would give us additional capacity and capability" to address threats to the homeland.[65] The MDA had progressed toward this underlay after its successful test of the SM-3 IIA against an ICBM-type target in 2020, but the DOD had not articulated a concept of operations for employing the SM-3 Block IIA and THAAD for homeland defense, including where in the United States those systems could be deployed or how many would be required, as requested by Congress. In addition, no funding for the layered homeland defense program was included in the budget request for FY 2023, and none is included in the budget request for FY 2024.

However, even though the MDA is investing in the GMD SLEP and the NGI program to ensure defense of the homeland, forgoing a homeland underlay will deprive the homeland of added capacity against worsening missile threats. The utility of exploring the use of SM-3 and THAAD interceptors to shoot down ICBMs can also extend beyond an

underlay for the continental United States, as they can work for other missions or defend assets like Hawaii, Alaska, and Guam.

Currently, the only interceptor the United States has available to intercept hypersonic missiles is the SM-6.[66] To strengthen U.S. capability against maneuverable hypersonic missiles, the MDA is in the early stages of developing the Glide Phase Interceptor (GPI), which is designed to intercept regional hypersonic missiles in their glide phase of flight, and plans to conduct a simulated engagement against a hypersonic glide vehicle in FY 2024.[67] The FY 2024 budget request includes $209 million for hypersonic defense.[68]

The Army's Indirect Fire Protection Capability Increment 2 (IFPC 2) program has been moving very slowly, and a key assessment of the system has recently been delayed by a year.[69] The IFPC 2 would defend against short-range rockets, artillery, and mortars as well as cruise missiles, against which the United States, as noted, lacks a sufficient defensive capability.[70] As a system, IFPC would fill the gap between short-range tactical air defense and ballistic missile defense like PAC-3 and THAAD.

In response to a congressional requirement that it field an interim cruise missile defense capability in response to the increasing cruise missile threat, the Army purchased two Iron Dome batteries manufactured by the Israeli company Rafael.[71] Despite prior concerns about integrating Iron Dome as part of an enduring IFPC solution, the Army is preparing the Iron Dome systems for operational deployment and integration into its future missile defense command and control system.[72] In 2021, the Army deployed Iron Dome to Guam and conducted a successful simulation to test the system,[73] but there is as yet no evidence to indicate that Iron Dome will be integrated into the Guam defense system that is under development.

In September 2021, the Army awarded a contract to Dynetics to develop its own enduring IFPC 2 system.[74] The Army set the initial date of March 2024 to receive 16 launcher prototypes and 60 "fieldable" interceptors.[75]

Overall, the United States has multiple capable interceptors, but there is much room for improvement, including strengthening missile defense capabilities against more robust missile threats from Russia and China, both qualitatively and quantitatively. The most important step for the near future will be on-time or early delivery of the NGI to ensure protection of the homeland from North Korea. The United States also ought to invest in research and development of space-based missile defense if it is ever to have a truly comprehensive protection from larger-scale missile attacks.

Sensors

The sensor component of the U.S. missile defense system is distributed across the land, sea, and space domains and provides the United States and its allies with an early warning of a launch of enemy ballistic missiles in addition to missile tracking and discrimination.[76] These sensors can detect a ballistic missile launch, track a missile in flight, and even classify the type of projectile, its speed, and the target against which the missile has been directed. They relay this information to the command and control stations that operate interceptor systems like Aegis (primarily a sea-based system) or THAAD (a land-based system).

Land-Based. On land, the major sensor installations are the Upgraded Early Warning Radars (UEWRs), which are concentrated along the North Atlantic and Pacific corridors that present the most direct flight path for a missile aimed at the United States. They include the phased array UEWRs based in Alaska, California, Massachusetts, the United Kingdom, and Greenland that scan objects up to 3,000 miles away.[77] They support homeland missile defense by providing early warning and improving the quality of midcourse tracking data.[78]

The United States also deploys mobile AN/TPY-2 land-based sensors. Of the 12 AN/TPY-2 systems that have been produced so far, five "are operating in forward-based mode worldwide in support of the U.S. and its allies" and seven "are operating in terminal mode as part of THAAD weapon systems in support of Army and regional defense Missions."[79] According to Admiral Hill, "Radar 13, planned for delivery in March 2025, will be part of THAAD Battery 8 and be a fully modernized configuration that includes significant obsolescence redesigns leveraged from our ongoing Foreign Military Sales (FMS) cases."[80] In cooperation with the Republic of Korea, the United States deploys a THAAD missile system accompanied by an AN/TPY-2 on the Korean Peninsula.

To fill a gap in missile discrimination capability for tracking North Korean missiles over the Pacific,

the MDA is developing the Long Range Discrimination Radar (LRDR) in northern Alaska to improve coverage in the northern Pacific. The LRDR utilizes the SPY-7 radar, which the MDA will also purchase for the Guam defense system.[81] The DOD has also identified the need to develop the Homeland Defense Radar–Hawaii (HDR–H) to fill a tracking and discrimination gap over Hawaii. The FY 2024 budget request includes $103.5 million for the radar, which will support the completion of acceptance testing and enable an operational flight test in FY 2023.[82]

Sea-Based. There are two types of sea-based sensors. The first is the Sea-Based X-band (SBX) radar, which is "mounted on a mobile, ocean-going, semi-submersible platform that provides the missile defense system with an extremely powerful and capable radar that can be positioned to cover any region of the globe."[83] SBX is employed primarily in the Pacific. The second is the SPY-1 radar system, which is mounted on U.S. Navy vessels equipped with the Aegis Combat System and is therefore able to provide data that can be utilized for ballistic missile missions. The Navy is installing the radar on 29 new ships and replacing all SPY-1 radars with the SPY-6 radar, which will have a greater detection range and other advanced capabilities.[84]

Space-Based. Finally, U.S. missile defense sensors operate in space. From the ultimate high ground, space-based sensors have the potential to detect and track missile launches from almost any location from boost phase to terminal phase, unlike ground-based radars that are limited in their tracking range.[85] The MDA, the U.S. Space Force, and the Space Development Agency (SDA) all control aspects of the space missile defense sensor system.

The oldest system that contributes to the missile defense mission is the Defense Support Program (DSP), a constellation of satellites that use infrared sensors to identify heat from booster and missile plumes to detect an initial launch. In 2020, the Department of Defense awarded a $222.5 million contract to keep the program going through 2030.[86] The DSP satellite system has gradually been replaced by the Space-Based Infrared Radar System (SBIRS) to improve the delivery of missile defense and battlefield intelligence.[87] Because SBIRS can scan a wide swath of territory while simultaneously tracking a specific target, for example, it is useful in observing tactical, or short-range, ballistic missiles.[88]

The Space Force launched the sixth and final SBIRS satellite in August 2022.[89] The Air Force originally planned to launch eight SBIRS satellites, but because of congressional funding delays, it decided to end production of SBIRS early and move on to development of its replacement, the Next-Generation Overhead Persistent Infrared (Next-Gen OPIR) satellite, in 2017.[90] The sixth SBIRS satellite was formally transferred from Space Systems Command to Space Operations Command on March 24, 2023.[91] The first of the Next-Gen OPIR satellites, which are designed to be more survivable against cyber and electronic attacks, is scheduled to launch in 2025.[92]

The MDA also has developed and deployed Spacebased Kill Assessment (SKA) sensors on commercial satellites.[93] SKA uses a network of infrared sensors to provide a hit and kill assessment of homeland defense intercepts. After several years of successful testing of SKA sensors in orbit, the FY 2024 budget supports "on-orbit operations by experimenting and participating in missile defense system ground and flight tests and providing situational awareness hit assessment to USNORTHCOM during declared periods of heightened activity."[94]

The United States is developing a system of satellites capable of providing global detection, tracking, and discrimination of any missile launch. Dating from as far back as President Reagan's Strategic Defense Initiative, successive Administrations have called for a proliferated layer of sensing satellites in space to track the flight of any type of missile—not just ballistic—from birth to death. A layer of space-based sensors can be particularly useful in tracking hypersonic vehicles, which fly at lower altitudes than ballistic missiles and can maneuver during flight. The DSP and SBIRS systems were designed for ballistic missiles and can lose track of missiles flying at lower altitudes. Since many new threats are not flying on ballistic trajectories (hypervelocity vehicles, for example), Congress has been paying close attention to development of a space sensor layer that is capable of tracking the evolving threat.

Beginning in 2009, the MDA operated two Space Tracking and Surveillance System-Demonstrators (STSS-D) satellites in an effort to demonstrate this capability to track ballistic missiles that exit and reenter the Earth's atmosphere during the midcourse phase. Data obtained by those demonstration satellites were used to provide risk reduction

to support future space trackers. According to the MDA, "Space Vehicle[s] Vehicle 1 and 2 were retired on orbit on February 9, 2022 and March 8, 2022 respectively."[95]

Today, the SDA, in conjunction with the MDA, is developing a space Tracking Layer of satellites proliferated in Low-Earth Orbit (LEO) as part of the SDA's Proliferated Warfighter Space Architecture, formerly known as the National Defense Space Architecture. According to the SDA:

> Once fully operational, the SDA Tracking Layer will consist of a proliferated heterogeneous constellation of Wide Field of View (WFOV) space vehicles (SVs) that provide persistent global coverage and custody capability combined with the Missile Defense Agency (MDA) Hypersonic and Ballistic Tracking Space Sensor (HBTSS) Medium Field of View (MFOV) SVs that provide precision global access capability.[96]

Once deployed, the Tracking Layer will be able to detect, track, and discriminate among different types of missile launches throughout the entirety of the missiles' flights, including both hypersonic glide vehicles and dimmer ballistic missile targets. The SDA is also exploring the ability of space sensors to provide fire control information directly to weapon platforms like THAAD or Aegis (as opposed to the data going through a ground station). The first 10 satellites were launched in April 2023.[97]

The MDA has requested $109.5 million for Missile Defense Space Programs in FY 2024 with a large portion of the funding dedicated to the HBTSS.[98] In 2021, the MDA awarded contracts to Northrop Grumman and L3Harris to develop HBTSS prototypes, which are scheduled to launch in the fourth quarter of FY 2023.[99]

Senior defense leaders have stated repeatedly that deploying sensor satellites to space to track missiles from the high ground throughout their entire flight is the best way to advance sensor capability. For example, MDA Director Vice Admiral Jon Hill has stated that "[s]pace-based sensors are critical to integrated sensor-to-shooter capabilities used to defeat ballistic and hypersonic missile threats."[100] According to Admiral Charles Richard, then-Commander of U.S. Strategic Command (STRATCOM):

> Future space-based sensors may be able to provide birth-to-death detection, tracking, and discrimination of hypersonic glide vehicle, cruise missile, and ballistic missile threats globally. These abilities cannot be fully achieved with the current or future terrestrial-based radar architecture due to the constraints of geography and characteristics of future missile threats.[101]

The space-based sensor program has been plagued by insufficient funding requests and bureaucratic infighting over whether the SDA or the MDA would develop the HBTSS,[102] and despite some progress in resolving the conflict, congressional concern has reemerged.[103] A strong assessment of missile defense sensing capabilities depends on progress made on the space-based sensor effort, especially in view of warfighting commanders' urgent need for improved missile tracking as well as the technological challenges associated with developing a sensor that can perform in LEO.[104]

Development of land-based sensors to fill the missile discrimination capability gap over the Pacific has progressed slowly. Development of the LRDR completed initial fielding, but the program incurred delays that were "caused by the COVID-19 pandemic and other factors."[105]

Additionally, improved sensor capabilities are critical to addressing the cruise missile threat to the homeland. As noted previously, the United States has no dedicated missile defense system to counter this threat. Because of their low altitude in flight and uncertain trajectories, cruise missiles are more difficult to detect and track than ballistic missiles are. Russia's ability to strike key strategic nodes in the U.S. homeland from its own territory is of particular concern. To address this threat, General VanHerck has emphasized improving domain awareness, because early identification of a threat allows for options like left-of-launch operations (destroying a missile before it is launched or preventing its launch by neutralizing launch enablers) or alerting forces to take precautionary actions.[106]

The Department of Defense is requesting $428.7 million in the FY 2024 defense budget "for the continued fielding of four new over-the-horizon radars."[107] These radars will provide long-range sensor coverage of likely air and cruise missile threats to North America, as well as a capability against

hypersonic threats, and maritime surface vessels. NORTHCOM's unfunded priorities list for FY 2024 includes $212 million for nine long-range radars "to fill surveillance gaps caused by existing radar failures."[108] (This refers to Chinese balloon intrusions early in 2023 that initially went undetected.[109]) Additionally, developing a capability to detect, track, and eventually intercept a conventional cruise missile attack will be critical to denying adversaries the ability to hold the homeland at risk below the nuclear threshold.

The Space Force removed one of three planned geosynchronous orbit satellites, a part of the Next-Gen OPIR program, from its FY 2024 budget request.[110] The Army is also progressing on development of the Lower-Tier Air and Missile Defense System (LTAMDS) radars that will provide 360-degree threat coverage for PAC-3 and other regional missile defense batteries; the current Patriot radar can scan only one-third of the sky at a time.[111] The LTAMDS program has experienced "cascading delays," and the current plan is to move it to the major capability acquisition phase in FY 2024.[112]

Command and Control

Command and control of the U.S. ballistic missile defense system requires bringing together data from sensors and radars and relaying those data to interceptors so that they can destroy incoming missiles directed against the U.S. and its allies. The operational hub of missile defense command and control is the Joint Functional Component Command for Integrated Missile Defense (JFCC IMD), a component of STRATCOM housed at Schriever Air Force Base, Colorado. JFCC IMD brings together Army, Navy, Marine Corps, Space, and Air Force personnel and is co-located with the MDA's Missile Defense Integration and Operation Center (MDIOC). This concentration of leadership from across the various agencies helps to streamline decision-making for those who command and operate the U.S. missile defense system.[113]

Command and control of the GMD system to defend the homeland utilizes the Ground-based Midcourse Defense Fire Control (GFC) system, which consists of "a suite of hardware, software, and specially trained personnel integrating GMD and supporting elements to manage all phases of engagement."[114] According to the MDA, "GMD employs integrated communications networks, fire control systems, globally deployed sensors and Ground-Based Interceptors that are capable of detecting, tracking and destroying ballistic missile threats," and as of June 2023, 44 GBIs were "currently emplaced" at Fort Greeley in Alaska and Vandenberg Air Force Base in California.[115]

Once a missile is launched, data from the U.S. global network of sensors and radars travel through secure satellite communications and ground-based redundant communications lines to the Command Launch Equipment (CLE) software that can task GBIs to fire at the incoming missile. Then, once the NORTHCOM Commander—who becomes the supported commander during GMD execution—in consultation with the President has determined the most effective response to a missile threat, the CLE fire response option is relayed to the appropriate GBIs in the field.[116] When the selected missiles have been fired, they maintain contact with In-Flight Interceptor Communications System (IFICS) Data Terminals (IDTs) to receive updated flight information that helps to guide them to their target.[117]

To prepare for and execute GMD operations, the NORTHCOM Commander can also utilize situational awareness data from the Command and Control, Battle Management, and Communications (C2BMC) system. Through its software and network systems, C2BMC helps to process and integrate sensor information to provide a more complete picture of the battlespace.[118] The GMD Fire Control system acts as the primary decision aid for GMD execution, and the C2BMC system provides integrated battlefield awareness information before and during GMD operations.[119] It also provides information to other missile defense systems like THAAD and Patriot. Dozens of C2BMC workstations are distributed throughout the world at U.S. military bases.

C2BMC has undergone multiple technical upgrades (called spirals) since 2004 to bring more missile defense elements into the network. In 2019, the MDA completed an upgrade that will help to expand Aegis missile defense coverage by enabling Aegis Weapons Systems to engage by remote sensing.

Regional missile defense systems like THAAD, PAC-3, and Aegis are equipped with their own individual fire control systems to control the launch of their interceptors. The C2BMC system can also provide tracking information to individual missile defense batteries from other regional sensors. Aegis

BMD systems have onboard control governed by the Aegis Combat System and can provide their sensor data to the GMD system through C2BMC.[120]

C2BMC connects sensors and shooters around the world to a global network, but there is no comparable system to link sensors and shooters in a single region. The Army is developing the Integrated Air and Missile Defense (IAMD) Battle Command System (IBCS) to provide this capability. Once fielded, IBCS would connect all sensors and shooters in a region to a single fire control network.[121] Like IFPC, IBCS would also link defenses against smaller threats with ballistic missile defense.

A strong global command and control system is critical to missile defense because linking information from sensors can increase domain awareness and the time available to engage a target, thereby improving the probability of intercept. According to General VanHerck, "domain awareness" remains one of the challenges that makes homeland defense "a potential limiting factor to ensuring rapid and effective implementation and execution of global contingency plans."[122] Domain awareness is especially important in dealing with cruise missile threats to the homeland—threats against which the U.S. has no comprehensive interceptor capability.

Continuing to upgrade the C2BMC system will remain critical to increasing the integration of missile defense elements across the world and therefore improving chances of intercept. For instance, it was revealed in 2021 that the MDA provided U.S. Indo-Pacific Command with a hypersonic missile defense capability, largely as a result of C2BMC improvements that allow sensors to see the threat sooner.[123] The MDA is expecting the LRDR's operational acceptance in the fourth quarter of FY 2024 after a delay.[124] It also has linked C2BMC to the Army's IBCS, and it was expected that the round of upgrades announced in August 2021 would further integrate those systems and enhance the threat data provided to the GMD system.[125]

The United States will need a more advanced command and control capability as global missile threats shift to include cruise and hypersonic missiles in addition to ballistic missiles. The DOD is currently developing a Joint All Domain C2 (JADC2) concept to integrate non-compatible sensors across all domains into a single network so that it can respond to a complex threat more efficiently.[126] Missile defense command and control will strengthen as the services begin to field JADC2 capabilities.

In addition, NORTHCOM and the North American Aerospace Defense Command (NORAD) have conducted a series of Global Information Dominance Experiments (GIDE) that GIDE V Mission Commander Colonel Matthew Strohmeyer describes as "an opportunity to stress-test our current systems and processes, introduce new technologies and approaches, and learn in an experimentation environment that replicates real-world operations."[127] Sensor information can tend to exist in stovepipes, and if it is not integrated, the result can be failure to detect a threat.[128] GIDE also uses artificial intelligence and machine learning cues to ensure that the commander receives a full data picture.[129]

IBCS will provide an important improvement in regional missile defenses. The system will link all missile defense sensors and interceptors to one fire control center as opposed to today's more stovepiped approach in which each unit operates its co-located sensor and launcher independently. By permitting air and missile defenses to function as a joint kill *web* rather than as a linear kill *chain*, IBCS will be able to determine the best shooter to take down an incoming missile, in turn increasing the defended battlespace.

The IBCS program has been approved for Full Rate Production in April 2023.[130] Advancements underway in missile defense command and control will become increasingly necessary to enable defense against the growing missile threat.

Conclusion

By choice of successive presidential Administrations and Congresses, the United States does not have in place a comprehensive set of missile defense systems that would be capable of defending the homeland and allies from robust ballistic missile threats from Russia and China. U.S. efforts have focused on a limited architecture that protects the homeland from quantitatively small and qualitatively relatively less advanced threats and on deploying and advancing regional missile defense systems. The United States has not invested in space-based missile defense in any serious manner.

The United States has in place multiple types of capable interceptors, a vast sensor network, and a command and control system, but many elements

of the missile defense system need to be improved to defend against today's threat more efficiently, and the system would have to be rethought from the ground up should a decision be made to provide a comprehensive layered and robust defense of the homeland against Russian and Chinese missile threats. At the same time, the development of missile threats, both qualitative and quantitative, is outpacing the speed of missile defense research, development, and deployment to address those threats.

Senior leaders continue to stress the importance of U.S. missile defense, but if the nation is to realize the strategic benefits that missile defense provides, Congress and the Administration must ensure that the funding of critical programs like NGI, space sensors, and JADC2 is commensurate with their importance and that the nation is investing in future research and development, including missile defense in space.

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Cyber Warfare and U.S. Cyber Command

James Di Pane

The world of cyber operations is notoriously secretive. Nevertheless, even a rudimentary understanding of the domain, the threats and opportunities associated with it, and the ability of the Department of Defense (DOD) to protect the U.S. from cyberattack and enable military operations against enemies is of the greatest importance. To supplement the concise overview of military cyber capabilities provided in this discussion, two essays, "National Defense and the Cyber Domain" and "The Reality of Cyber Conflict: Warfare in the Modern Age," from previous editions of the *Index of U.S. Military Strength* provide a wealth of information about the cyber domain and how it fits into the world of national defense.[1]

The vulnerability of allies and the private sector to cyberattacks can lead to complications for the military services that negatively affect the ability of the United States to sustain a war effort, thereby compromising our national security. But the need for cybersecurity goes beyond the Department of Defense alone. In the words of former Assistant Secretary of Defense for Homeland Defense and Global Security Kenneth P. Rapuano:

> The increasingly provocative activities of key competitors, such as the NotPetya cyber operation conducted by Russia in February 2018, demonstrate how vulnerable the Department is to attacks against the many non-DoD-owned assets that are nevertheless critical to our ability to execute our missions. These assets include civilian ports, airfields, energy systems, and other critical infrastructure. Vulnerabilities in these areas will likely be targeted by our adversaries to disrupt military command and control, financial operations, the functioning of operationally critical contractors, logistics operations, and military power projection, all without ever targeting the comparatively well-protected DoD Information Network. Any large-scale disruption or degradation of national critical infrastructure represents a significant national security threat.
>
> To address these challenges, the DoD Cyber Strategy directs DoD to strengthen alliances and attract new partners to ensure that we are taking a whole-of-society approach and to enable better security and resilience of key assets....[2]

The use of cyber as a military tool to target enemy forces and capabilities falls into categories that are similar to those of other military operations.

- Cyber tools can be used in the form of conventional operations like the operations against the Islamic State that were used to disrupt command and control nodes and the group's ability to distribute propaganda.[3] In this type of campaign, cyber supplements other military capabilities as a way to target enemy forces.

- Cyber also can take the form of special operations–type activity like the Stuxnet cyber operation against Iran, which could be compared to the U.S. Navy Seal raid to kill Osama Bin Laden.[4] In these operations, cyber is used to achieve targeted goals, sometimes in a covert way that, like special operations, falls below the threshold of traditional armed conflict.

In conventional operations, cyber is used to support forces and commanders by ensuring that they can operate uninhibited in cyberspace or by disrupting the enemy's ability to operate in order to achieve necessary objectives more effectively. In this way, cyber is used to gain an advantage over an adversary in much the same way advantage is sought in the other domains[5] (for example, when naval forces restrict the enemy's ability to use the seas to achieve strategic ends).

Like naval power, cyber is an important means with which to maximize one's own access and effectiveness while restricting the opponent's access and effectiveness. However, it differs from other domains in a very important respect: In cyber operations, time and space are incredibly compressed. A cyber force can launch an attack from anywhere in the world and strike very quickly; more traditional forces need time to move, are affected by terrain and weather, and must position themselves physically to launch attacks.

U.S. Cyber Command

U.S. Cyber Command (USCYBERCOM) is a capability-based Unified Combatant Command similar to U.S. Special Operations Command and is the military's primary organization for both offensive and defensive cyber activity. It is currently commanded by U.S. Army General Paul Nakasone, who serves simultaneously as Director of the National Security Agency (NSA). The two organizations have a close cooperative relationship: The NSA and Cyber Command operate, respectively, under Title 50 and Title 10 of the U.S. Code, the sections that govern intelligence and military affairs.[6]

U.S. Cyber Command was founded in 2010 as a sub-unified command under U.S. Strategic Command. It was elevated to full Unified Combatant Command status by the Trump Administration in 2018 and reached full operational capability in the same year.[7] Over the past approximately 12 years, Cyber Command has grown from a very small organization that was largely dependent on the NSA for personnel and resources into the much more robust and independent organization that exists today.

In FY 2024, CYBERCOM will take on more "Service-like authorities" that "will allow it to deliver priority capabilities with agility and at speed." Specifically:

> In Fiscal Year 2024, USCYBERCOM will assume control of the resources for the Cyber Mission Force cyberspace operations and capabilities. Enhanced budgetary control (EBC) gives USCYBERCOM the ability to directly allocate resources for greater efficiencies during the Department's programming phase and ensure they remain aligned with priorities through execution. EBC will lead to better alignment between USCYBERCOM responsibilities and authorities for cyberspace operations.[8]

Missions

U.S. Cyber Command has a wide range of missions, from offensive and defensive operations to monitoring DOD networks and assisting with the defense of critical infrastructure. Its primary role is to ensure the DOD's ability to operate in a world that is increasingly dependent on cyber.

To this end, Cyber Command has three "enduring lines of operation." As described by General Nakasone, they are to:

- Provide mission assurance for the Department of Defense (DoD) by directing the operation and defense of the Department of Defense Information Networks (i.e. the DoDIN) and its key terrain and capabilities;
- Defeat strategic threats to the United States and its national interests; and
- Assist Combatant Commanders to achieve their missions in and through cyberspace.[9]

These "lines of operation" are critical to ensuring the success of the military enterprise and national defense, as any compromise in the ability to communicate or operate could jeopardize the full range of U.S. military activities.

A key part of these missions is the concept of "defending forward." As described in the 2018 DOD Cyber Strategy, "[t]his includes working with the private sector and our foreign allies and partners to contest cyber activity that could threaten Joint Force missions and to counter the exfiltration of sensitive DoD information."[10] According to a fact sheet on the 2023 DOD Cyber Strategy, "the Department recognizes that the United States' global network of Allies and partners represents a

foundational advantage in the cyber domain that must be protected and reinforced."[11]

CYBERCOM defines "defending forward" as "actively disrupting malicious cyber activity before it can affect the U.S. Homeland."[12] Passive defense, by contrast, involves monitoring within U.S. networks for intrusions. As noted, in the battlespace, cyber by its very nature compresses time and space, and attacks can emanate from anywhere in the world with similar speed. U.S. forces must therefore engage adversaries in their networks and work to disrupt attacks in their early stages, because it is often too late once the networks have been compromised.

U.S. Cyber Command physically deploys teams abroad to work alongside the cyber forces of partner nations to operate in selected networks.[13] Since 2018, U.S. Cyber Command has conducted "Hunt Forward" missions more than 40 times in more than 20 countries.[14] The U.S. completed one of these missions in Latvia in May 2023 and discovered malware at the end of a three-month defensive operation.[15] Cyber Command also completed its first "Hunt Forward" mission in support of U.S. Southern Command in Latin America in 2023, although it did not disclose which country it supported.[16]

Cyber and the War in Ukraine

Russia's invasion of Ukraine is significant for cyber because it shows how cyber can be used in conjunction with conventional military assets. While cyber was largely overshadowed by other aspects of Russia's invasion like the movements of armor units and use of artillery, the Russians used it throughout as part of their overall war plan. This includes some notable operations that had effects beyond Ukraine. For example:

- The Russians targeted Viasat, an American satellite communications company that provided support to the Ukrainian military, with malware designed to erase its data before disabling it. Because the Russians did not limit the malware's scope, it ended up affecting other ground satellite components, causing hundreds of thousands of people outside of Ukraine to lose electrical power and their connection to the Internet.[17]

- A cyberattack against the City Council of Odessa, a major Ukrainian port city situated on the Black Sea, was timed to coincide with a cruise missile attack that was meant to disrupt Ukraine's response to Russian forces attacking in the South.[18]

- Cyberattacks have also been launched against many parts of Ukraine's infrastructure and government and civilian networks, including hospitals.[19]

These actions show that cyber operations are not limited to the military forces of combatants and, like World War II strategic bombing efforts, often extend to strike at infrastructure and areas of economic significance. The Russians continued to use cyber in Ukraine in 2023, reusing a malware program called Cadet Blizzard in February that was used originally in cyber-attacks in 2020.[20]

U.S. Cyber Command has provided analytic support and has sought additional ways to support Ukraine. It has deployed cyber teams to support both Ukraine and NATO allies, and those efforts have proved critical to protecting U.S. networks and critical infrastructure as well as those of NATO allies. Specifically, according to General Nakasone:

> U.S. Cyber Command (with NSA) has been integral to the nation's response to this crisis since Russian forces began deploying on Ukraine's borders last fall. We have provided intelligence on the building threat, helped to warn U.S. government and industry to tighten security within critical infrastructure sectors, enhanced resilience on the DODIN [Department of Defense Information Networks] (especially in Europe), accelerated efforts against criminal cyber enterprises and, together with interagency members, Allies, and partners, planned for a range of contingencies.[21]

Budget

Analyzing the budget for cybersecurity is difficult because of the degree of classification involved, but some data can be tracked with respect to USCYBERCOM and the broader Department of Defense. The Biden Administration's FY 2024 DOD budget request includes $13.5 billion for "cyberspace activities to defend and disrupt the efforts of advanced and persistent cyber adversaries, accelerate the transition to Zero Trust cybersecurity architecture,

and increase defense of U.S. critical infrastructure and defense industrial base partners against malicious cyberattacks.[22] The budget requests for FY 2023 and FY 2022, respectively, included $11.2 billion[23] and $10.4 billion[24] for cyberspace activities.

General Nakasone testified in March 2021 that "USCYBERCOM's FY21 budget [was] roughly $605 million, which covers the headquarters staff and the Cyber National Mission Force," and that "27 different components shape the Department's overall Cyber Activities Budget, which averages about $10 billion a year."[25] Given a 25 percent increase in budget authorities for cyber activities between FY 2021 and FY 2024, the DOD clearly believes that this area of competition is critical to success in defending the U.S. and its interests.

Capacity

The operational arm of U.S. Cyber Command is its Cyber Mission Force (CMF), and CMF teams are distributed across various mission sets. In 2013, a force of 133 teams with 6,200 personnel was envisioned based on the mission requirements at that time. All 133 CMF teams reached full operational capability in 2018.[26]

CYBERCOM's CMF teams are distributed across functional areas. The DOD's FY 2023 budget overview lists a total of 133 active CFM teams:

- "13 National Mission Teams to defend the United States and its interests against cyber attacks";
- "68 Cyber Protection Teams to defend DoD networks and systems against rapidly evolving-threats and technologies in cyberspace";
- "27 Combat Mission Teams to provide support to Combatant Commands by generating integrated cyberspace effects in support of operational plans and contingency operations"; and
- "25 Support Teams to provide analytic and planning support to National Mission and Combat Mission teams."[27]

It further specifies "14 new CMF Teams [to be] created in FY 2022 and FY 2023 to support the Combatant Commanders in Space Operations and for countering cyber influence."[28]

The teams are supported by four service components: Army Cyber Command (ARCYBER); Air Force Cyber Command (AFCYBER); Navy Fleet Cyber Command (FLTCYBER); and Marine Corps Forces Cyberspace Command (MARFORCYBER). These four commands, created when U.S. Cyber Command was created, provide the operational forces that make up the teams.

- ARCYBER supplies 41 teams to the CMF,[29]
- AFCYBER supplies 39 teams,[30]
- FLTCYBER supplies 40 teams,[31] and
- MARFORCYBER provides 13 teams.[32]

In April 2022, General Nakasone testified that Cyber Command had "approximately 6,000 Service members, including National Guard and Reserve personnel on active duty" in its 133 teams and was expecting to "grow by 14 teams over the next five years."[33] In March 2023, the Congressional Research Service similarly reported that:

> The CMF's 133 teams comprise approximately 6,000 servicemembers and civilians, including reserve component personnel on active duty. Reportedly, DOD expected the CMF to add 14 more teams to the existing 133 between FY2022 and FY2024, with four teams to be added in FY2022 and five in FY2023. The growth is projected to add about 600 people, a 10% increase, to the CMF. The new CMF teams are to include both civilian and military personnel. Each military service is responsible for recruiting and training their own CMF units. CYBERCOM has reported that it is in the process of centralizing advanced cyber training, with the Army serving as the executive agent.[34]

In addition, there is the Cyber Excepted Service (CES), "a DOD enterprise-wide personnel system for managing defense civilians in the cyber workforce."

> Congress established the authorities for this system as part of the FY2016 NDAA, and these provisions provide DOD with flexible tools to attract and retain civilians with cyber skills.

Prior to this law's enactment a majority of cyber positions were in the competitive service; certain existing competitive service employees were offered the opportunity to convert to CES. The DOD Chief Information Officer (CIO) is responsible for developing CES policy and providing recommended policy issuances to the Undersecretary of Defense for Personnel and Readiness. According to the DOD CIO's office, as of September 2022 there were 15,000 department employees in the CES, and the Department planned to expand the number of CES positions in coming years.[35]

Recruiting and retaining cyber talent is one of the key challenges for U.S. Cyber Command, which has invested in retention and incentive programs in an effort to keep the talent it cultivates. The high demand for cyber personnel in the private sector makes this challenge a difficult one.

Capability

As noted at the outset, the world of cyber operations is notoriously secretive, and much is classified. Thus, analyzing USCYBERCOM's capability as reflected in open-source (unclassified) literature is nearly impossible. However, the United States is viewed as one of the world's most capable cyber actors—an assessment that is based on its wide range of infrastructure and strategies and the advanced technologies that the U.S. is known to employ.[36]

Readiness

Because of the lack of open-source reporting, it also is nearly impossible to assess the readiness of America's cyber forces. The U.S. Government Accountability Office has identified some issues of training consistency in the past.[37] Standardizing and improving training is one of the main priorities for U.S. Cyber Command, along with retaining its talent, and both are critical to maintaining readiness.

Conclusion

Cyber is a key domain for the U.S. military. It also is increasingly important in the modern world generally. As seen in the various breaches and ransomware attacks that have come to light, cybersecurity for defense extends well beyond the Department of Defense. For the Joint Force, cyber supports military capabilities by ensuring that U.S. forces can operate in cyberspace without disruption, by making it difficult for enemies to conduct their own operations, and by conducting independent operations against targets as directed to achieve specified goals.

Within the DOD, U.S. Cyber Command bears the primary responsibility for the full spectrum of military cyber operations. Having reached its authorized manning levels, USCYBERCOM has shifted its focus to training the force to ensure that it will be as capable as possible in helping to advance and protect the nation's interests.

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Conclusion: U.S. Military Power

The Active Component of the U.S. military is two-thirds the size it should be, operates equipment that is older than it should be, and is burdened by readiness levels that are more problematic than they should be. To the extent that progress has been made, it has been at the expense of both capacity and modernization. Accordingly, this *Index* assesses:

- **The Army as "Marginal."** Based on the historical use of its ground forces in combat, the Army has less than two-thirds of the forces in its Active Component that it would need to handle more than one major regional conflict (MRC). This shortfall in capacity might be offset if the modernity or technological capability of its forces were very high, but this is not the case. The Army has fully committed to modernizing its forces for great-power competition, but its programs are still in their development phase, and it will be a few years before they are ready for acquisition and fielding.

  In other words, the Army is aging faster than it is modernizing, and an 8 percent decrease in fiscal year (FY) 2024 procurement and research and development (R&D) funding only adds to the problem. The Army remains "weak" in capacity with 62 percent of the force it should have but has significantly increased the force's readiness, exceeding its own internal requirement that 66 percent of its Brigade Combat Teams (BCTs) must be at the highest readiness levels, thereby scoring the highest level of "very strong." However, with operational training being pushed down to the company level below battalion and brigade, it is unclear how ready the Army's brigades actually are or how effective they would be in combat. The Army has a better sense of what it needs for war against a peer, but funding uncertainties could threaten the ability of the service to realize its goals.

- **The Navy as "Weak."** The technology gap between the Navy and its peer competitors is narrowing in favor of competitors, and the Navy's ships are aging faster than they are being replaced. The fleet is too small relative to workload, and supporting shipyards are overwhelmed by the repair work that is needed to make more ships available. This inadequate maintenance infrastructure prevents ships in repair from returning to the fleet in a timely manner, which in turn causes readiness problems as steaming days needed to train crews to levels of proficiency are lost. The Navy is projected to have a fleet of 280 ships by 2037, which is smaller than the current force of 298 and well below the 400 needed to meet operational demands. Current and projected funding shortfalls will make it harder to deal effectively with any of these serious deficiencies. This leaves the Navy unable to arrest and reverse the decline of its fleet as adversary forces grow in number and capability.

- **The Air Force as "Very Weak."** The Air Force has deployed an average of 28 fighter squadrons to major theaters of war since the end of World War II. This equates to 500 Active Component fighter aircraft to execute one MRC. Adding a planning factor of 20 percent for spares and attrition brings the number to 600 aircraft. An Air Force able to manage more than a single major conflict would necessarily require 1,200 active-duty, combat-coded fighter aircraft. Currently, the service has 897,

U.S. Military Power: Army

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity		✓			
Capability			✓		
Readiness					✓
OVERALL			✓		

U.S. Military Power: Navy

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity	✓				
Capability			✓		
Readiness		✓			
OVERALL		✓			

U.S. Military Power: Air Force

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity			✓		
Capability			✓		
Readiness	✓				
OVERALL	✓				

U.S. Military Power: Marine Corps

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity		✓			
Capability				✓	
Readiness				✓	
OVERALL				✓	

U.S. Military Power: Space

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity			✓		
Capability			✓		
Readiness			✓		
OVERALL			✓		

U.S. Military Power: Nuclear

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Nuclear Stockpile				✓	
Delivery Platform Reliability			✓		
Warhead Modernization			✓		
Delivery Systems Modernization				✓	
Nuclear Weapons Complex			✓		
National Labs Talent			✓		
Allied Assurance				✓	
OVERALL			✓		

three-quarters of what is needed as assessed by this *Index*. The service's inventory of bombers is worse at 64 percent.

Accounting for better inventories in aerial refuelers and strategic lift aircraft, the USAF currently is at 83 percent of the capacity required to meet a two-MRC benchmark. However, the geographic disposition of these aircraft limits the service's ability to deploy them rapidly to a crisis region, and its ability to replace combat losses is highly questionable because of low mission capability rates (a function of maintenance and trained crews). As a result, the USAF could likely handle only a single major conflict, and that only by resorting to global sourcing, leaving it unable to do much else.

New F-35 and KC-46 aircraft continue to roll off their respective production lines but in small numbers that are more than offset by aircraft retirements. Incredibly low sortie rates and flying hours across every pilot community will prevent any Air Force combat-coded fighter squadron from being able to execute all or even most of its wartime mission. At best, half of the cadre of pilots within the most capable units will be able to execute just "some" of the unit's wartime missions. There is not a fighter squadron in the Air Force that holds the readiness levels, competence, and confidence levels required to square off against a peer competitor, and readiness continues to spiral downward.

As with a three-legged stool, success or failure is determined by the weakest leg. The shortage of pilots and flying time for those pilots degrades the ability of the Air Force to generate the quality of combat air power that would be needed to meet wartime requirements even if aircraft production was higher and a larger percentage of the Air Force was comprised of newer aircraft.

- **The Marine Corps as "Strong."** The score for the Marine Corps was raised from "marginal" to "strong" in the *2022 Index* and has remained "strong" for two reasons: because the Corps' capacity is measured against a one-war requirement rather than the two-war requirement to which the other services are held and because the Corps has made extraordinary, sustained efforts to modernize, which improves capability, and enhance its readiness during the assessed year.

  Of the five services, the Marine Corps is the only one that has a compelling story for change, has a credible and practical plan for change, and is effectively implementing its plan to change. However, in the absence of additional funding in FY 2024, if the Corps retains its intention to reduce the number of its battalions from 22 to 21, this reduction will limit the extent to which it can conduct distributed operations as it envisions and to replace combat losses (thus limiting its ability to sustain operations). The Corps is already at 73 percent of the battalions and related air and logistical capabilities it should have. It needs to grow.

Though the service remains hampered by old equipment in some areas, it has nearly completed modernization of its entire aviation component, is making good progress in fielding a new amphibious combat vehicle, is fast-tracking the acquisition of new anti-ship and anti-air weapons, and is aggressively leveraging developments in unmanned systems and advanced computing and communication technologies. Full realization of its redesign plan will require the acquisition of a new class of amphibious ships, for which the Corps needs support from the Navy. The Corps is still too small and has no stated desire to grow, but it possesses fairly modern equipment, especially its air arm, and is wholly committed to adapting as rapidly as possible to meet the challenges of an evolving threat environment.

- **The Space Force as "Marginal." The Space Force has risen from "weak" in the *2023 Index* to "marginal."** The service doubled its counterspace weapons systems with the Ascent and Tetra-1 satellites, adding the first two known offensive systems to its portfolio. Other counterspace systems are probably being developed or, like cyber, are already in play without public announcement. Nevertheless, the USSF's current visible capacity is not sufficient to support, fight, or weather a war with a peer competitor.

  The numbers and types of Backbone and intelligence, surveillance, and reconnaissance (ISR) assets are sufficient to support global positioning, navigation, and timing (PNT) requirements and the majority of strategic-level communications, imagery, and collection requirements of the National Command Authorities and the Department of Defense. But while that capacity is growing, the Space Force is not capable of meeting current—much less future—on-demand, operational, and tactical-level warfighter requirements. The service's asset modernization plan has significantly accelerated the delivery of systems to the force over the past year, elevating USSF capabilities, but a majority of Backbone and ISR assets have exceeded their designed life spans, and the Department of the Air Force has been willing to delay and/or defer the acquisition of replacement systems. The capability of these satellites is marginal, but the service has narrowed gaps in space situational awareness and defensive and offensive capabilities.

  The mission sets, space assets, and personnel that transitioned to the Space Force and those that have been assigned to support the USSF from the other services have not missed an operational beat since the Space Force stood up in 2019. However, there is little evidence that the USSF has improved its readiness to provide nearly real-time support to operational and tactical levels of force operations or that it is ready to execute defensive and offensive counterspace operations to the degree that Congress envisioned when it authorized creation of the Space Force.

- **America's Nuclear Capability as "Marginal."** The status of U.S. nuclear weapons must be considered in the context of a threat environment that is significantly more dangerous than it was in previous years. Until recently, U.S. nuclear forces needed to address one nuclear peer rather than two or more. Given a U.S. failure to adapt rapidly enough to these developments and the Biden Administration's decision to cancel or delay various programs that affect the nuclear portfolio, overall U.S. nuclear weapons capability is assessed as "marginal," down from "strong" in the 2023 *Index*. U.S. nuclear forces face many risks that without the continued bipartisan commitment to a strong deterrent could warrant an eventual decline to an overall score of "weak" or "very weak.

  The reliability of current U.S. delivery systems and warheads is at risk as they continue to age and the threat continues to advance, and the fragility of "just in time" replacement programs only exacerbates this risk. In fact, nearly all components of the nuclear enterprise are at a tipping point with respect to replacement or modernization and have no margin left for delays in schedule—delays that appear to be occurring despite the best efforts of the enterprise. Since every other military operation—and therefore overall national defense—relies

on a strong nuclear deterrent, the United States cannot afford to fall short in fulfilling this imperative mission. Future assessments will need to consider plans to adjust America's nuclear forces to account for the doubling of peer nuclear threats. It is clear that the change in threat warrants a reexamination of U.S. force posture and the adequacy of our current modernization plans. Failure to keep modernization programs on track while planning for a three-party (or more) nuclear peer dynamic could lead to a further decline in the strength of U.S. nuclear deterrence.

In the aggregate, America's overall military posture must be rated "weak." The Air Force is rated "very weak," the Navy and Space Force as "weak," and the U.S. Army and the nuclear forces as "marginal." The Marine Corps is "strong," but the Corps is a one-war force, and its overall strength is therefore not sufficient to compensate for the shortfalls of its larger fellow services. Moreover, if the United States should need to employ nuclear weapons, the escalation into nuclear conflict would seem to imply that handling such a crisis would challenge even a fully ready Joint Force at its current size and equipped with modern weapons. Additionally, the war in Ukraine, which threatens the economic and political stability not just of Europe, but of other regions as well, shows that some actors (in this case Russia) will not necessarily be deterred from conventional action even though the U.S. maintains a strong nuclear capability. Thus, strong conventional forces of necessary size are essential to America's ability to respond to emergent crises in areas of special interest.

The *2024 Index* concludes that the current U.S. military force is at significant risk of being unable to meet the demands of a single major regional conflict while also attending to various presence and engagement activities. The force would probably not be able to do more and is certainly ill-equipped to handle two nearly simultaneous MRCs—a situation that is made more difficult by the generally weak condition of key military allies.

In general, the military services continue to prioritize readiness and have made some progress over the past few years, but modernization programs, especially in shipbuilding and production of fifth-generation combat aircraft, continue to suffer as resources are committed to preparing for the future, recovering from 20 years of operations, and offsetting the effects of inflation. With respect to the Air Force, some of its limited acquisition funds are being spent on aircraft of questionable utility in high-threat scenarios while R&D receives a larger share of funding than efforts meant to replace quite aged aircraft are receiving. As observed in the 2021, 2022, and 2023 editions of the *Index*, the services have normalized reductions in the size and number of military units, the forces remain well below the level needed to meet the two-MRC benchmark, and the substantial difficulties involved in trying to recruit young Americans to join the military services are frustrating even modest proposals to maintain service end strength.

Congress and the Administration took positive steps to stabilize funding in the latter years of the Budget Control Act of 2011 (BCA), thereby mitigating the worst effects of BCA-restricted funding, but sustained investment in rebuilding the force to ensure that America's armed services are properly sized, equipped, trained, and ready to meet the missions they are called upon to fulfill will be critical. This is amplified by the extent to which the United States has drawn from its inventories of munitions and equipment to support Ukraine's defense and the extent to which the defense industry has been limited in its ability to replenish depleted stocks, much less support the expansion and deepening of U.S. capabilities in preparation for any other conflict. The Administration's proposed defense budget for FY 2024 falls far short of what the services need to regain readiness and replace aged equipment, and proposals advanced in the House and Senate[1] account for barely half of the current rate of inflation, which averaged 8 percent in calendar year 2022 and 4.6 percent during the first six months of 2023.[2]

As currently postured, the U.S. military is at significant risk of not being able to defend America's vital national interests with assurance. It is rated as "weak" relative to the force needed to defend national interests on a global stage against actual challenges in the world *as it is* rather than as we wish it were. This is the inevitable result of years of sustained use, underfunding, poorly defined priorities, wildly shifting security policies, exceedingly poor discipline in program execution, and a profound lack of seriousness across the national

security establishment even as threats to U.S. interests have surged.

In 2023, this has been compounded by the cost of U.S. support for Ukraine's defense against Russia's assault, which is further exacerbated by the limited ability of allies in Europe to shoulder a greater share of the support burden. The war has laid bare the limited inventories of equipment, munitions, and supplies of all supporting countries as well as the limitations of the industrial base that will be required to replenish them.

Endnotes

1. At $842 billion, the defense budget for FY 2024 proposed by the White House is 3.2 percent higher than the $816 billion proposed for FY 2023. The $832 billion proposed by the Senate represents an increase of 2 percent (or 3.5 percent depending on one's reference point for what constitutes defense spending). The proposal voted out of the House Appropriations Committee generally aligns with the Senate's, but as this book was being prepared, it had not been subject to a vote of the full House. All of these numbers fall well below the current rate of inflation. See Chart, "DoD Topline Growth FY22–FY23–FY24 Budgets," in U.S. Department of Defense, Office of the Under Secretary of Defense (Comptroller/Chief Financial Officer), *United States Department of Defense Fiscal Year 2024 Budget Request*, PowerPoint Presentation, March 2023, p. 3, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2024/FY2024_Budget_Request.pdf (accessed August 22, 2023); news release, "Bill Summary: Defense Fiscal Year 2024 Appropriations Bill," Committee on Appropriations, U.S. Senate, July 27, 2023, https://www.appropriations.senate.gov/news/majority/bill-summary-defense-fiscal-year-2024-appropriations-bill (accessed August 22, 2023); and press release, "Committee Approves FY24 Defense Bill," Committee on Appropriations, U.S. House of Representatives, June 22, 2023, https://appropriations.house.gov/news/press-releases/committee-approves-fy24-defense-bill (accessed August 22, 2023).
2. CoinNews Media Group LLC, U.S. Inflation Calculator, "Current US Inflation Rates: 2000–2023," https://www.usinflationcalculator.com/inflation/current-inflation-rates/ (accessed August 22, 2023). Based on "U.S. Labor Department data published on Aug. 10, 2023."