

# **IS THE U.S. MILITARY GETTING SMALLER AND OLDER?**

**And How Much Should We Care?**

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## About the Author



**STEVEN KOSIAK** is a nationally recognized expert on the U.S. defense and international affairs budgets, with extensive experience in national security planning and budgeting. Currently, he is a partner with ISM Strategies, a Washington-based consulting firm that provides high-value counsel, expert assessments, and other strategic support to a range of clients working in the defense and international affairs fields. Areas of expertise include the federal budget process, especially within the executive branch, and the national security planning and budgeting processes within the Executive Office of the President, as well as the programs and budgets of the Department of

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## About the Defense Strategies & Assessments Program

The Defense Strategies and Assessments (DSA) program focuses on the strategic choices and opportunities available to preserve and extend U.S. military advantage in the face of evolving security challenges. From assessing the past, present, and future security environments to exploring alternative operating concepts, force structures, and basing options to testing alternatives through innovative scenarios and wargames, the DSA program aims to be a hub of innovation and action during a critical period in the debate concerning U.S. defense strategy and spending.

## Introduction

Concerns about the adequacy of the U.S. military frequently focus on two issues: whether its force structure has gotten too small, and whether U.S. forces are being modernized too slowly and are too dependent on an aging weapons inventory. While this report offers some partial answers to these questions, its goal is less to provide answers than to raise the level of discussion. The report is organized into four sections, focused respectively on:

- Historical trends in the size of the U.S. military’s force structure and the pace of its modernization efforts.
- The main drivers of these trends.
- The impact of these trends on U.S. military capabilities.
- Shortcomings in the U.S. military’s traditional approach to sizing, shaping, and modernizing its forces that may have left it with smaller and older forces than could have been sustained within historical funding levels.

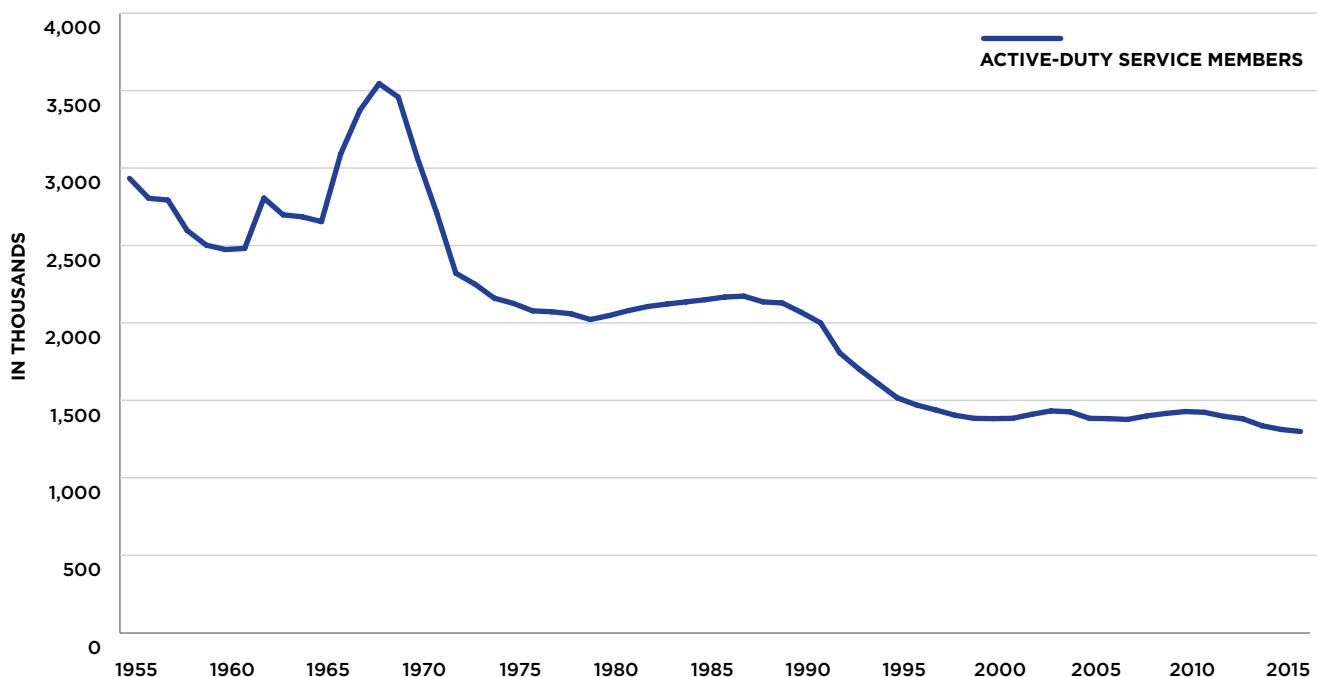
More than anything else, the goal of this report is to make clearer the degree to which historical trends in the U.S. military’s force structure and modernization plans are largely the result of policy and programmatic choices made by Department of Defense (DoD) and

service leadership. Contrary to a widely held belief, notwithstanding the influential role played by Congress and some other key actors, the size and shape of today’s forces are not simply a byproduct of budgetary or other pressures beyond DoD’s control. For good or ill, the trends described in this report largely reflect tradeoffs made by senior U.S. defense leadership. Among other things, this conclusion suggests that to the extent there are concerns about the current U.S. approach, more than anything else, charting a different course in the future will require a shift in the decisionmaking of that leadership.

### Overview of Trends in Force Structure and Modernization

Measured in terms of personnel and major weapons platforms, the size of the U.S. military has been on a generally downward trajectory for decades. The path has not been simple, uniform, or smooth, and there have been important exceptions in certain areas. Nevertheless, the overall trend is unmistakable and, viewed from a long-term perspective, quite consistent. In the mid-1950s, after the Korean War drawdown the U.S. military consisted of some 2.9 million active-duty troops. By 1975, after the Vietnam War drawdown it stood at about 2.1 million. After the end of the Cold War, it fell to some 1.4 million troops. And today, the U.S. military is manned by some 1.3 million active-duty service members (see Figure 1). Trends in weapons inventories paint a

FIGURE 1  
Active-Duty End Strength, 1955-2016<sup>2</sup>



more complex picture, depending upon the particular force structure elements considered. For example, the overall number of battle force ships in the U.S. Navy has declined dramatically over time – from over 1,000 ships in 1955 to some 560 ships in 1975 and about 270 ships today. However, the size of the carrier force – still very much the core of the U.S. Navy – has been reduced at a more measured pace, falling from 15 in 1975 to 10 today.<sup>1</sup> Similarly, while the number of Air Force fighter and attack aircraft has been cut significantly since the mid-1980s, falling from some 4,400 in 1985 to 2,500 by 2000, and to 2,000 today, the Air Force's fleets of transport and intelligence, surveillance, and reconnaissance (ISR) and related aircraft have been cut much more modestly – respectively, by about one-third and one-quarter since the 1980s. Despite this more complex pattern, however, the overall trend in numbers has clearly been consistently toward a smaller force, whether measured in terms of military personnel or major weapons platforms.

Paralleling this downward trend have been trends in both the frequency with which new weapons are introduced and in the aging of the military's inventory of major weapons platforms, reflecting a significant decline in weapons production rates. There has been even more variability across services in the aging of the weapons inventory than in cuts to force structure. Notably, the Air Force has witnessed a far more severe aging of its weapons inventory over the past several decades than have the other services. The impact on the Air Force can

be seen especially in its combat aircraft and tanker fleets. In 1980, the average age of the Air Force's fighter inventory was under 10 years;<sup>3</sup> today the average age stands at 24 years.<sup>4</sup> Likewise, over this same period the average age of the Air Force's bomber force has increased from under 20 years to 39 years, and its tanker fleet from about 20 years to 38 years.<sup>5</sup> But among the other services and in other areas, the trends in weapon systems aging have generally been substantially less significant. The average age of the Navy's inventory of battle force ships, for example, is now about 17 years, up from 13 years in 1980, but roughly the same age as it was in the late 1980s, when it approached the Reagan-era goal of a 600-ship Navy. In the case of Navy fighter aircraft, as well as Army ground combat vehicles and helicopters and Air Force airlift aircraft, the trends in aging have been similarly more modest than for Air Force combat aircraft and tankers. Nevertheless, the overall trend has clearly been toward an older weapons inventory for the U.S. military.

Similarly, the pace at which successive generations of new weapons platforms are developed and deployed has, over time, slowed significantly. This trend has, again, probably been most significant in the Air Force, particularly among combat aircraft. Between 1946 and 1965, the Air Force deployed 15 different types of fighter and attack aircraft. By comparison, between 1966 and 1985 it introduced only five new aircraft of these types. And in the roughly 30 years since, it has introduced only two new designs – the F-22 and the F-35.



*An F-35 Lightning II flies over the USS Zumwalt (DDG-1000) in the Chesapeake Bay in Maryland. The F-35 Lightning II is an example of the Air Force's newest aircraft design, which has also had a lengthy development and deployment process. (DoD/Flickr)*

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## A Smaller and Older Force: What Are the Main Drivers of These Trends?

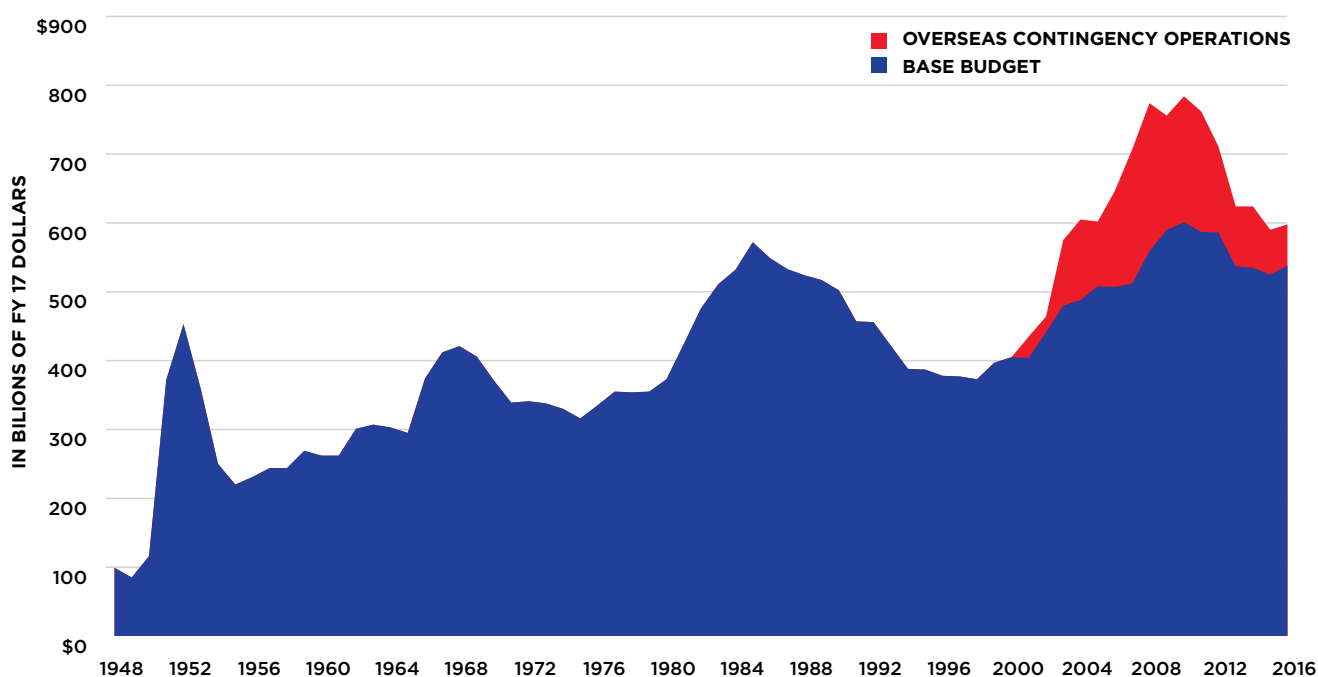
What have been the major drivers of the trends toward a smaller and older force? At the broadest level, it is possible to identify four major contributors. These are related to spending per troop on both military personnel and operations and maintenance (O&M) activities, and spending on both the development and procurement (i.e., production) of new weapon systems. Though easy to identify, as discussed in the next section of this report, understanding the policy choices and pressures that underlie trends in these areas is a substantially more difficult and less straightforward task. It is possible, however, to dismiss the two factors that are typically thought to be the most significant contributors. Despite widely held misconceptions to the contrary, neither a declining defense budget top line nor declining resources for weapons acquisition explain the trends in the size of the U.S. military or the aging of the weapons inventory. This is for a simple reason: Viewed from a long-term perspective, neither the defense budget top line nor overall acquisition funding has declined.<sup>6</sup>

If anything, over time, the defense budget top line has grown modestly in real (inflation-adjusted) terms. To be sure, the growth has been uneven and somewhat cyclical, with significant peaks and troughs. But a modest upward trend, with a significant cumulative effect, is nevertheless

identifiable (see Figure 2). And this is true even when the cost of military operations – currently funded through the Overseas Contingency Operations (OCO) account – is removed from the data. The “base” defense budget (i.e., the defense budget exclusive of war costs) has averaged about \$497 billion (Fiscal Year 2017 dollars<sup>7</sup>) annually over the past 20 years. This is actually about 10 percent more in real (inflation-adjusted) terms than provided in defense budgets over the preceding 20 years (1977–1996) and 76 percent more than provided in the 20-year period before that (1957–1976).<sup>8</sup> So it would be difficult to blame the trends in force size or weapons age on changes in the defense budget top line.

In the case of acquisition funding – including both research and development (R&D) and procurement spending – the long-term trend has been essentially flat. Even more so than the defense budget top line, acquisition funding has witnessed some fairly dramatic swings over time. But viewed from a long-term perspective (and given the length of time weapons are typically kept in the inventory, it is especially critical to take a long-term perspective in this case), acquisition funding has remained relatively stable. Exclusive of war-related costs, acquisition funding has averaged about \$168 billion annually over the past two decades; this is only 3 percent below the average of the preceding 20-year period.<sup>10</sup> And it is more than one-third higher than funding during the 1957–76 period – even including Vietnam War-related acquisition funding. As such, it would be difficult to

FIGURE 2  
Department of Defense Funding<sup>9</sup>



blame the trends toward the less frequent introduction of new weapon systems and lower weapons production rates on changes in acquisition funding.

Rather than changes in either the defense budget top line or overall acquisition funding, what explains the trends in the size of the U.S. military, as well as the slower introduction of new weapon systems and the age of its weapons inventory, are funding trends *within* the operations and support (O&S) and acquisition portions of the defense budget. Specifically, as discussed in more detail below, these trends have been driven primarily by relatively consistent and significant growth in spending per troop on O&S activities – both military personnel and O&M – and even more dramatic growth in both spending on the development of individual weapon systems and the unit procurement costs of those weapons.



*A soldier in an opposing-forces surrogate vehicle surveys the battlefield during a rotation at the National Training Center at Fort Irwin, California. The soldier, vehicle, and related maintenance costs all fall within O&S spending. (DoD/Flickr)*

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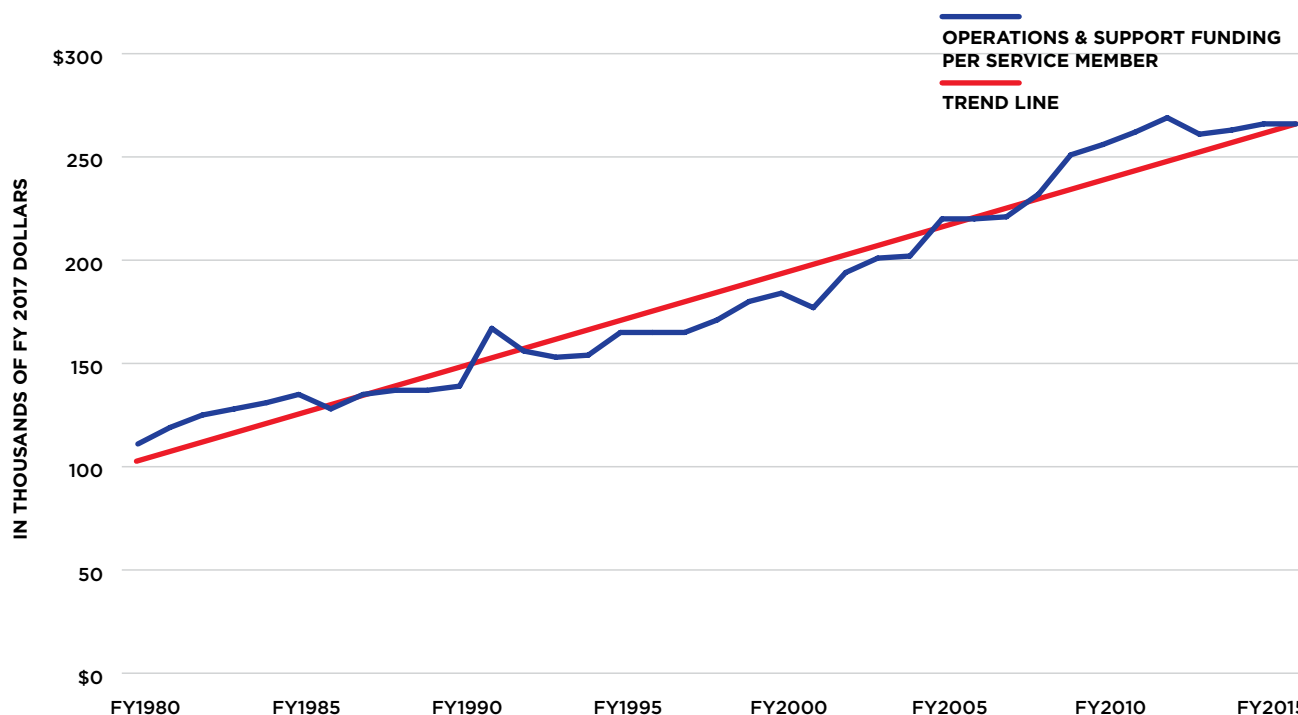
### **Cost Growth in Operations and Support Activities**

Adjusted for changes in the size of the U.S. military, spending on O&S activities – funded primarily through the military personnel and O&M accounts – has been on a consistently upward path since at least the 1950s. An imperfect but useful way to measure this trend is to consider changes in O&S funding – exclusive of war-related costs – per active-duty service member over time. By that measure, funding grew from about \$50,000 per troop in 1955 to \$111,000 in 1980 and \$184,000 by 2000. Today O&S spending per troop stands at about \$266,000. In other words, O&S spending has over time typically grown at an average annual rate of some 2 percent to 3 percent per year (see Figure 3).

O&S programs and activities include everything from military and civilian pay to funding for health care and other benefits, food, fuel, utilities, most spare parts, and other supplies. Increases in compensation both for military and civilian DoD personnel have played a significant part in the growth in O&S spending. Although the specific rate of growth has varied during different periods, viewed from a long-term perspective, both groups have received substantial increases, with the growth significantly exceeding the overall inflation rate. Funding for military personnel, which covers the cost of military pay, housing and subsistence allowances, retirement pensions, and most (but not all) other forms of military compensation outside of health care, has grown from about \$52,000 per active-duty service member in 1980 to about \$111,000 in 2016. That works out to an average annual growth rate of some 2.5 percent. Pay for civilian DoD personnel has increased more slowly. However, here too the long-term trend has involved significant growth. Between 1980 and 2016, for example, spending per civilian DoD employee grew from an average of some \$59,000 to \$93,000 per year.<sup>12</sup> Because compensation (exclusive of military health care) accounts for well over half of O&S spending, this growth has been the biggest driver of the overall increase in per capita O&S spending.

Another significant contributor to the growth in O&S spending has been the rise in health care expenditures. Although representing a far smaller part of overall O&S spending than pay, health care spending – an important component of military compensation – has, on a per capita basis, grown much faster than either military or civilian pay. Since 1980, spending on military health care has nearly quadrupled, reaching some \$48 billion in 2016.<sup>13</sup> This equates to an annual growth of 5 percent to 6 percent per active-duty service member.<sup>14</sup> To be sure, if

FIGURE 3  
**Operations & Support (O&S) Funding Per Service Member (in thousands of FY 2017 dollars)<sup>11</sup>**



the total number of beneficiaries, rather than the number of active-duty personnel, is used as the basis for the calculation, the growth rate has been lower – reflecting the fact that while the number of active-duty service members has declined by about one-third during this period, the total number of beneficiaries (which also includes dependents and retirees) has actually increased modestly, from about 9 million to 9.4 million. But that still implies a robust annual growth rate of some 4 percent per capita.

Part of this growth is the result of the same factors that have caused per capita health care costs to generally rise faster than the overall inflation rate in the civilian economy (e.g., higher costs associated with the introduction of new medical technologies). But various benefit expansions have also accounted for a significant share of this growth. Particularly costly was the establishment in FY 2002 of the TRICARE for Life program, which made TRICARE a “second payer,” covering any costs not covered by Medicare, for military retirees 65 and older. Taken together, growth in military and civilian pay and the rise in military health care costs have accounted for about two-thirds of the increase in O&S spending since 1980.

The remaining roughly one-third of the O&S budget is allocated to a broad range of other programs and activities supported through purchases of goods and services from the private sector. This includes everything from weapons and facilities maintenance and repair to the provision of fuel, some spare parts, and other consumables, as well as spending on utilities, information technology, and other support. As with military health care, spending in this category has grown especially rapidly and has substantially exceeded the growth rate in military and civilian pay.



Army range safety officers observe as soldiers fire M4A1 carbines at Camp Smith, New York. As costs in military compensation increase, the discussion regarding force structure and budget should take on renewed significance. (DoD/Flickr)



*At the U.S. Army Human Resources Command, Fort Knox, Kentucky, soldiers are briefed on GoArmyEd programs available through Tuition Assistance benefits. Tuition Assistance is just one example of improvements in troop compensation. (DoD/Flickr)*

The increased O&S spending per active-duty troop described above was not inevitable or preordained. To be sure, pressures caused by health care inflation, the need to compete with growth in private-sector compensation, and other factors to some extent outside of DoD's control created powerful incentives for DoD to increase spending per troop. And in the case of pay and other benefits, in particular, Congress and outside interest groups have frequently played a significant part in pushing spending upward. But ultimately, as much as anything else, the increased spending on O&S activities has reflected a policy choice. It is a choice that rests on the assumption that increasing pay and other O&S spending per troop is the best way to maintain or improve the effectiveness of the military's overall combat capabilities – even if that means reductions in the size of the force must be made to offset those higher per capita costs.

In the case of military and civilian personnel, DoD and service leadership have consistently taken the view that maintaining or improving quality is generally more important than sustaining numbers of personnel. This has been especially true since the establishment of the All-Volunteer Force (AVF) and the end of the draft in the 1970s. That the quality of the U.S. military's workforce – both uniformed military and civilian – has, indeed, improved significantly over time is clear. Among other things, this can be seen through changes in education, aptitude, and level of experience. DoD defines recruits who have both graduated from high school and score above the median on the Armed Forces Qualification Test (AFQT) as “high-quality”

recruits.<sup>15</sup> The share of such recruits fell from 43 percent in 1973 (when the draft was ended) to only 28 percent in 1977. However, thanks in part to a series of significant increases in compensation and other benefits, the numbers improved from the late 1970s through the late 1980s and had reached 60 percent by 1990. Since then, with the exception of the Army during a few years around 2000 and the peak years of the wars in Iraq and Afghanistan, the services have generally been able to maintain the share of recruits in this category at between 55 percent and 65 percent. Over time, the U.S. military has also become significantly older and more experienced. In 1969, only 18 percent of Army enlisted personnel had more than four years of service. By 1977 that share had increased to 37 percent, and by 2000 it had reached 50 percent.<sup>16</sup> This same general trend is also reflected in the experience of the other services, as well as among the officer corps.

And to the extent that significant improvements in personnel quality were achieved, increases in pay, as well as the sustainment – and in some cases expansion – of relatively generous medical and other benefits, clearly played a part in achieving that result. Such increases also certainly played a part in helping to sustain the force during wartime. The wars in Iraq and Afghanistan placed tremendous stress on the U.S. military, particularly the Army and Marine Corps. In part due to the significant pay raises provided over much of the past decade and a half, personnel quality was nevertheless maintained to a remarkable degree. Likewise, thanks in part to compensation increases, DoD has also been able to support a civilian workforce that has generally grown more professional and skilled over time.<sup>17</sup>



*U.S. and NATO paratroopers conduct mock door exercises before participating in a Peacemaster Unity airborne operation at Aviano Air Base, Italy. As budget considerations promote a reduction in overall U.S. military size, it is important to retain readiness. (DoD/Flickr)*



It is more difficult to correlate increases in O&S spending over time with improvements in areas other than personnel quality – such as unit readiness, equipment mission-capable rates, flying hours, steaming days, and other readiness indicators.<sup>18</sup> However, certainly DoD and the services believe that the funding increases in O&S, and particularly O&M, provided over the decades have been critical to sustaining readiness as measured by such indicators.

Since, as noted earlier, the long-term trend in the defense budget top line has been upward, but only relatively modestly so, and acquisition funding has remained relatively flat, the only possible way to accommodate this relatively consistent and enduring long-term increase in per capita O&S spending – both for military personnel and O&M activities – has been to reduce the size of the U.S. military. And that is the long-term tradeoff the U.S. military has consistently made. Overall funding for O&S activities is about \$341 billion today, 19 percent higher than it was in 1990, at the end of the Cold War, and more than double what it was in 1964 before the start of the Vietnam War. But the U.S. military today, measured in terms of active-duty service members, is 37 percent smaller than it was in 1990 and less than half as large as it was in 1964. Although in a world of less constrained resources many in DoD would certainly have preferred to fund both high readiness levels and a larger force

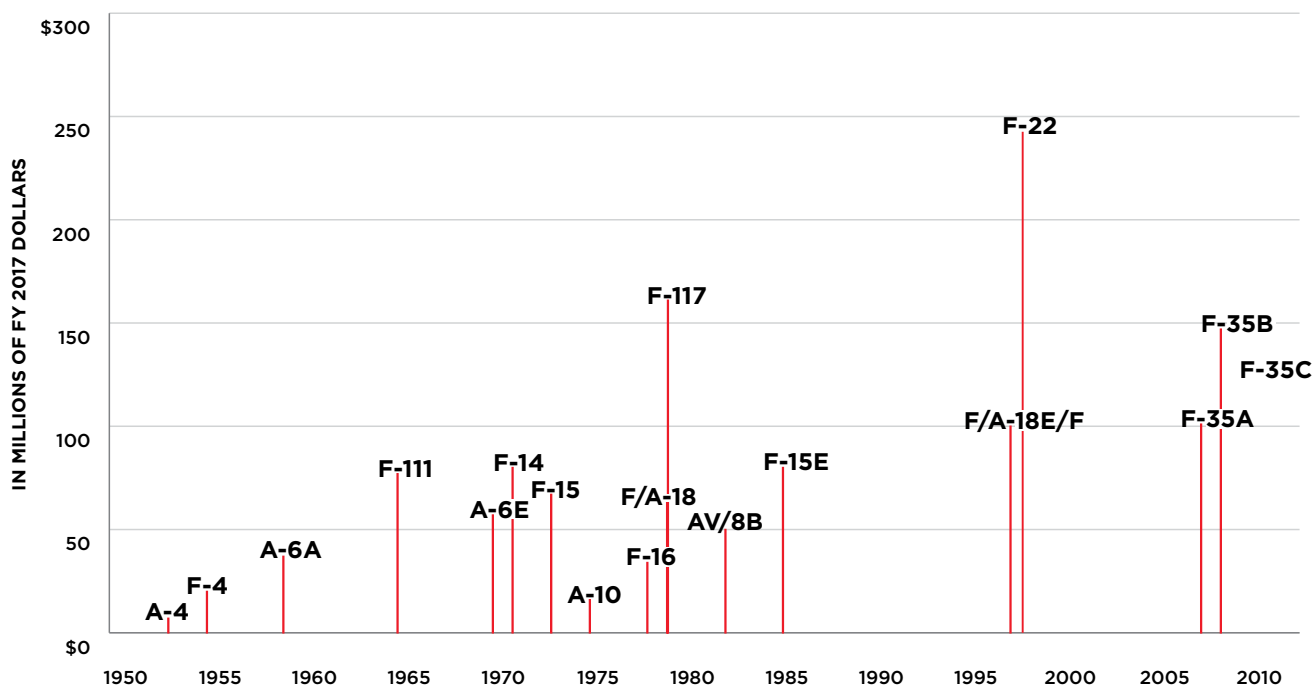
structure, given the choice between a smaller and ready force and a larger but to some extent “hollow” force, few would have chosen the latter.

### Cost Growth in Weapons Acquisition

Historically, successive generations of weapon systems have tended to cost far more to acquire than the systems they are intended to replace. This intergenerational cost growth has, if anything, been even more consistent and, in many instances, more dramatic than in the case of O&S cost growth. This trend is clearly illustrated with the F-35 fighter, which with total acquisition costs of about \$350 billion is far and away the Pentagon’s largest and most costly acquisition program. The F-35 is projected to cost about \$64 billion to develop and have a unit procurement cost averaging some \$110 million among the three variants of the aircraft being produced – for the Air Force, Navy and Marine Corps.<sup>19</sup> By comparison, the aircraft the F-35 is intended to replace had total development costs of about \$21 billion and unit procurement costs ranging from about \$16 million (for the A-10) to \$64 million (for the F/A-18).<sup>20</sup> This kind of cost growth is typical among major acquisition programs (see Figure 4).

Even more so than in the case of O&S spending, it is important to recognize that this growth in the cost of developing and procuring next-generation weapon systems is not something imposed on Pentagon planners.

FIGURE 4  
Unit Procurement Costs of Fighter and Attack Aircraft<sup>21</sup>





*An Air Force B-2 Spirit stealth bomber flies in the Pines Open House and Air Show at Joint Base McGuire-Dix-Lakehurst, New Jersey. With only 20 in service, the B-2 Spirit stealth bomber represents a newer capability with fewer numbers. (DoD/Flickr)*

There is no iron rule of nature mandating that successive generations of weapon systems cost so much more to acquire than the systems they are intended to replace. The Pentagon could – and occasionally does – buy next-generation systems that do not manifest such significant cost growth. Alternatively, it sometimes acquires entirely new types of weapon systems (e.g., unmanned aircraft) to perform certain missions. But for the most part, military planners have shown a very enduring preference for the acquisition of next-generation systems that are both far more capable and far more costly than their predecessors, even though – in the context of an overall acquisition budget that has remained relatively flat – this clearly means that next-generation systems

Along with the growth in O&S costs discussed earlier, these lower production numbers have contributed to the decision by DoD to accept cuts in the size of the U.S. military over time. However, the impact of lower production numbers on force size has been mitigated to some extent by another long-term feature of the U.S. military's approach to modernization: longevity. The flip side of its preference for pursuing the acquisition of very capable and costly next-generation weapon systems is a willingness to keep current-generation systems in the force longer. This willingness is at least implicitly based in part on a belief that, as platform technologies have matured over time, the pace at which they must be replaced has slackened and in part on the view that the effective

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must be introduced less frequently and procured in smaller numbers. As noted earlier, the time separating the introduction of successive generations of weapon systems has grown substantially over the past several decades, while procurement rates for many weapon systems have likewise declined significantly.

service lives of older platforms can be extended through the exploitation of advances in precision strike, ISR and related technologies.

### The U.S. Approach to Shaping, Sizing, and Modernizing its Forces

To summarize, the persistent trend toward a U.S. military that is smaller, generally equipped with older weapons platforms, and less frequently infused with next-generation weapon systems reflects several relative constants in DoD policymaking and planning:

- Support for the acquisition of increasingly costly and more capable next-generation weapon systems, as well as higher spending on personnel and other operations and support activities.
- A willingness, as these costs grow, to trade off quantity for quality in terms of both weapons platforms.
- And (*partially* mitigating the need to make the above tradeoffs) a belief that, as platform technologies have matured over time, the pace at which they must be replaced has slackened, and faith in the potential for extending the effective service lives of older platforms through the exploitation of advances in precision strike, ISR, and related technologies.

Absent these three policy choices and assumptions, the rapid growth in development and unit procurement costs, as well as O&S costs per troop, experienced since the 1950s could not have been reconciled with the significant but slower rate of growth that occurred in the defense budget top line over those same years. The next question we turn to concerns the effectiveness of this approach, both in principle and in execution. Put bluntly, should it matter that U.S. military forces have been getting smaller and older, and if so, what can and should the United States do about it?



An aircraft launches from the flight deck of the USS Carl Vinson (CVN-70) as the ship transits the Pacific Ocean. Based on the costs and advancements in precision strike technologies, the aircraft carrier sits as a focal point in the discussion of modernizing the force. (DoD/Flickr)

### How Much Should We Care that U.S. Forces Are Getting Smaller and Older?

Whether the United States should care that, over time, the size of its military has been declining, new weapons platforms have been introduced less frequently, and the age of its weapons inventory has been growing depends in part on what the point of comparison is. If one looks at today's forces and assesses them compared with the forces that existed a decade and a half ago, or at the end of the Cold War, or against the threats that exist today, the answer is generally reassuring. For the most part, although smaller and often equipped with older weapons platforms, today's U.S. military forces are far more capable than the significantly larger and chronologically newer forces that composed the U.S. military in earlier years.

On the other hand, although the U.S. military's general approach to managing its forces appears to have served it well, particularly the tradeoffs it has made in terms of force size and platform age, reasonable minds may differ on the wisdom and cost-effectiveness of some specific tradeoffs made in implementing this approach. Put differently, even if the general direction was appropriate, it is fair to ask whether in some instances a more cost-effective balance might have been struck between quantity and quality, both in terms of forces and weapons platforms – perhaps resulting in a somewhat larger military equipped with somewhat newer weapons platforms.

### U.S. Forces Have Become Far More Capable Even as They Have Become Smaller and Older

In general, the traditional U.S. approach to shaping, sizing, and modernizing its forces appears to have served it well. Weapon-for-weapon and unit-for-unit, U.S. military forces have become progressively more capable, and in many cases far more capable, over the past several decades. Moreover, even taking into account its smaller size, the slower introduction of next-generation weapons platforms, and aging weapons inventory, *taken as a whole*, the U.S. military has grown far more capable and today clearly remains the world's pre-eminent military power.

The U.S. military's improved capabilities are most vividly illustrated by its performance in the wars it has waged over the past several decades. Beginning with the 1991 Persian Gulf War, through the 1999 conflict in Kosovo, the 2001 invasion of Afghanistan, the 2003 invasion of Iraq, and the 2011 conflict in Libya, as well as the ongoing campaign against the Islamic State group (ISIS) in Iraq and Syria, the U.S. military has proved



*Ordnance awaits storage in the hangar bay of the aircraft carrier USS Dwight D. Eisenhower (CVN-69) in the Persian Gulf. Developments in smart munition systems are a prime example of a more capable military. (DoD/Flickr)*

highly effective. It has shown itself to be especially dominant in conventional conflicts or during the initial conventional phases of longer campaigns – where, at least when given free rein, it has consistently been able to defeat its opponents quickly and decisively while suffering relatively modest losses. Its power has proved less dominant and decisive when involved in stability operations or irregular warfare. But even then, the U.S. military has displayed a level of professionalism and effectiveness that it is doubtful the military of any other country could match.

The impact and effectiveness of the U.S. approach to sizing, shaping, and modernizing its forces can perhaps most easily be seen in the case of U.S. air forces. These forces have become far more capable even as they have become much smaller and, on average, older over the decades. As in most other areas of weapons modernization, U.S. planners have consistently decided to acquire successive generations of combat aircraft that cost far more both to develop and produce than the systems they are intended to replace; to accept, as a tradeoff, the introduction of these next-generation aircraft both less frequently and in smaller numbers; and to continue to rely on existing current-generation systems for progressively longer periods.

The U.S. Air Force has invested enormous resources in the acquisition of a handful of next-generation aircraft, including, since the early 1990s, the B-2 bomber, the F-22 and F-35 fighters, and now a new bomber. In each case, the number of aircraft produced and fielded, at least to date, has been far smaller than for their predecessors.<sup>22</sup>

And the systems have taken far longer to develop and field than was the case with earlier systems. These new platforms have incorporated important design features that cannot be retrofitted onto current-generation aircraft – perhaps most importantly stealth (i.e., radar-evading) characteristics, but in the case of the F-22 also a super-cruise capability. Even though these next-generation platforms have been deployed in relatively small numbers, they have contributed significantly to the Air Force’s combat capabilities. The B-2 and other stealthy aircraft have played a critical role in destroying key targets, especially early in conflicts before enemy air defenses have been degraded, and the F-22 is unmatched in air-to-air combat capabilities.

Complementing this relatively small force of next-generation combat aircraft, the Air Force has also retained a significant number of current-generation aircraft, including F-15 and F-16 fighters, A-10 attack aircraft, and B-52 bombers. These aircraft have in some cases reached unprecedented ages. But they have continued to perform effectively in many roles. This is partly due to the fact that, notwithstanding advances in stealth and in some other areas of platform design, the pace of technological change has not been so rapid in recent decades as to render current-generation aircraft essentially obsolete – at least not for all missions and if complemented with even relatively small numbers of next-generation systems.

Perhaps more importantly, the effective service lives of current-generation combat aircraft have been greatly expanded by exploitation of advances in sensors, precision-guided munitions (PGMs), ISR, and other information-related technologies. Unlike some aircraft features, such as stealthiness, which must be incorpo-

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rated into the actual structure and design of the aircraft, these technologies can to a large extent be retrofitted onto, or carried by, existing current-generation aircraft or taken advantage of through data links to specialized ISR aircraft or satellites.

Taken together, the combination of relatively small numbers of highly capable but costly next-generation combat aircraft and chronologically older but still capable current-generation aircraft equipped with advanced sensors and PGMs, and supported by other ISR assets, has left the United States with highly effective air forces. Some idea of the extent to which U.S. airpower has grown in effectiveness over the past several decades despite reductions in the number of aircraft deployed can be gained by comparing the capabilities and performance of U.S. air forces in the 1991 Gulf War with the performance of those forces in more recent conflicts. U.S. air forces proved highly effective in the 1991 Gulf War. In terms of number of targets destroyed, speed and decisiveness of the air campaign, and losses suffered by U.S. air forces, the war was a tremendous success. Desert Storm owed much of its success to the effectiveness of a small number of first-generation F-117 stealth aircraft and PGM-capable aircraft. But compared with more recent operations, both the stealth and PGM revolutions were in their infancy in that war.

In 1991, the U.S. military possessed some 5,000 combat aircraft. After the Cold War ended, this force was reduced by about one-third. However, through the 1990s, the military also made a number of dramatic improvements in the capabilities of that force. Among other things, the military began fielding its stealthy B-2 bombers and, perhaps more importantly, greatly expanded the number of combat aircraft equipped with advanced sensors and PGMs. Laser-guided bombs (LGBs) were the most widely used and effective type of PGM employed by the

## Today, virtually all U.S. combat aircraft are capable of employing precision-guided munitions autonomously.

U.S. military in the 1991 Gulf War. However, the ability to employ LGBs during the war was severely constrained because of the relatively small number of aircraft in the U.S. inventory equipped with laser designators. The United States had only 200 to 300 such aircraft at the time.<sup>23</sup> By comparison, in large part because of the procurement of special navigation and targeting pods that could be attached to existing aircraft, the number of fighters equipped with such designators more than doubled by 2001, when the United States invaded Afghanistan. Today, virtually all U.S. combat aircraft are capable of employing PGMs autonomously, including the satellite-guided Joint Direct Attack Munition (JDAM).<sup>24</sup>

Since the 1991 Gulf War, there has been a similarly dramatic increase in the number of combat aircraft capable of operating at night and in all weather – primarily through modifications made to existing aircraft. In 1991, the U.S. military possessed only a small number of such aircraft. However, by the time of the 2001 invasion of Afghanistan, the number of aircraft equipped with forward-looking infrared (FLIR) systems, or night vision goggles and modified cockpits, had grown to over 1,000. And today virtually all combat aircraft possess similarly improved sensor capabilities.<sup>25</sup>



*A Marine cleans the barrel of an M777 howitzer during Spartan Fury at Marine Corps Base Hawaii. As success in precision-guided munitions increases, the military has looked toward similar smart munitions for artillery. (DoD/Flickr)*

This proliferation of PGMs and advance sensors has greatly enhanced the effectiveness of U.S. airpower. Unguided “dumb” bombs dropped from aircraft often fall hundreds of feet from their intended targets. For example, during the Vietnam War, F-105 fighters armed with unguided bombs achieved circular error probabilities (CEPs) on the order of 500 feet when attacking heavily defended targets.<sup>26</sup> By contrast, LGBs and satellite-guided JDAMs have consistently achieved CEPs in the 10- to 20-foot range. Moreover, both of these munitions have had reliability rates exceeding 90 percent in recent conflicts.<sup>27</sup> As Figure 5 shows, the use of PGMs by U.S. air forces has increased dramatically since the 1991

**FIGURE 5**  
**Precision-Guided Munitions Used by U.S. Forces in Recent Conflicts<sup>28</sup>**

CONFLICT	UNGUIDED BOMBS	PGMS	PERCENTAGE PGMS
Iraq (1991)	210,000	17,161	8
Kosovo (1999)	16,587	6,728	29
Afghanistan (2001-02)	11,201	12,001	52
Iraq (2003)	10,383	18,365	64

Gulf War, increasing from only 8 percent of the ordnance delivered during that war to 64 percent only 12 years later, in the second Gulf War.

Taken together, the employment of relatively small numbers of next-generation combat aircraft and the growing use of PGMs, supported by the widespread employment of improved sensors and other ISR and information technologies, meant that the U.S. Air Force needed to deploy only about 40 percent as many fighter aircraft in support of Operation Iraqi Freedom in 2003 as it did during Operation Desert Storm.<sup>29</sup> The extent to which U.S. air forces have grown more effective and capable, even as they have shrunk in size, can also be seen in the extremely low casualty rates suffered by those forces in recent conflicts. U.S. and allied air forces flew some 43,000 strike sorties in the 1991 Gulf War and suffered 38 combat losses. This loss rate was several times lower than that suffered by U.S. air forces flying over North Vietnam during the Vietnam War. In the 1999 war in Kosovo, U.S. air forces flew about 10,500 such sorties and lost only two aircraft to Serbian air

defense. More recently, U.S. air forces lost no aircraft during the air campaign supporting the initial invasion of Afghanistan in 2001 and lost only one aircraft due to enemy action in the 2003 invasion of Iraq.<sup>30</sup>

The degree to which the U.S. approach to shaping, sizing, and modernizing its forces has led to dramatic increases in effectiveness, even as the size of its forces has declined and the age has increased somewhat, can also be seen in the case of U.S. naval forces. As noted earlier, the number of ships in the U.S. Navy has declined significantly over time. In 1989, at the end of the Cold War, it stood at some 552 battle force ships. By 2001 it had been cut to just over 300 ships – where it has hovered for most of the past 15 years. However, focusing on these numbers misses the significant improvement in overall combat capabilities that has occurred in the fleet over that same period.

Among other things, this improvement can be seen in the changes in the number of capital ships (primarily aircraft carriers) and large surface combatants capable of delivering either long-range air or missile strikes against targets ashore. In 1989, the fleet contained only 48 such ships. By comparison, the much smaller fleet of 2001 included 91 ships capable of delivering these kinds of long-range strikes.<sup>31</sup>

Likewise, over the past two and a half decades the U.S. Navy has greatly improved its ability to rapidly launch both air defense and cruise missiles. It did so by replacing above-deck rail missile launchers and rotary magazines with the vertical launch system (VLS), which allows for much more efficient storage and firing. As a result of the transition to VLS



*An Air Force F-15 Strike Eagle flies over Iraq in support of Operation Inherent Resolve. As technology continues to be useful, the military should examine how to cost-effectively manage its life expectancy. (DoD/Flickr)*

cells, even as the size of the fleet shrank, the number of missiles carried aboard major surface combatants increased, from 7,133 in 1989 to 7,917 in 2001.<sup>32</sup> Moreover, the number of missiles that were immediately ready to fire grew from under 40 percent to over 95 percent,<sup>33</sup> among other things, dramatically improving the fleet's ability to defend against saturation attacks.

Unit-for-unit, U.S. ground forces have likewise become far more effective over the past several decades. Moreover, as in the cases of air and naval forces, it is also clear that – at least for conventional conflicts – U.S. ground forces have become not only more effective as individual units, but in terms of overall capabilities as well. The Army and Marine Corps deployed the equivalent of about 11 divisions in the 1991 Gulf War.<sup>34</sup> By comparison, they deployed the equivalent of roughly four divisions during the 2003 invasion of Iraq, including only a single heavy Army division.<sup>35</sup> And the objectives in that conflict, which required U.S. forces to drive all the way to Baghdad and occupy the entire country, were substantially more ambitious than they had been in the earlier war. The recognition that individual units had become far more effective also played a significant part in the Army's decision in the 2000s to move from a force organized around divisions (of three brigades each) to a force organized around a much larger number of brigade combat teams (BCTs). It is less clear in the case of stability operations and irregular warfare how significant the impact of improvements in the capabilities of individual units has been. The introduction of new technologies such as unmanned aerial vehicles (UAVs), as well as improved training, has led to some improvement in capabilities. But these missions continue to be relatively labor-intensive, reducing the ability of technology to effectively substitute for manpower.

Across all the services and domains of warfare, improvements in personnel quality, supported by increases in pay and other compensation, have also clearly enhanced the performance of U.S. forces. As noted earlier, measured in terms of education, test scores, age, and experience, the U.S. military has become progressively more professional over time. Moreover, a large number of studies have shown that intelligence and experience are positively correlated with productivity and, specifically, the ease of training and the ability to perform a variety of military tasks.<sup>36</sup> For example, research has shown that, in the case of both Patriot air defense and tank crews, personnel with higher test scores tend to perform better than those with lower scores both with simulators and at firing ranges. Likewise, educational attainment has been positively



*Marines conduct a pass in review during a wreath-laying ceremony at the Marine Corps War Memorial in Arlington, Virginia. As the military improves compensation, retention improves and so too does performance. (DoD/Flickr)*

linked to retention and, thus, experience. In turn, greater experience has been linked to better performance – with studies showing that career military personnel are at least 50 percent more effective than first-term personnel in a variety of important tasks.<sup>37</sup>

Closely linking higher O&M spending to the U.S. military's ability to effectively operate, support, and sustain its combat forces is more difficult. Nevertheless, there is good reason to believe those increases have played an important part in sustaining and, in some areas, improving the capabilities and readiness of U.S. forces. Increases in the salaries of civilian DoD workers in part reflect the increased professionalism and experience of that workforce. And presumably these trends – as has been the case in terms of military personnel – have led to similarly significant improvements in the performance of the civilian workforce.

**Measured in terms of education, test scores, age, and experience, the U.S. military has become progressively more professional over time.**

Some of the historical increase in O&M spending has also been used to cover cost growth related both to the aging of the military's inventory of weapons platforms and the introduction of new next-generation weapon

systems. As equipment ages, a point is reached where the costs associated with operating the system and keeping it in good repair begin to grow – sometimes significantly. But buying new equipment does not typically reduce operating costs. In most cases, the services have emphasized combat performance, rather than low operational costs, in the design of next-generation systems. As a result, those systems have tended to cost more to operate and support than the systems they replace. Absent increased spending in these areas, it is likely that mission-capable rates and other equipment readiness indicators would have fallen over time. The impact of these trends on O&M costs should not be overstated – equipment operations and support costs, although significant, constitute only a relatively small share of the overall O&M budget. But they are one of the clearest and direct links between higher spending and the maintenance of high levels of readiness.

### Shortcomings and Possible Improvements to the U.S. Military's Current Approach

Viewed from a long-term perspective, the overall approach taken by the U.S. military to shaping, sizing, and modernizing its forces appears to have yielded highly capable forces. And the direction of the tradeoffs embraced in that approach seems to have been effective and appropriate. That is not, however, to say that this approach has been flawless either in design or execution. As noted earlier, DoD policymakers and planners do not operate in a vacuum, but rather in a world that, to varying degrees, is influenced by a range of political, bureaucratic, and other, sometimes parochial, interests. Moreover, even to the extent that DoD and service leadership are able to operate independently of these interests, there is room for honest disagreement concerning, among other things, the wisdom and cost-effectiveness of some of the specific tradeoffs made in implementing this approach. Reasonable minds can differ on everything from technical and operational issues to views about grand strategy and the timing and nature of the challenges facing the U.S. military – and all of those issues and questions can affect one's views concerning the right balance among various tradeoffs.

Put differently, even if the general direction has been appropriate, it is fair to ask whether in some instances a more cost-effective balance might have been struck between quantity and quality, both in terms of forces and weapons platforms – perhaps resulting in a somewhat larger military equipped with somewhat newer weapons platforms.



*An AH-64E Apache helicopter taxis after refueling during training at Orchard Combat Training Center, Idaho. As newer technology increases procurement cost, tradeoffs between numbers and capabilities are likely to be a consideration. (DoD/Flickr)*

### Military Personnel

Although the U.S. military is widely known for developing and deploying the world's most advanced weapon systems, probably nothing has been more critical to its success over the past several decades than the quality of its personnel. As noted earlier, judged by almost any measure of personnel quality, the U.S. military today is at or near its historical peak and has progressed dramatically since the early days of the All-Volunteer Force. Moreover, a military manned by such an educated, skilled, experienced, and motivated workforce requires the provision of substantial resources to support recruitment and retention efforts, including significant and consistent increases in pay and the sustainment of other important benefits, such as health care.

This suggests that much of the growth in spending on military pay and other benefits that has been provided since the 1980s has been both necessary and appropriate. There is, however, also good reason to believe that some of this spending growth was unnecessary or at least inefficient and that, in some cases, the services could have achieved similar results through a more cost-effective approach to compensation. And had per capita compensation costs grown even modestly more slowly than they did historically, substantial savings could have accrued. In turn, those savings might have allowed the U.S. military to retain more of its force structure or invest more funding in acquisition, with implications for the age of the weapons inventory and the pace of modernization.

As noted earlier, military compensation has grown substantially over the past three decades. Given structural differences between military and civilian compensation, it is difficult to precisely compare the two. However, it is clear that, overall, military compensation



has grown at a significantly faster rate than has compensation for workers in the civilian economy over this same period.<sup>38</sup> It is also clear that, adjusted for age and education, military personnel are today relatively highly compensated compared with their civilian counterparts.

A 2006 study by the Congressional Budget Office (CBO) found that, on average, regular military compensation (RMC) exceeded the 75th percentile of earnings for comparably educated civilian workers.<sup>39</sup> In other words, it found that three-quarters of civilian workers with comparable education had earnings that were below the average RMC, and one-quarter had earnings that were higher. Moreover, an updated analysis by DoD estimated that, by 2009, the average RMC for enlisted personnel had reached the 90th percentile compared with the earnings of comparably educated civilians. And for officers, the DoD study found that average RMC in 2009 was at the 83<sup>rd</sup> percentile compared with the earnings of civilians with roughly comparable levels of education.<sup>40</sup>

If noncash and deferred benefits (such as health care and military pensions, which are excluded from RMC) are taken into account, the gap between military and civilian compensation is even greater. According to estimates by DoD and CBO, adding these other benefits increases the value of military compensation, per active-duty service member, by some 80 percent to 100 percent compared with RMC.<sup>41</sup> By contrast, CBO estimates that noncash and deferred benefits boost the overall value of compensation for the average, comparably educated civilian worker in the private sector by only about 45 percent.<sup>42</sup>

**By 2009, the average regular military compensation for enlisted personnel had reached the 90th percentile compared with the earnings of comparably educated civilians.**

It is certainly appropriate, and likely necessary, that military personnel be more highly compensated than comparable workers in the civilian economy. To some extent, this higher compensation can be viewed as a premium paid to service members, who face dangers and challenges that few in the civilian economy face. It may, however, be the case that the premium currently being paid is higher than necessary to sustain the quality force that the services need. In the past, DoD has indicated



*Marine Corps Gen. Joe Dunford, chairman of the Joint Chiefs of Staff, talks with deployed Marines about the importance of the mission in Irbil, Iraq, in 2016. Should the discussion of troop compensation take into account the risk to the individual soldier's life? (DoD/Flickr)*

that to meet its goals for recruitment and retention, in general, it needs to keep RMC at the 70th percentile of earnings for comparably educated civilians.<sup>43</sup> Although, given the lower pay raises received in recent years, military personnel may no longer exceed this benchmark by quite as much as they did in 2009, it seems certain that they remain substantially above it – especially if health care and other benefits are included in the totals.

Perhaps a more compelling reason to suspect that the increases in military compensation over the past several decades have been higher than necessary to achieve the services' goals for high-quality personnel is that in many instances the growth has been focused in areas and on forms of compensation that may be relatively inefficient in terms of their impact on recruitment and retention. In general, research indicates that improvements in compensation that provide relatively immediate and easily recognizable benefits (such as increases in pay), and especially those that are targeted to the classes of individuals the services need to keep (such as retention bonuses) and that reward performance rather than time in service, are the most cost-effective.<sup>44</sup> These, and similar tools, are the best means of attracting and retaining personnel in those critical fields and specialties where competition with the civilian sector is most intense (and there are always some particular areas where such competition exists, even when compensation levels, overall, match or exceed those for comparable civilian workers).

By contrast, increases in compensation that focus on noncash benefits, and especially noncash benefits

that are deferred until service members retire from the military, tend to be less cost-effective.<sup>45</sup> Unfortunately, despite these findings, which have been widely understood for many years, most of the increases in military compensation provided in recent decades – particularly since the late 1990s – have been provided in an across-the-board fashion and largely directed to increases in noncash and deferred benefits. For example, by one estimate, between 1999 and 2005, average military compensation per active-duty service member increased by some \$28,000, with almost 60 percent of that funding allocated to noncash and deferred benefits. This included both the establishment of the TRICARE for Life program and the enhancement of pensions for military retirees. Moreover, all but a relatively small fraction of the remaining 40 percent that was allocated to immediate cash compensation was provided in an essentially across-the-board fashion.<sup>46</sup>

**In many instances the growth has been focused in areas and on forms of compensation that may be relatively inefficient in terms of their impact on recruitment and retention.**

Estimating how much DoD might have saved over the past several decades had it focused increases in military compensation in a more cost-effective manner is an impossible task, or at least one well beyond the scope of this report. However, given how much of DoD's budget is accounted for by military compensation, as well as the substantial and long-term nature of the trend toward higher spending, the cumulative impact of even a relatively modest reduction in per capita costs is potentially significant. For example, had an emphasis on more cost-effective forms of compensation allowed DoD to trim its spending on military personnel by as little as 0.3 percent (less than one-third of 1 percent) on average over the past three decades, its annual costs would today be about \$15 billion less – enough to cover pay and benefits for some 130,000 additional military personnel.



*An airman performs maintenance on the engine on a CV-22 Osprey tilt-rotor aircraft at Hurlburt Field, Florida. A high state of readiness will often incur high maintenance costs. (DoD/Flickr)*

### Operations and Maintenance

As discussed earlier, per capita spending on O&M activities has increased significantly and consistently for decades – with rates of growth generally exceeding even the relatively high growth rates associated with spending on military personnel. As in the case of spending on military personnel, it is clear that much of this growth was needed to ensure that U.S. forces were kept at high states of readiness. However, again as with spending on military compensation, there is good reason to believe that more efficient spending could have reduced costs at least modestly.

Given the difficulty of tracking sources of cost growth in O&M spending, especially outside of pay for DoD civilian employees and military health care, it is in some ways even more difficult to suggest areas within the O&M budget where, over the past several decades, DoD might have been able to trim its spending. On the other hand, over the years, numerous expert panels and studies have concluded that substantial O&M savings could be achieved. For example, a 2014 study by a task group of the Defense Business Board (DBB) estimated that by adopting a range of measures commonly used by businesses in the private sector, DoD could lower its annual operating costs by \$18 billion to \$23 billion a year.<sup>47</sup> The report focused especially on the potential for DoD to streamline its logistics and supply chain management. Specific measures recommended by the panel include:

- Expanding the strategic sourcing initiatives of the Defense Logistics Agencies and other defense agencies (\$8 billion in annual savings).

- Further reducing excess inventories (\$2 billion to \$3 billion in savings).
- Consolidating DoD depots, reducing warehouse space, and other efficiencies (\$1 billion to \$2 billion in savings).
- Reducing DoD's maintenance and related infrastructure (\$8 billion in savings).
- Conducting another round of Base Realignment and Closure (\$1 billion to \$2 billion in savings).<sup>48</sup>

The potential for *future* savings of this magnitude suggests that had DoD implemented similar initiatives in the *past*, it could have avoided a comparable amount of cost growth. As with spending on military personnel, given the size of the O&M budget and its relatively rapid rate of growth historically, even a modest reduction in that growth rate could have yielded significant savings. In this case, had DoD been able to trim its spending by just 0.3 percent annually on average over the past three decades, its annual O&M spending would today would be about \$20 billion less – enough to cover the O&M costs associated with the 130,000 additional military personnel that (as noted above) a more efficient approach to military compensation might have made affordable.



A launched shadow unmanned aerial system gains altitude during training at Orchard Combat Training Center, Idaho. Often the newer, more cost effective technologies the military needs can be hindered by the acquisition system. (DoD/Flickr)

## Acquisition

As with military personnel and O&M spending, it is difficult to escape the conclusion that DoD and the services could have adopted an approach to acquisition that would have cost less or allowed for the more rapid introduction of new systems and the procurement of those systems in larger numbers. That conclusion rests in part on the widespread, and long-standing, view that – as in the case of various areas of O&S spending – reforms to the acquisition process still hold the promise of yielding not only significant savings but improvements in the speed and effectiveness of that process. It also rests in part on the fact that, as in other areas of the budget, DoD planners have substantial discretion in choosing alternative approaches to modernization. *How*, not *whether*, to modernize is generally the much more critical and difficult question facing DoD and the services. And different answers have very different implications for the cost, pace, and breadth of modernization efforts.

Options for how to modernize military forces typically include: replacing current-generation weapon systems with next-generation systems; replacing current-generation systems with the latest versions of the same system; upgrading and extending the effective service lives of existing systems, pushing back the date at which they must be replaced; and a transformational option that involves acquiring entirely new and different kinds of systems to carry out the same mission. All of these options will result in improved capabilities, but they differ greatly in terms of both how much additional performance will be provided and their costs.

Historically, DoD has made use of each of these approaches. Frequently, the initial choice has been to buy very advanced next-generation systems. But as the cost of those systems rises – as it almost inevitably does during the course of the acquisition process<sup>49</sup> – and the reality of funding constraints sinks in, that choice is modified. Specifically, the pace of the effort is slowed and reduced in scope – and supplemented and complemented with one or more of the lower-cost alternatives.

**DoD and the services could have adopted an approach to acquisition that would have cost less or allowed for the more rapid introduction of new systems and the procurement of those systems in larger numbers.**

At the extreme, the effort may be abandoned entirely and replaced with one of the other options. This was the case, for example, with the DDG-51 *Arleigh Burke*-class destroyer, a modernized version of which has continued to be produced, in large part because of excessive cost growth in the new DDG-1000 *Zumwalt* destroyer program (which was, ultimately, limited to only three ships).

Had DoD implemented more effective acquisition reform that improved cost-effectiveness or placed greater focus on these other modernization options, it would have been able to afford to introduce new weapon systems more frequently and have procured new, or upgraded, systems in larger numbers – with significant implications for force structure. Even to the extent it continued to focus on the acquisition of next-generation weapon systems, it could

**Next-generation weapon systems have typically had development and unit procurement costs several times higher than that of the systems they are intended to replace. But there is nothing inevitable about such cost growth.**

have placed more emphasis on affordability rather than performance in design. As noted earlier, new next-generation weapon systems have typically had development and unit procurement costs several times higher than that of the systems they are intended to replace. But there is nothing inevitable about such cost growth. Different design tradeoffs would yield different results. One indication of the degree of discretion inherent in the design of next-generation systems can be seen in the variability in cost growth that has existed among different types of weapon systems. While substantial cost growth has been endemic in all cases, there has nevertheless been considerable variability among different classes of systems.<sup>50</sup>

As with military personnel and O&M spending, had DoD been able, over the past several decades, to shave off even a modest amount of the dramatic cost growth witnessed in this area, the cumulative impact on both the pace of modernization and numbers of platforms procured could have been substantial – possibly significant enough to have allowed for fully arming and equipping the additional force structure that more efficient and cost-effective spending on military personnel and O&M (noted above) might have yielded.

## Conclusions and Lessons

Over time, the U.S. military has become smaller, introduced next-generation weapon systems less frequently, and fielded a progressively older weapons inventory. Despite widely held misconceptions to the contrary, neither a declining defense budget top line nor declining resources for weapons acquisition explain these trends. Although, over time, overall funding for defense has witnessed considerable variability from year to year, including significant peaks and troughs, over the long term it has grown – modestly on an annual basis, but with a significant cumulative effect. For its part, although subject to even more dramatic swings in funding, over the past several decades, viewed from a long-term perspective DoD's acquisition budget has remained relatively flat.

Instead of declining resources, what explains the trends in the size of the U.S. military and the age of its weapons inventories are spending trends in O&S activities and acquisition programs. Measured in terms of funding per active-duty service member, DoD spending on O&S activities has grown significantly and consistently for decades. Likewise, its spending on individual acquisition programs has grown substantially, in many cases dramatically, over time. The cuts to the size of the U.S. military and the slower approach to modernization implemented by DoD and the services over the past several decades were needed to reconcile these spending increases with a defense budget top line that grew – but grew more slowly than either per capita O&S spending or spending on individual weapons programs.

Neither the increased O&S spending per active-duty service member nor the growth in the cost of developing and procuring individual weapon systems experienced since the 1950s was inevitable or preordained. To be sure, factors to some extent outside of DoD's control (such as rising health care costs and congressional input) influenced the choices made. But ultimately, more than anything else, the increased spending on O&S activities and weapons acquisition programs reflected policy and programmatic choices made by DoD and service leadership. Those choices rested on the assumption that increasing pay and other O&S spending per troop is the best way to maintain or improve the effectiveness of the military's overall combat capabilities – even if that means reductions in the size of the force must be made to offset those higher per capita costs – and that, similarly, the acquisition of next-generation systems that are both far more capable and far more costly than their predecessors represents the best approach to modernization – even

though, in the context of an overall acquisition budget that has remained flat, this clearly means that next-generation systems must be introduced less frequently and procured in smaller numbers.

**Neither the increased O&S spending per active-duty service member nor the growth in the cost of developing and procuring individual weapon systems experienced since the 1950s was inevitable or preordained.**

There is good reason to believe that, in general, the U.S. military's traditional approach to shaping, sizing, and modernizing its forces has served it well. Weapon-for-weapon and unit-for-unit, U.S. military forces have become progressively more capable, and in many cases far more capable, over the past several decades. Moreover, even taking into account its smaller size, the slower introduction of next-generation weapons platforms, and aging weapons inventory, *taken as a whole*, the U.S. military has grown far more capable and today clearly remains the world's pre-eminent military power. That said, this approach has not, of course, been flawless either in design or execution. In particular, even if the general direction of the tradeoffs made appears to have been appropriate, it is fair to ask whether in some instances a more cost-effective balance might have been struck between quantity and quality, both in terms of forces and weapons platforms – perhaps resulting in a somewhat larger military equipped with somewhat newer weapons platforms.

Judged by almost any measure of personnel quality, the U.S. military today is at or near its historical peak and has progressed dramatically since the early days of the All-Volunteer Force. Likewise, while after a decade and a half of military operations there are pockets of problem areas, the readiness of the U.S. military overall remains relatively high. And in terms of weapon systems, the U.S. military's capabilities are unmatched. Acquiring and sustaining this high-quality, ready and technologically superior force requires the provision of substantial – and, on a per capita basis, growing – resources.

Nevertheless, there is good reason to believe that the U.S. military's spending per capita on O&S activities and on the acquisition of successive generations of weapon

systems may have grown faster over the past several decades than was necessary or prudent. Too much of the increase in military compensation provided was focused on noncash and deferred benefits, or pay raises allocated in an across-the-board fashion, rather than targeted to those categories of personnel the services most needed to recruit and retain. While the sources of cost growth are in some ways harder to identify in the O&M budget, based on the findings of numerous studies and expert panels, it appears that reforms in this area could similarly have yielded substantial savings. Finally, DoD likely could have held down cost growth in weapons programs if it had implemented more effective acquisition reform or placed greater focus on lower-cost modernization options. Taken together, more efficient spending in each of these areas might have allowed the services both to retain more force structure and to introduce new weapon systems more frequently and in larger numbers.

Based on this history, a number of observations can be made and lessons drawn that have potentially important implications for U.S. military planning and budgeting going forward:

- Some trading off of quantity for quality will likely continue to make sense; the question is how much. For a modern, industrialized country such as the United States, there is clearly a logic to focusing on military personnel quality, high readiness, and superior technology, even at the cost of having to accept a smaller military that in many cases is equipped with older weapons. The more serious and difficult question going forward, as in the past, is the degree and extent to which these tradeoffs should be made – with the answers likely to vary depending on the specific missions and force structure elements being considered.
- Different missions and strategies may imply different tradeoffs. Not all missions are equally susceptible to substituting quality for quantity, or making other tradeoffs. Strategic strike and conventional warfare missions, for example, may lend themselves more easily to a substitution of quality for quantity than stability operations or irregular warfare missions – where numbers are generally more important.
- Slowing growth in spending on O&S activities and acquisition programs is key to protecting force structure and addressing the aging of the military's weapons inventories. Even a relatively modest slowing of growth in spending in these areas could free up sufficient resources to allow for a slowing – and in some cases perhaps an end – to further force

structure cuts and possibly the implementation of a broader approach to modernization. The debate over how to find efficiency savings in DoD has been raging for many years, and the record of success so far has been, at best, mixed. However, the recent enactment of changes to the military retirement system – which will yield modest, but real, savings over the long term – suggests that, while difficult, savings in these areas can, indeed, be found and achieved.

- Transforming the way certain missions are performed by introducing new technologies, organization, or concepts of operations may help. Making greater use of unmanned combat aircraft and other transformational capabilities could yield substantial savings and allow the U.S. military in some cases to expand key elements of its force structure.
- By itself, growing the defense budget top line is unlikely to move the U.S. military off of its current path toward a progressively smaller military equipped with older weapon systems. The U.S. defense budget has, on occasion, witnessed periods of dramatic growth. These periods have sometimes mitigated the trends discussed here. On the other hand, they have sometimes accelerated those trends, by committing DoD and the services to funding levels for compensation and weapons programs that cannot be sustained. In any event, given the enduring nature of the demographic and budgetary challenges facing the United States, there is little likelihood that a major increase in the defense budget – even if it can be supported over the next few years – will be sustained over the long term. As such, over the long term, DoD will likely have to continue down its current path toward a smaller and older force structure – unless it takes steps to effectively slow the growth in O&S and acquisition costs or further transform the U.S. military to make it more cost-effective.
- On the other hand, without adequate resources, even a different approach to modernizing and shaping the U.S. military is likely to fall short. In other words, adopting a more cost-effective balance between quantity and quality, and other tradeoffs, may help mitigate funding shortfalls. But, given the difficulty of quickly turning the corner on some existing costly programs and policies, and growing challenges abroad, at least some modest growth in funding levels for defense is also likely to be needed over the long run.
- Charting a different course in the future will require a shift in the decisionmaking of senior U.S. defense leadership. For good or ill, the trends described in this report largely reflect tradeoffs made by the Pentagon's senior civilian and uniformed leadership. It will only be possible to move in a different direction if that leadership – supported by other key players, such as the leadership of the House and Senate defense-related committees – changes its approach.



## Endnotes

1. The decline is projected to be temporary. Under current plans, the number of aircraft carriers will increase to 11 once the USS Gerald Ford, the first of a new class of aircraft carrier, is deployed.
2. 258-260, Table 7-5, "Department of Defense Manpower."
3. All estimates for weapon systems for 2009 and prior years in this report are from Congressional Budget Office, *The Long-Term Implications of the Fiscal Year 2009 Future Years Defense Program: Detailed Update*, January 6, 2009, 28.
4. "The Air Force in Facts and Figures," *Air Force Magazine* (May 2016), 30, [www.airforcemag.com/MagazineArchive/Magazine%20Documents/2016/May%202016/0516facts-figures.pdf](http://www.airforcemag.com/MagazineArchive/Magazine%20Documents/2016/May%202016/0516facts-figures.pdf).
5. Ibid.
6. For a discussion of trends in the defense budget, see Todd Harrison, "Analysis of the FY 2017 Defense Budget" (Center for Strategic and International Studies, April 2016), <https://defense360.csis.org/wp-content/uploads/2016/08/Analysis-of-the-FY-2017-Budget.pdf>.
7. Unless otherwise noted, all spending and cost figures cited in this report are expressed in Fiscal Year 2017 dollars.
8. Unless otherwise noted, all changes in spending or costs cited in this report are expressed in real terms.
9. Department of Defense, *National Defense Budget Estimates for FY 2017* (March 2016), Table 10-1, "Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2021," in Office of Management and Budget, *Fiscal Year 2017 Budget of the United States, Historical Tables*, <https://www.whitehouse.gov/omb/budget/Historicals>.
10. Adjusted for the substantial amount of procurement funding that has been provided through the OCO budget that is intended essentially to meet base (rather than war-related) budget requirements, it is likely that even this marginal reduction would disappear.
11. Derived from Table 7-5, "Department of Defense Manpower," 258-260, Table 6-8, "Department of Defense Budget Authority by Public Law Title," 133-139, and Table 2-1, "Base Budget, War Funding, and Supplementals by Military Department, By Public Law Title," 22-31, in Department of Defense, *National Defense Budget Estimates for FY 2017* (March 2016). Converted into FY 2017 dollars using Office of Management and Budget deflators from Table 10-1, "Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2021," in Office of Management and Budget, *Fiscal Year 2017 Budget of the United States, Historical Tables*, <https://www.whitehouse.gov/omb/budget/Historicals>.
12. The cost of pay and other benefits (e.g., health care) for civilian DoD employees is covered primarily through the O&M budget.
13. Congressional Budget Office, *Long-Term Implications of the 2016 Future Years Defense Program*, CBO 51050 (January 2016), 28, [https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/51050-2016\\_FYDP.pdf](https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/51050-2016_FYDP.pdf). Excluding the military and civilian DoD pay components of military health care, spending has grown from about \$6 billion to \$32 billion.
14. The military health care system provides care not only to active-duty service members but also their family members, as well as military retirees and their family members. Altogether, more than 9 million individuals are eligible for health care through that system. Since, unlike the number of active-duty service members, the total number of eligible beneficiaries has actually increased modestly in recent years, on a per *beneficiary* basis the rate of cost growth, while still significant, would be substantially lower than the cost growth per active-duty *service member* cited above.
15. The AFQT assesses basic verbal and mathematical abilities. It is benchmarked against the 18 to 23-year-old civilian population.
16. Bernard Rostker, "I Want You!: The Evolution of the All-Volunteer Force" (Rand Corp., 2006), 8.
17. For a discussion of trends in the civilian workforce and DoD and other federal agencies, see Government Accountability Office, *Federal Workforce: Recent Trends in Federal Civilian Employment and Compensation*, GAO-14-215 (January 2014).
18. For an excellent discussion of trends and issues related to military readiness, see Todd Harrison, "Rethinking Readiness," *Strategic Studies Quarterly* (Fall 2014), 38-68, [www.au.af.mil/au/ssq/digital/pdf/fall\\_2014/Harrison.pdf](http://www.au.af.mil/au/ssq/digital/pdf/fall_2014/Harrison.pdf).
19. These estimates, converted into FY 2017 dollars, are taken from Jeremiah Gertler, "F-35 Joint Strike Fighter (JSF) Program," RL30563 (Congressional Research Service, April 29, 2014), 14, <https://fas.org/sgp/crs/weapons/RL30563.pdf>.
20. Author's estimates based on DoD and Congressional Budget Office data.
21. Author's estimates based on Department of Defense and Congressional Budget Office data from Congressional Budget Office, *A Look at Tomorrow's Tactical Air Forces* (January 1997), 37, Figure 7, "Unit Procurement Cost for Fighter and Attack Aircraft"; Department of Defense, *F-22, Selected Acquisition Report*, December 31, 2010, 12-13; Department of Defense, *F-35 Joint Strike Fighter Aircraft, Selected Acquisition Report*, December 2015, 24-67; and Department of Defense, *F/A-18E/F, Selected Acquisition Report*, December 31, 2011, 13-19. Converted



- into FY 2017 dollars using Office of Management and Budget deflators from Table 10-1, “Gross Domestic Product and Deflators Used in the Historical Tables, 1940-2021,” in Office of Management and Budget, *Fiscal Year 2017 Budget of the United States, Historical Tables*, <https://www.whitehouse.gov/omb/budget/Historicals>.
22. This is true even in the case of the very large F-35 program. That program currently projects a total buy of 2,457 aircraft. By comparison, a total of over 4,200 A-10s, F-16s, AV-8Bs, and F/A-18s were procured. Moreover, given cost growth and budget pressures there is good reason to doubt that the quantities projected for the F-35 will not be met.
  23. Steven Kosiak, “US Defense Budget: Options and Choices for the Long Haul” (Center for Strategic and Budgetary Assessments, 2008), 38, <http://csbaonline.org/uploads/documents/2008.08.21-Defense-Budget-Options-and-Choices.pdf>.
  24. *Ibid.*, 37–38.
  25. Steven Kosiak, “Matching Resources with Requirements: Options for Modernizing the US Air Force” (Center for Strategic and Budgetary Assessments, August 2004), 57, <http://csbaonline.org/research/publications/mathcing-resources-with-requirements-options-for-modernizing-the-us-air-for/publication>.
  26. Wayne Thompson, *To Hanoi and Back: The U.S. Air Force and North Vietnam, 1966-1973* (Washington: Smithsonian Institution Press, 2000), 45–46. CEP is the radius of a circle around the aim-point within which 50 percent of the bombs are expected to hit.
  27. Kosiak, “US Defense Budget: Options and Choices for the Long Haul,” 38.
  28. Government Accountability Office, *Operation Desert Storm: Evaluation of the Air Campaign* (June 1997), 178; William Arkin, “Weapons Total from Afghanistan Includes Large Amount of Cannon Fire,” *Defense Daily*, March 5, 2002; and Lt. Gen. T. Michael Mosley, *Operation Iraqi Freedom-By the Numbers* (CENTAF-PSAB, Saudi Arabia: U.S. Central Command, April 30, 2003).
  29. *Ibid.* U.S. air forces, of course, also benefited in 2003 from the fact that Iraq’s air defense capabilities were substantially degraded compared with those that existed at the start of the 1991 Gulf War.
  30. *Ibid.*, 53.
  31. Robert Work, “The Challenge of Maritime Transformation: Is Bigger Better?” (Center for Strategic and Budgetary Assessments, 2002), I, <http://csbaonline.org/uploads/documents/2002.03.21-Maritime-Transformation.pdf>.
  32. *Ibid.*, 57–58.
  33. *Ibid.*, 70.
  34. John M. Collins, “Desert Shield and Desert Storm: Implications for Future U.S. Force Requirements” (Congressional Research Service, April 19, 1991), 4, [http://digital.library.unt.edu/ark:/67531/metacrs6962/m1/1/high\\_res\\_d/91-361\\_1991Apr19.pdf](http://digital.library.unt.edu/ark:/67531/metacrs6962/m1/1/high_res_d/91-361_1991Apr19.pdf).
  35. Congressional Budget Office, *An Analysis of the U.S. Military’s Ability to Sustain an Occupation of Iraq* (September 3, 2003), 4.
  36. Congressional Budget Office, *The All-Volunteer Military: Issues and Performance*, CBO Pub. No. 2960 (July 2007), 17, <https://www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/07-19-militaryvolO.pdf>.
  37. *Ibid.*, 13.
  38. As noted earlier, spending per active-duty service member on military compensation (including pay, health care, and other benefits) has roughly doubled since the mid-1980s. By comparison, after-tax real income (including pay, health care, and other benefits, but also investment income and government transfers) for the average U.S. household grew by about 62 percent from 1979 to 2007, while real after-tax income for the median U.S. household grew by only about 35 percent over this same period. Congressional Budget Office, *Trends in the Distribution of Household Income Between 1979 and 2007*, CBO Pub. No. 4031 (October 2011), 2, <https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/10-25-householdincome0.pdf>. Moreover, for most American workers (the 80 percent of the U.S. labor force employed in private-sector production/nonsupervisory positions) the rate of growth in real hourly compensation has been substantially lower still. Josh Bivens and Lawrence Mishel, “Understanding the Historic Divergence Between Productivity and a Typical Worker’s Pay: Why It Matters and Why It’s Real,” EPI Briefing Paper No. 406, (Economic Policy Institute, September 2, 2015), 2, <http://www.epi.org/files/2015/understanding-productivity-pay-divergence-final.pdf>.
  39. RMC includes basic pay, the basic allowance for housing (BAH), the basic allowance for subsistence (BAS), and the tax advantage that accrues from the tax-free status of BAH and BAS.
  40. Congressional Budget Office, *The All-Volunteer Military: Issues and Performance*, 20.
  41. *Ibid.*
  42. *Ibid.*
  43. *The All-Volunteer Military: Issues and Performance*, 20.
  44. See, for example, Todd Harrison, “Rebalancing Military Compensation: An Evidence-Based Approach” (Center for Strategic and Budgetary Assessments, April 2012), [www.csbaonline.org/publications/2012/07/rebalancing-military-compensation-an-evidence-based-approach/](http://www.csbaonline.org/publications/2012/07/rebalancing-military-compensation-an-evidence-based-approach/).

Is the U.S. Military Getting Smaller and Older? And How Much Should We Care?

45. Such benefits tend to be especially ineffective in terms of encouraging recruitment, not only because individuals typically heavily discount benefits to be provided only in the distant future, but because, historically, only about 1 in 5 recruits has remained in service long enough to become eligible for retirement benefits.
46. Steven M. Kosiak, "Military Compensation: Requirements, Trends and Options" (Center for Strategic and Budgetary Assessments, February 2005), 27.
47. Defense Business Board Task Group, *Implementing Best Practices for Major Business Processes in the Department of Defense*, Department of Defense Report FY 14-01, [www.gsa.gov/portal/mediaId/125330/fileName/Secretary\\_of\\_Defense\\_Implementing\\_Best\\_Practices.action](http://www.gsa.gov/portal/mediaId/125330/fileName/Secretary_of_Defense_Implementing_Best_Practices.action).
48. *Ibid.*, 16-17.
49. For a useful discussion of this issue, see Col. Mark F. Cancian (USMCR, Ret.), "Cost Growth: Perception and Reality" (Defense Acquisition University, July 2010), [http://www.dau.mil/pubscats/PubsCats/AR%20Journal/arj55/Cancian\\_55.pdf](http://www.dau.mil/pubscats/PubsCats/AR%20Journal/arj55/Cancian_55.pdf).
50. Historically, for example, cost growth has tended to be substantially higher in the case of combat aircraft than naval platforms. See, for example, N. Davies, A. Eager, M. Maier, and L. Penfold, "Intergenerational Equipment Cost Escalation," Defence Economic Research Paper, 22, [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/280041/18\\_december\\_2012.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/280041/18_december_2012.pdf).

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