Technology, Qualitative Superiority, and the Overstretched American Military

Daniel R. Lake

Why did the wars in Afghanistan and Iraq put so much strain on the US military? During the 1990s, the question was whether US forces should be prepared to fight two "major regional conflicts" or just one. No one thought that smaller operations would cause problems. Nonetheless, by 2006–07, operations in Iraq involving less than one-third the forces deployed for Desert Storm were stressing the US Army so much there was open debate over how close it was to breaking. The proximate cause is obvious—the Army lacked the assets it needed for operations in Iraq. The real question is why that would be the case. How is it the United States requires roughly half of the world's military spending to support a military too small to comfortably sustain moderate-intensity operations? I argue that the strain on the US military is the direct result of focusing on technological solutions to tactical and strategic problems. This practice is rooted in American culture, which is particularly prone to technological optimism. The focus on leveraging technology to gain qualitative superiority over US foes has resulted, due to escalating procurement costs and increased logistic needs, in a military that is too small where it needs to be: on the battlefield.

For more than a decade now, we have been hearing that the US military is "overstretched" and "at the breaking point." This is not simply an exercise in hyperbole. Rather, it reflects real problems the military was already facing even before the war in Iraq. For example, the intervention in Kosovo escalated to include seven out of 20 Air Force combat wings and required the call-up of reservists to conduct air refueling.[1] The high demand on reconnaissance and electronic-warfare aircraft for Kosovo also forced the Air Force to cut back on monitoring the "no-fly" zones in Iraq. This is indicative of the wider issue, which is that the US military in general was arguably understaffed and overstretched by the end of the 1990s.[2]

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It was evident by late 2003 that due to the force cutbacks of the 1990s, the need for troops in Iraq would strain the US military.[3] As the Iraq war dragged on, it became clear those projections were on the mark, and sustained operations in Afghanistan and Iraq risked breaking the Army.[4]

Why did these operations strain the US military so much? The United States has the largest defense budget in the world, the second-largest active duty military, and the seventh-largest military when reserves are included.[5] If any state should be able to handle operations like Afghanistan and Iraq with ease, it is the United States. Nevertheless, even with a $670 billion defense budget, the United States found it challenging to sustain a deployment of 200,000 troops.[6] This is particularly interesting because the much larger forces deployed for Operation Desert Storm did not cause any such problems.

A partial explanation is the mismatch between US military capabilities and needs. The bulk of the forces in Afghanistan and Iraq were ground forces, so most of the burden of these operations was borne by the Army and Marines. Such was the case with Desert Storm, but its much shorter duration made that larger deployment easier on the military. During 2005–06, the United States averaged 175,000 to 200,000 ground forces deployed to Afghanistan and Iraq, according to the Congressional Budget Office (CBO).[7] The CBO considered this an unsustainable level of deployment, based on the current availability of active duty and reserve forces. By January 2006, virtually all the available combat units in the Army, Marine Corps, and National Guard had been deployed to Afghanistan or Iraq at least once.[8] Many were already on their second or third tour. Many National Guard and reserve units had already hit their legal limit of two years deployed in a five-year period, shifting almost the full burden of operations onto active duty forces. The US Army and Marine Corps are simply too small to sustain such a level of operations.[9] To sustain an all-volunteer professional army, the rule of thumb is a three-to-one rotation ratio, meaning you have two units at home for every one deployed.[10] Higher deployment rates make it more likely that service members will decide against a military career, reducing retention and making it harder to sustain the overall force. Sustaining a deployment of 175,000 to 200,000 troops thus requires about 525,000 to 600,000 personnel. This is perilously close to the total active strength of US ground forces (around 700,000). When you take into account other deployments outside the continental United States (South Korea, Okinawa, Europe, etc.) and their

personnel needs, the Iraq and Afghanistan operations overstretch available ground forces. In essence, the US military has a manpower deficiency that is likely to get worse in the future if not addressed.[11] The drawdown in Iraq has temporarily mitigated this problem, and the situation will further improve as forces are pulled out of Afghanistan, but the potential for military overstretch remains.

This is not just a problem affecting US ground forces. The challenges created by the Kosovo intervention demonstrate how the Air Force can be overstretched. The Navy could also easily be overstretched by current obligations (much less a new operation) because it has too few warships.[12] While each warship is individually very capable, it cannot be in two places at once. As such, the decline in fleet size since the end of the Cold War is already causing problems.[13] For example, the Navy is currently unable to provide enough warships to control piracy off the coast of Somalia.[14] Dealing with that problem would take several times the 30 or so warships that various navies have deployed to the area. In the future, the small size of the Navy could also cause problems in a confrontation with China, which may already have a larger navy than the United States.[15]

The US military is even at risk of running out of critical types of ammunition. This has already happened at least once. Operations over Kosovo depleted the supply of air-launched cruise missiles to the point the Air Force had to cut back on their use.[16] Government stocks of the most expensive precision-guided munitions (PGM) are inherently limited due to their higher cost,[17] so every time there is a high demand on them there is a risk of running out. For example, a military strike against Iran's nuclear program would probably rely heavily on the new Massive Ordinance Penetrator, a 15-ton "bunker buster" bomb, but the Pentagon is only buying 20 of them.[18]

Why does the United States, with the largest defense budget by far, have inadequate land, air, and naval forces to carry out sustained operations at even a moderate tempo? The immediate cause is the shrinking military, which is the smallest it has been since the late 1940s. This has been exacerbated by a change in the distribution of forces within the military away from combat forces (the "tooth") toward an ever larger support network (the "tail"). While defense budgets are higher now than they have been in 60 years, the military is smaller in absolute terms, and the combat forces necessary to carry out missions make up a relatively smaller share of this smaller military.

These changes are mainly due to an increasing reliance on technology. While advanced technology does make the military more effective in many ways, it comes at an ever increasing cost. This is exacerbated by the US military's cultural bias toward technological solutions, which results in intensive use of cutting-edge technologies for maintaining qualitative superiority. The high cost of these efforts under conditions of relatively flat budgets has led to cuts in personnel and equipment. In addition, the increasingly sophisticated weaponry requires more logistical support. This has caused both a shift of troops from combat to support roles and an increased reliance on contractors for support. Ultimately, the overstretch has been due to the technological sophistication of the US military.

The US military's bias toward technological solutions to military problems explains its cultural basis and shows how it has manifested since World War II. Thus the focus on advanced technology has affected the size and composition of the US military. This begs the question whether (and how) the experience of military strain will affect US defense policy and how other states and nonstate actors are reacting to US technological superiority. In the end one must consider what this means in terms of the basic dynamics of providing for US national defense.

Technology and the American Way of War

The "American way of war" has a couple of basic characteristics that have implications for military organization and procurement.[19] The first is a bias toward waging war for unlimited political objectives and a concomitant focus on annihilating its foes.[20] US military leaders traditionally have rejected Clausewitz's maxim that war is merely the continuation of policy through other means,[21] hence the American way of war can be thought of more as a way of battle than of war.[22] American generals typically resisted the "meddling" of politicians in their conduct of war (and still resent it), and civilians were largely content to leave war to the professionals.

The second characteristic is strategic materialism, which developed due to the extensive resources available to American armies by the Civil War era.[23] This entails a preference for defeating the foe through the use of firepower and material superiority rather than through technique.[24] Material superiority has been seen as a way to avoid casualties, which American elites see as desirable because they perceive the public to be casualty averse.[25] Therefore, in each major war, starting with the Civil War, American armies

(except the South during the Civil War) have been lavishly equipped compared to their European counterparts.

These two main characteristics manifested repeatedly from the Civil War through the Korean War. In each major conflict during this period, the United States entered the war with a military inadequate for the current struggle. It responded by massively mobilizing the population and the economy and sought to completely defeat its foe. While not always successful, the victories of the North in the Civil War and the Allies in World War II—combined with the way that failure to completely defeat Germany in World War I led to World War II—reinforced American prejudices regarding how war should be fought.

The Korean War broke the pattern in two ways. First, after China's intervention it was not possible for the United States to achieve a decisive victory without resorting to massive use of nuclear weapons. Second, combined with the Berlin crisis, it clearly indicated that the Cold War had begun, which led the United States to maintain a large peacetime military for the first time.

The establishment of a large peacetime military allowed American culture[26] to express itself through the structure and equipment of the military in ways that had previously not been possible due to the small military budgets typical of interwar periods.[27] Culture is important because it affects how war is fought and thus how a nation prepares for war.[28] Most relevant here is a cultural bias where the application of technology is seen as the best way to solve a problem.[29] While an openness to technology is characteristic of Western cultures and helps explain how Europe was able to become so dominant by the nineteenth century,[30] American culture is unique in containing a strain of "technological utopianism" that sees technology as a panacea.[31] This focus on technological solutions is a logical extension of military materialism, though with particular consequences described below.

Technology has been seen as the solution for several tactical and strategic problems since the beginning of the Cold War, including avoiding American casualties, limiting collateral damage, and countering the quantitative superiority of America's foes.[32] In addition, America's political culture has developed to the point that having the most advanced military is an end in itself.[33]

The preference for technological solutions manifested repeatedly during the Cold War. The Eisenhower administration proposed to deal with the

threat posed by large Soviet conventional forces in Europe by threatening nuclear retaliation (the "New Look"). This involved general cuts in the military and an emphasis on strategic nuclear forces, mostly air forces. Since there were massive cuts in conventional forces, all three services (Army, Navy, and Air Force) pursued their own independent nuclear programs.[34]

By the end of the Eisenhower presidency, it was becoming apparent that the United States could no longer rely on nuclear deterrence to protect Europe from the Soviets. The development of Soviet strategic nuclear forces, including the first intercontinental ballistic missiles, was inaugurating the era of "mutually assured destruction." Since both sides now had the ability to destroy the other using strategic nuclear forces, US nuclear deterrence was no longer seen as credible for preventing a conventional assault in Europe. In response, the Kennedy administration developed the doctrine of "flexible response" to deal with the new strategic reality.[35] Civilian specialists in military strategy and business, led by Robert McNamara, sought to make force more adaptable by creating options short of nuclear Armageddon.[36] While this included a conventional buildup, the United States mainly sought to counter Soviet quantitative superiority with NATO qualitative superiority.[37] This included introducing a whole new generation of equipment, including the M-60 main battle tank, new tactical aircraft like the F-111 Aardvark and the F-4 Phantom II fighter, and new naval capabilities in antisubmarine warfare.

The way the United States conducted the Vietnam War also demonstrates its cultural predisposition toward technological problem solving, as well as the limits of that approach.[38] To deal with North Vietnamese air defenses, the Air Force and Navy began extensive deployment of electronic countermeasure (ECM)–equipped aircraft and antiradiation missiles.[39] To provide the mobility needed to effectively fight the guerrillas, the Army deployed the first airmobile division and used helicopters extensively throughout the war.[40] To interdict North Vietnamese supply routes through Laos and Cambodia, the US military developed and deployed new sensors that remotely provided targeting data.[41] The Vietnam War also saw the development of the first remotely piloted aircraft (RPA), or drones, and the first widespread use of PGMs.[42] Ultimately, all this technological innovation was unable to compensate for the failure to develop a political strategy for winning the war.[43]

Efforts to gain and maintain qualitative superiority increased with the end of the draft and the switch to an all-volunteer military in 1974, in part

because of increased casualty aversion after Vietnam.[44] Called the "offset strategy," it involved a systematic attempt to leverage new technologies (such as information technology) and develop new equipment to counter Soviet numerical superiority, particularly after the Soviets engaged in a major modernization effort during the 1970s.[45] This resulted in another new generation of military equipment including the M-1 Abrams main battle tank, the M-2/3 Bradley infantry fighting vehicle, the F-15 and F-16 fighters, the F/A-18 fighter/attack plane, the F-117 stealth fighter, the B-2 bomber, the *Ticonderoga*-class guided missile cruisers, and the Patriot surface-to-air missile system.

The astonishingly effective performance of the US military in the Persian Gulf War seemed to validate the focus on technological solutions.[46] New equipment developed since Vietnam—including PGMs, global positioning system (GPS) satellites, the joint surveillance and target attack radar system (JSTARS), stealth aircraft, and more prosaic hardware developed as part of the offset strategy—was given credit for the lopsided victory achieved.[47] During the 1990s the American military began to increasingly focus on PGMs as a way to avoid US and civilian casualties[48] and accomplish what Leslie Gelb referred to as "immaculate destruction."[49] The technological advances involved were seen as allowing the United States to use military coercion more freely,[50] as in Bosnia and Kosovo.

When Donald Rumsfeld became secretary of defense in 2001, he entered office firmly believing in the virtue of technology as a solution for myriad tactical and strategic problems. He set out to transform the culture of the military away from its risk- and casualty-averse preference for overwhelming force in favor of precise application of force—Gelb's "immaculate destruction.[51] This included a focus on reducing or eliminating Clausewitz's "fog of war" through better reconnaissance and communications capabilities as well as increased use of PGMs to make warfare more predictable and allow the military to do more with less.[52] In particular, Rumsfeld sought to make the military more efficient through the "superempowerment of the individual" and by automating war through tools such as drones.[53] The success of the invasion of Iraq in 2003 seemed to validate this approach.[54]

While technological optimism has been a feature of US defense planning for several decades now, each service has its own culture which persists and manifests itself in its attitude toward technology.[55] The Air Force is the most technology-oriented branch, since it is defined by technology

and emphasized its core technologies when building its identity after its creation in 1947.[56] The Navy is also very technology oriented, but as an old service it has traditions that constrain and channel its technological enthusiasm.[57] The Army is fairly accepting of technology, seeing it as a means to gain an advantage over foes.[58] The Marines value technology the least, due to their warrior ethic and a history of tight budgets that created an institutional culture focusing on personnel rather than equipment.[59] In a broad sense, a key difference in service culture comes down to the difference between "manning equipment" (Air Force and Navy) and "equipping the man" (Army and Marines).

Technology and the Incredible Shrinking US Military

As a general rule, the cost of military equipment tends to rise faster than the inflation rate due to technological change.[60] This is true especially for modern weapons, which rely heavily on computing power for their effectiveness. Military computers do not rapidly decline in cost, per Moore's Law,[61] since they lack the massive economies of scale afforded to consumer electronics—much military hardware and software is custom designed and must constantly be upgraded to remain secure.[62]

Seeking to maximize performance also maximizes costs, particularly when developing multirole equipment.[63] Multirole systems, by their very nature, are going to be more complicated to develop and more costly to field.[64] Research and development costs increase rapidly as the technology incorporated increases and becomes more recent.[65] As a result, new weapon systems almost always cost more than expected, usually more than double the original estimate.[66]

Rapid technological change, which has been the norm for several decades, exacerbates these problems. First, anticipation of future improvements leads to smaller production runs.[67] This increases the unit cost of equipment because the research and development (R&D) costs get amortized over fewer units.[68] The large-scale production necessary to generate economies of scale (and reduce per-unit R&D costs) is constantly deferred.[69] Second, there is always an incentive to wait a little longer to incorporate a little more advanced technology.[70] This serves both to delay the introduction of new weapon systems and to keep costs high. Third, there is a constant desire to modernize existing equipment to take advantage

of technological advances, which also makes it harder to realize economies of scale.[71]

The combined effects of intergenerational cost growth, incorporation of the latest technologies, and smaller production runs have made the latest US weapon systems extremely expensive.[72] For example, the "flyaway cost" (excluding R&D) of a new F-35 fighter increased from $69 million in 2001 (current $) to $133 million in 2011 due to cost overruns and production delays.[73] This is more than four times the inflation-adjusted flyaway cost of the aircraft it is replacing, the F-16 ($30 million in 1985).[74] R&D costs add at least another $23 million per plane.[75] The cost is so much higher in part because the F-35 incorporates cutting-edge technologies, such as stealth, developed since the F-16. These planes are also very expensive because they are multirole aircraft meant to perform both air superiority and ground attack missions.

The impact of smaller production runs is particularly visible in the case of the B-2 bomber. The original production run was supposed to be 132 planes, but only 21 were actually purchased. As originally proposed (in 1986), the Air Force would acquire 132 B-2 bombers for a total program cost of $58.3 billion.[76] After cutting the production run to 21 and spending an extra $10 billion in R&D, the total program cost (in 1997) was $44.3 billion.[77] While the original estimated cost per plane of $442 million was undoubtedly inaccurate, cutting the production run from 132 to 21 certainly more than doubled the program unit cost based on the 1997 flyaway cost per bomber of $737 million. Even with no production economies of scale to realize, if the entire original planned production run had occurred, the total program unit cost would have been less than $1 billion ($737 million flyaway cost and $227 million per plane in R&D costs) instead of more than $2.1 billion. Another example played out with the F-22 fighter, the Air Force's top-of-the-line air superiority fighter, meant to replace the F-15. The original plan was to purchase 750 F-22s. When the production run was cut to 183, the unit cost went from $149 million to $342 million.[78]

This pattern of rising equipment costs is found across the US armed services. The Navy's new *Zumwalt*-class destroyer (DDG-1000) is the most recent class of surface warship developed. Its average procurement unit cost (not including R&D) is estimated at $4.3 billion per ship in 2010 dollars.[79] This compares to the $2.2 billion procurement unit cost of an *Arleigh Burke*–class destroyer (DDG-51), which originally entered service

in 1991. The increased unit cost is due to the inclusion of more advanced technologies, such as much greater automation, as well as its larger size (almost 15,500 tons vs. 9,500 tons). Because of the high unit cost, *Zumwalt* production was stopped after the third ship in the class was begun. As a result, the $9.3 billion in program R&D costs increased the total program cost per ship to $7.4 billion.[80] In comparison, the production of *Arleigh Burke*–class destroyers continues with 63 currently in service or on order, so the R&D costs have been spread across a much larger production run.

The nature of rising unit costs over time is shown on figure 1. As you can see, intergenerational unit costs go up exponentially for combat aircraft, and the same basic pattern (albeit more slowly) holds for other types of equipment such as ships.[81]

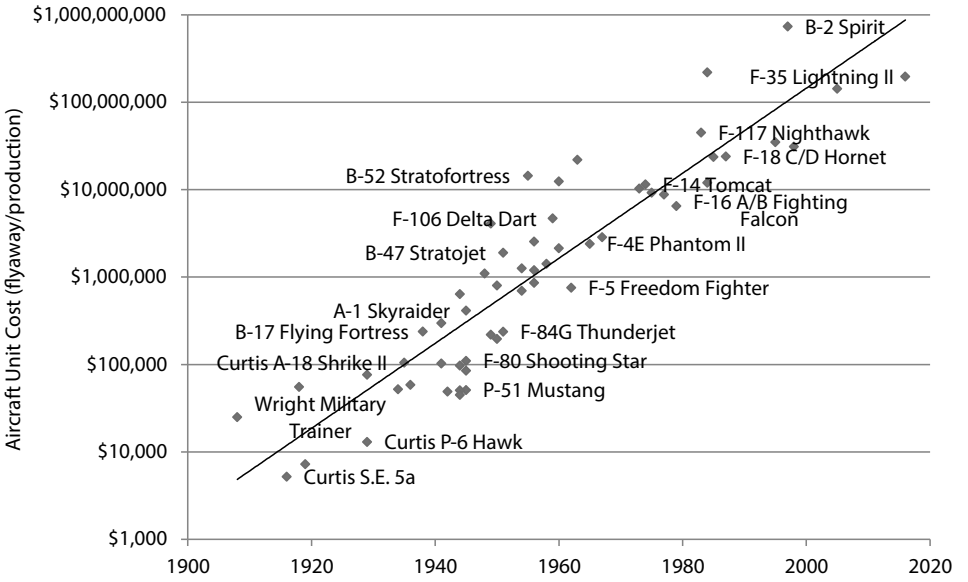

Figure 1. The rapidly increasing costs of US combat aircraft

Equipment that pushes the limit of what is technically possible also tends to be less reliable.[82] While component reliability tends to improve over time, the benefits are undermined by a tendency to improve capabilities by cramming more components into each system.[83] The net result has been rapidly increasing operations and maintenance (O&M) costs over the last several decades. For example, Air Force O&M costs increased

in real terms by 20 percent between the late 1980s and the late 1990s.[84] This is directly related to fielding more-sophisticated equipment. For example, the F-35 is estimated to cost a third more to keep flying than the F-16 it is replacing.[85] The B-2 bomber (an extreme example) requires 60 man-hours of maintenance for every hour of flight time.[86] When you include all O&M costs (personnel, equipment, fuel, maintenance, etc.), the average flight-hour cost went from about $4,800 in 1970, to $11,000 in 1985, to about $23,000 today (in constant dollars).[87]

Increasing the technological sophistication of military equipment also has important implications for personnel policy. While it reduces the relative importance of numbers, it puts a premium on high troop quality.[88] This is because to effectively use more-advanced equipment requires more training,[89] and the ability to successfully complete such training is a function of base troop quality in terms of intelligence and education. High-quality, smart, and well-trained troops are simply not available in large numbers, while low-quality recruits are less able to use complex weapons correctly.[90]

The switch to the all-volunteer military in 1974 made staffing more difficult and costly.[91] While conscripts can simply be required to serve, volunteers need to be enticed.[92] This requires investment in marketing, recruiting, higher salaries, and better benefits. Personnel costs have rapidly increased since 9/11, with total pay and benefit costs increasing from $73,300 to $126,800 per person in real terms (a 73-percent increase) between 2000 and 2011.[93] Fully a third of that increase is due to expanding costs of health care for retirees, an expense that is likely to continue to grow for the foreseeable future.[94] Recruiting and training costs have also risen. During 2008, it was estimated that recruiting and training 10,000 soldiers cost $1.2 billion a year.[95]

Critical for understanding the impact of technological change on the US military is the budget environment. As shown in figure 2, the US defense budget has been fairly stable in constant dollar terms since the Korean War. During this period, it never drops below $343 billion FY-2009 dollars (the 1955 low) and—except for the Reagan defense buildup—never exceeds $450 billion FY-2009 dollars during peacetime.

The result of dramatic increases in equipment and personnel costs within a fairly stable budget is evident on the table. While defense spending for 2009 is artificially inflated by costs associated with the Afghanistan and Iraq missions, even after deducting that expense (about $155 billion, ac-

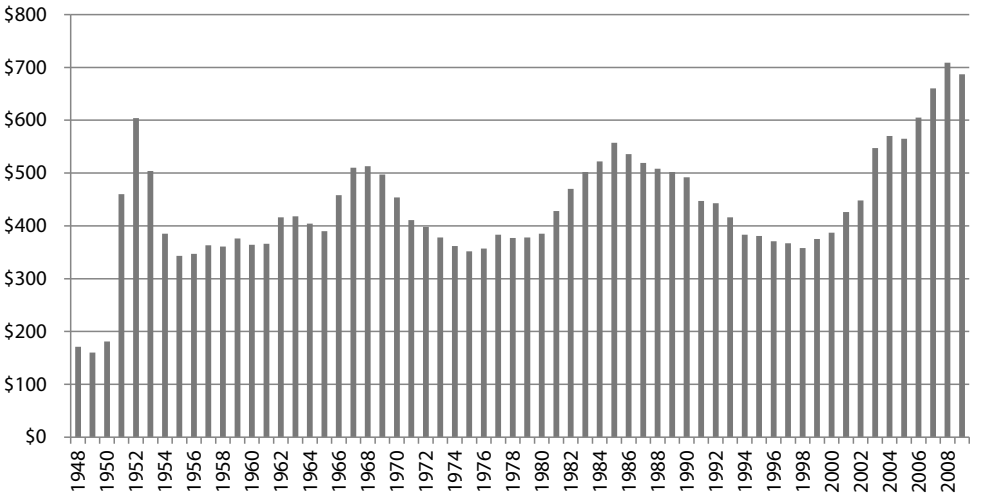

Figure 2. US defense budget authority in FY-2009 billions of dollars

Data from the Center for Arms Control and Nonproliferation.

cording to the Center for Defense Information) the United States still spent 38 percent more for almost 50 percent fewer combat assets compared with 1980. As discussed above, this trend is largely driven by increasing equipment costs resulting from technological change and the extensive use of cutting-edge new technology. In the case of the Navy, it is exacerbated by the decision to keep so many aircraft carriers, which forces the sacrifice of larger numbers of smaller vessels.[96] To save money, most navies have shifted to smaller ships, but the United States is bucking that trend at a high price.

The incredible shrinking US military

Item	1980	2009	Change
Total budget authority (2009 constant)	$385 billion	$687 billion	+78 percent
Navy ships (active)	530	285	-46 percent
Air Force fighter/attack planes (active)	2,769	1,493	-46 percent
Army divisions (active)	19	10	-47 percent

Data from the Center for Arms Control and Nonproliferation; the Naval History and Heritage Command; Ruehrmund and Bowie, *Arsenal of Airpower*; and Defense Business Board, "Task Group Report on Tooth-to-Tail Analysis."

Technology and the Changing Tooth-to-Tail Ratio

The focus on high technology has also shifted the US military's "tooth-to-tail" ratio toward a smaller tooth (combat assets) and a larger tail (support).

Technologically sophisticated weapon systems generally require more support, in part because (as noted above) they are less reliable than simpler systems.[97] The general rule is the more that is spent on an item, the more maintenance hours it will require to keep it operational.[98] Because of this, the increasing reliance on technologically sophisticated equipment since World War II has resulted in larger overall support requirements for the US military.[99]

Currently, the US tooth-to-tail ratio is very low, especially for the Air Force.[100] Only 16 percent of US military personnel have combat specialties (such as armor, infantry, reconnaissance, combat aviation, and surface warfare), which is lower than any of our NATO allies (except France and Poland), as well as China, India, Russia, Saudi Arabia, Singapore, South Korea, and Kuwait.[101] It is somewhat astonishing how few combat personnel are in uniform. For example, in 2003–04, the US military included only about 71,000 infantry,[102] which is a mere 10 percent of the combined Army and Marines or roughly 5 percent of the entire US military.

To some extent, the larger tail of the US military is the result of its global projection capabilities,[103] but most of it is related to increases in the logistical support required by combat forces.[104] This has increased over the last 100 years as the military has become more technologically sophisticated and is a direct result of that process. Basically, each generation of equipment requires more support than the previous one.

The impact of technological change is visible in the declining tooth-to-tail ratio for wars fought during the last 100 years.[105] While more than 50 percent of US troops deployed to France in World War I were combat forces, following the mechanization of the Army (during World War II), the share of combat forces in theater has never exceeded 40 percent. Since World War II, the trend is generally downward, though it appeared to reverse itself during the Iraq war, where 40 percent of the troops in theater during 2005 were combat forces. This was an artifact of two practices: an unprecedented use of contractors to support the troops and the location of many support forces in neighboring Kuwait. When support troops in Kuwait and contractors are taken into account, only 25 percent of the personnel in theater were combat forces.[106]

Note that there is a mismatch between the percentage of troops in Iraq that are combat forces (40 percent) and the share of the Army and Marines that is combat forces (about 25 percent). The burden of the Iraq and Afghanistan operations fell mostly on the Army and Marines and in particular

on combat forces and certain types of support troops (such as civil affairs and psychological operations). The strain on the military (both active duty and reserve components) resulting from post–Cold War demands has led to increased outsourcing of noncombat roles (and sometimes, but rarely, combat roles) to contractors.[107]

Contractors are increasingly important for providing support for US forces. This is due to the force cuts after the Cold War, the desire to keep as many combat units as possible on active duty, and high demands on the available troops.[108] It is easier to outsource logistical/support functions than combat functions, so that is where most of the activity has been.[109] In particular, contractors are heavily used for providing maintenance for our most advanced weapon systems such as the B-2 bomber and Navy vessels.[110] Very large numbers of contractors have been used to support US operations in Iraq, totaling more than the troops provided by US allies.[111] They perform a critical function, since replacing the 113,000 security and logistics contractors deployed in Iraq would require more than 250,000 additional military personnel to allow for normal personnel rotations.[112] That is simply not possible, as shown by the way the Army struggled to increase its numbers by 65,000 to support the "surge" in Iraq.[113]

The net impact of all this is a military that increasingly fields fewer, yet more-advanced, weapon systems and which contains a shrinking share of combat forces but still relies heavily on outsourcing support to contractors. The end of operations in Iraq has reduced some of the pressure, and things will continue to improve as operations in Afghanistan draw down. However, if the United States needs to use military force in the future, the same overstretch that characterized the last decade is likely to recur unless something changes the structure of the force. Even routine operations may cause strain on limited assets.

Implications

The United States

Right now the US military is vulnerable to overstretch by virtually any sustained operation, and even routine operations may cause problems. There are really only two ways to reduce the potential for overstretch. One is to increase the size of the military.[114] For example, another 100,000 to 200,000 ground troops are necessary to deal with existing security

threats.[115] Since the baseline defense budget (excluding Iraq and Afghanistan) is not a particularly large share of GDP,[116] in principle it could be increased enough to expand the military. This is not a good solution to the problem. Larger budgets increase the likelihood that equipment will be built to the limit of available technology,[117] rather than alleviating the problem of military overstretch. In fact, they may make conditions worse due to the increased support associated with maximizing equipment technology. Recall that the baseline defense budget has increased by almost 40 percent in real terms since 1980 (see table) while the military has shrunk by about one-third and combat assets by nearly half. Simply throwing more money at the military is not likely to reverse this trend. Regardless, since the baseline US defense budget is projected to remain stable for the next few years,[118] this is probably a moot point. If anything, budgets will likely be cut in the short term.[119]

Another possibility is to reduce costs within the existing budget to allow funds to be shifted toward expanding the military. For example, cutting unnecessary weapon programs could free up funds.[120] In reality, this would be extremely difficult due to the politics of US defense contracting which result in strong constituencies for existing programs.[121] When weapon programs are cut, the normal practice is to replace them with new programs or some other form of equipment-related compensation.[122] This practice seriously reduces the net benefit of program cuts. In addition, any savings from eliminating weapon systems tends to be very small since the spending is spread over several budget years and the contracts frequently include cancellation fees.[123]

Even if some funds could be freed up, high personnel costs make increasing the size of the US military very expensive.[124] In fact, the Pentagon has requested that Congress stop spending so much money on the troops, but it is politically unpopular (if not impossible) to do so.[125] Congress raises pay and benefits to signal its appreciation for service members and their families, and any attempt to rein in these costs faces opposition from powerful lobbying groups.[126] This is a long-term problem, because rising personnel costs (particularly health care) threaten to cut into procurement and maintenance budgets.[127] In fact, to cut personnel costs (thus protecting procurement and maintenance budgets), the Army is shedding personnel,[128] even though that makes future overstretch more likely.

A more promising approach would be to change the procurement process so military equipment is not at (or beyond) the limits of available

technology and does not try to do everything.[129] This would drive down costs since, as a rule of thumb, the last 10 percent of capability results in one-third of the costs and two-thirds of the problems.[130] It would also reduce logistical support and maintenance requirements, allowing a shift of troops from the tail to the tooth. This would be a very efficient way to address the problem. For example, if the military could reduce its requirements for support personnel by only 2 percent from the current level, it would be able to transfer nearly 30,000 personnel to combat functions. That dwarfs the impact of increasing the military by 100,000 personnel, which would only add about 16,000 combat personnel if current staffing patterns are followed. It would also free up money from the equipment budget because the equipment would require less R&D and be cheaper. One suggestion along this line is for the United States to develop light attack turboprops instead of relying only on jets like the F-35 and drones like the Predator for air support.[131] This would result in an air support platform that is cheaper to procure and operate and much easier to maintain. While it would not be able to operate in the same range of threat environments, it might provide a viable option for wars like the United States has found itself fighting in recent decades.

But this shift in procurement procedures is unlikely to happen. Perhaps unfortunately, the only times the US military has been willing to accept less than cutting-edge equipment has been when starved for funds (such as the peacetime before the Cold War) or during emergencies. Wartime demands tend to shift procurement toward large quantities at the lowest possible cost, which favors simple and cheap designs.[132] For example, during World War II neither the Liberty ship nor the M4 Sherman tank were very technologically sophisticated, but they were cheap to produce in volume, and that is what was needed at the time.[133] None of the wars the United States has been involved in since WWII has been big enough to cause a broad shift to wartime procurement patterns, which is just as well, since in this case the cure really is worse than the disease.

The rest of the time, the dominant trend is to generate "99-percent solutions," because that is how our procurement system is set up.[134] This is a function of the combination of entrenched interests (the defense industry and Congress) and a military culture of technological optimism. As such, shifting US procurement practices will be very difficult. There is some potential for change in the form of the Sustainable Defense Task Force, which has recommended cutting military spending and shrinking some

programs.[135] However, this would not actually alleviate the potential for overstretch since the proposals involve cutting US forces. The task force recommendations are also unlikely to be implemented because they face strong opposition from defense industry lobbyists and congressional districts with large defense industries.[136]

As a result, the United States is at the top end of the "cost/quality spectrum," using very high quality equipment but at a very high cost,[137] and, if anything, appears to be reemphasizing advanced technology.[138] The Air Force and Navy have persisted in purchasing expensive multirole aircraft even though their main role since Vietnam has been ground attack.[139] This practice continues with the F-35 program, though it is being delayed slightly.[140] The Air Force is also developing a new long-range bomber that is being fully funded, at least so far,[141] a new "space plane" (the X-37B Orbital Test Vehicle) to replace damaged military satellites and possibly attack enemy satellites, and the Hypersonic Technology Vehicle-2, which (if it works) will allow for very fast and long-range strikes anywhere on the globe.[142] The Navy is keeping all 11 of its aircraft carriers[143] and continues to procure highly sophisticated (and thus expensive and complicated) ships like the DDG-1000 and the littoral combat ship (LCS).[144] The Army is testing a new personal weapon (the XM25) that shoots projectiles that explode at a set distance.[145] The cost per rifle is around $35,000, and the cost per bullet will be around $25 after mass production begins. This is far more expensive than the M-4 rifle, the current standard personal weapon, and will require far more support. All the services are experimenting with electromagnetic weapons that may disable enemy equipment and missiles.[146]

The one new technology that seems to have some potential to alleviate the pressure on the budget and generate a more efficient force is remotely piloted aircraft, or drones. There have been dramatic increases in the use of RPAs in the last decade, to the point that they now fly more total hours than US manned strike aircraft.[147] Predator drones cost much less than the aircraft they can replace, like the F-16 for ground support, and can be more freely deployed in dangerous situations because their pilot is safely on the ground and they have a lower replacement cost.[148] In particular, RPAs have already proved useful as reconnaissance and fire-support platforms.[149] In the future, we are likely to see increased automation of combat systems on land and sea as well.[150] RPAs are simpler than the aircraft they replace and thus should require less maintenance and support.[151]

However, RPAs are not actually going to materially affect the potential for overstretch, at least not in the short term. Because 75 percent of the support for RPAs has been outsourced to contractors, it is quite difficult to assess what impact their deployment has on the US military.[152] As with outsourcing support in general, this serves to mask the real support required by the military without actually reducing it. In fact, armed drones require *more* support than the aircraft they replace, at least so far.[153] Their potential cost-effectiveness may also be compromised by a higher loss rate due to the lack of redundant systems (part of the reason they are cheaper to build) and the perception they are more expendable than manned aircraft.

Other States and Nonstate Actors

To some extent, the success of the United States at leveraging technology to gain military superiority is causing emulation by those states which can afford it.[154] None can fully emulate the United States at present, so different states maintain different capabilities. Britain and France have largely stopped including capital ships in their navies.[155] Other NATO states have completely abandoned certain weapon systems or capabilities, such as the Dutch (maritime reconnaissance) and the Danes (submarines).[156] This may have something to do with why our NATO allies tend to have a larger proportion of combat forces but still required US support to intervene in Libya.[157] Rivals, including Russia and China, are engaged in modernization programs which include weapon systems that approach the capabilities of US systems.[158] In Russia, this is deliberately aimed at countering US conventional superiority through professionalizing its military and upgrading its equipment.[159]

Two main barriers face other states that seek to emulate the United States: individual weapon systems are too costly, and operating high-tech equipment requires highly trained and educated, long-service professionals that most states lack.[160] This can be thought of as a function of the financial intensity of the technologies involved and the organizational capital necessary to adopt the technologies. *Financial intensity* simply refers to the resource mobilization required to adopt a particular military innovation in terms of the unit cost of new equipment compared to that of the item being replaced.[161] *Organizational capital* refers to the ability of personnel to master new tasks and the willingness to fundamentally transform the way the institution operates (cultural flexibility). The financial intensity of the US way of waging war is very high due to the high unit costs associated

with key technologies, such as PGMs and stealth technology. By itself, this limits the ability of many states to emulate the United States because they lack the financial resources. As costs fall we should see more countries adopt these technologies, since the organizational capital to incorporate them is relatively low. Cyber warfare may require less financial intensity to adopt because of the extensive use of related technologies by commercial enterprises, but it will probably require a high organizational capacity because it constitutes a fundamentally different way of waging war. This may limit the ability of states like China to exploit this technology, even though they are trying to develop this capability.[162] It may also explain why the Soviet Union was unable to emulate the US military when the Soviets realized the revolutionary implications of US advances in electronics and precision guidance before the United States did.[163]

One area with real potential for other states to compete with the United States is in RPAs.[164] The technology itself is new enough and potentially revolutionary enough that it could render much of America's existing conventional inventory obsolescent, much like the development of aircraft carriers rendered battleships obsolescent during World War II. RPAs are also relatively cheap to operate, so financial intensity does not prevent adoption.[165] The similarity of operating an RPA to playing video games also reduces the organizational capacity necessary for adoption, since potential "pilots" are readily available.

The main way potential opponents have responded to US technological superiority so far is through asymmetric approaches.[166] The intensive use of technology by the United States has resulted in conventional superiority but also creates opportunities for foes to employ asymmetric counters to top-of-the-line US weapons.[167] These include missiles which can threaten US tanks, ships, and planes for a fraction of their price; submarines to undermine US naval superiority; and cyber warfare capabilities to degrade US communications and intelligence systems.[168] They also include weapons of mass destruction (WMD), particularly nuclear weapons.[169] Asymmetric tactics, such as attacking US bases or using irregular forces (who are also becoming more effective due to technological change) rather than directly confronting the United States with conventional forces, are another option.[170] Much of the conventional superiority of the US military can also be countered by operating in urban environments or other congested terrain.[171]

Conventional asymmetric approaches that have the greatest potential to degrade US military superiority tend to focus on air defense, missiles, and

submarines. Rod Thornton suggests that antiaircraft artillery and man-portable air-defense systems (MANPADS) are particularly problematic for US aircraft because both can use passive sensors which make them harder for US forces to suppress. This could force the United States to either carry out airstrikes from a higher altitude (which reduces effectiveness) or place very expensive aircraft at risk from relatively cheap air defenses.[172] While the potential for these weapons to threaten near-future US aircraft like the F-35 is probably overstated, in general it is cheaper to build extensive air defenses than it is to acquire the capability to suppress them. In a similar way, sea-skimming cruise missiles offer a cost-effective counter to US naval superiority by either forcing the ships to stay far offshore (where carrier-based aircraft are no longer useful) or risk destruction by much cheaper missiles.[173] Submarines are another cost-effective counter to US naval superiority, because cheap diesel-electric submarines are difficult to detect in littoral waters where US ships will need to go if they are to be of use during a conflict.[174] The net impact of these developments is that US conventional superiority is increasingly under threat in key regions like the South China Sea.

Conclusion

The strain on the US military resulting from Afghanistan and Iraq is related to the age-old tradeoff between quantity and quality, which is driven by inherent limitations on the resources that can be allocated to national defense.[175] Military power is a function of both, so excessive focus on either will compromise the whole. Quantity is particularly important for long wars,[176] which is exactly why operations in Afghanistan and Iraq put the Army and Marines under so much strain. Therefore, as former secretary of defense Robert Gates notes, the United States may have reached the point of diminishing returns for focus on qualitative superiority.[177]

The lack of sufficient forces in Iraq led directly to the post-invasion problems the United States experienced there.[178] We are seeing a similar dynamic take hold in Afghanistan, because even with the extra surge forces, the United States and its NATO allies lack enough troops on the ground to adequately police the entire country. Relying on Afghan forces is not a solution, because their level of training is much lower and the threat of Taliban infiltration is too high. This is an example of how technologies reduce personnel requirements for some missions but not for all. In

effect, the attempt to take advantage of the "revolution in military affairs" has resulted in a US military largely unprepared for missions other than high-intensity interstate war.[179] Firepower lethality can be decisive in wars that are "enemy-centric" but not in wars that are "population-centric," because the latter require spreading troops throughout the population.[180] Population-centric wars are precisely what the United States has found itself involved in over the last decade. Failing to better balance US military capabilities with the types of conflict it is likely to get involved in will probably result in similar problems in the future.[181] While it lacks a true peer competitor, the consensus position is that the United States needs to retain the full spectrum of military capabilities so it can carry out any type of mission.[182] Of course, that still leaves the question of priorities, since it is unlikely the United States will be able to excel at every type of conflict at the same time.[183] Unconventional approaches such as insurgency and terrorism are particularly difficult for the United States.[184] Counterinsurgency requires large numbers of costly ground troops, so it puts a large burden on a scarce resource. Terrorism offers US foes the chance to carry out damaging attacks at low cost and is challenging to combat because of the international scope of terrorist networks.[185] It is likely that the United States will find itself in further irregular conflicts,[186] but it still needs to be able to fight a high-intensity conflict against a major foe.

It would be easier to balance these demands if military forces were fungible, but most are not.[187] One possible solution is to establish two separate militaries, one for fighting conventional wars and one for unconventional conflicts and state-building,[188] though it seems unlikely any such plan would be implemented.[189] Barring such a radical step, the next best solution would be to place greater emphasis on factors like cost effectiveness and support requirements when new equipment is evaluated. Doing so offers the greatest potential for expanding US combat forces without increasing the defense budget, as discussed above. This approach may actually enhance US capabilities to fight a major war, if necessary, since it will provide more combat forces, and US technological advantages are already so large that cutting-edge equipment is probably not necessary to maintain conventional superiority.

The United States is a great power with interests around the globe and a tendency toward liberal interventionism.[190] It has a military quite capable of defending against any conventional threat that is likely to manifest for decades to come. However, barring a fundamental change in the way the

US military is staffed and equipped, periods of military overstretch are likely to recur whenever there is an increase in the operational tempo. As technological change continues, overstretch may even become the normal state of affairs. On the plus side, the conventional dominance of the United States and the inability of any other state to challenge it may help keep the international system relatively peaceful. If so, that may be an unexpectedly good side effect of American technological optimism. SSQ

Notes

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3. Jeffrey Record, *Bounding the Global War on Terrorism* (Carlisle, PA: Strategic Studies Institute, 2003), 39–40; Max Boot, "The New American Way of War," *Foreign Affairs* 82, no. 4 (2003); and Phillip Carter, "Hollow Force," *Slate.com* (2004), http://www.slate.com/articles/news_and_politics/war_stories/2004/04/hollow_force.html.
4. Defense Business Board, "Task Group Report on Tooth-to-Tail Analysis," 2008; David Isenberg, "Budgeting for Empire: The Effect of Iraq and Afghanistan on Military Forces, Budgets, and Plans," in *Independent Policy Reports* (Oakland, CA: Independent Institute, 2007); Kagan, "U.S. Military's Manpower Crisis"; and Robert Haddick, "This Week at War: General Casey's Doubts," *ForeignPolicy.com*, 2009, http://www.foreignpolicy.com/articles/2009/10/23/general_caseys_doubts.
5. James Hackett, ed., *The Military Balance 2010* (London: Routledge, 2010).
6. Defense Business Board, "Task Group Report."
7. Isenberg, "Budgeting for Empire," 12.
8. Ibid., 13.
9. Kagan, "U.S. Military's Manpower Crisis."
10. Isenberg, "Budgeting for Empire," 13.
11. Lawrence J. Korb and Peter Ogden, "The Army You Have," *Foreign Affairs* 85, no. 6 (2006); and Kagan, "U.S. Military's Manpower Crisis."
12. Robert D. Kaplan, "Center Stage for the Twenty-first Century," *Foreign Affairs* 88, no. 2 (2009).
13. Ibid., 26.
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15. "Defence Spending in a Time of Austerity," *Economist*, 26 August 2010; and Kaplan, "Center Stage for the Twenty-first Century."
16. Richter, "As Campaign Intensifies."
17. Michael Handel, "Numbers Do Count: The Question of Quality versus Quantity," *Journal of Strategic Studies* 4, no. 3 (1981): 235.
18. Tony Capaccio, "Pentagon's New Bunker-Busters Not for Iran or 'Any One Country,'" *Businessweek*, 21 November 2011.
19. Max Boot describes another "American Way of War" that deals with fighting small wars, though in many of these, the materialist approach to annihilating foes also was present. Boot, *The Savage Wars of Peace: Small Wars and the Rise of American Power* (New York: Basic Books, 2003).
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Strategy and Policy, The Wars of the United States (New York: Macmillan, 1973); Thomas G. Mahnken, *Technology and the American Way of War* (New York: Columbia University Press, 2008), 4; Reuben E. Brigety, *Ethics, Technology, and the American Way of War: Cruise Missiles and US Security Policy*, Contemporary Security Studies (London; New York: Routledge, 2007), 37–38; and Benjamin Buley, *The New American Way of War: Military Culture and the Political Utility of Force*, LSE International Studies (New York: Routledge, 2007), 2. This has been described more broadly as the "Western way of war," though the United States has generally been understood as adopting an extreme form of this preference for decisive battle. Victor Davis Hanson, *The Western Way Of War: Infantry Battle in Classical Greece* (Berkeley: University of California Press, 2000); Hanson, *Carnage and Culture: Landmark Battles in the Rise of Western Power* (New York: Doubleday, 2001); and John Keegan, *A History of Warfare* (New York: Knopf/Random House, 1993).

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25. Buley, *New American Way of War,* 49–50.

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28. Keegan, *History of Warfare*, 387; John A. Lynn, *Battle: A History of Combat and Culture* (Boulder, CO: Westview Press, 2003); Hanson, *Western Way of War*; and Hanson, *Carnage and Culture*.

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34. Mahnken, *Technology and the American Way of War*, 27–50.

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38. Ibid., 89.
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40. Ibid., 102–3.
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42. Ibid., 113–17.
43. Ibid., 118; and Hoffman, *Decisive Force*, xi.
44. Buley, *New American Way of War*, 72–73, 77; and Shimko, *Iraq Wars and America's Military Revolution*, 32–33.
45. Mahnken, *Technology and the American Way of War*, 122–24; Adamsky, *Culture of Military Innovation*; and Shimko, *Iraq Wars and America's Military Revolution*, 35–36.
46. Mahnken, *Technology and the American Way of War*, 157, 75; Adamsky, *Culture of Military Innovation*, 74–75; and Shimko, *Iraq Wars and America's Military Revolution*, 171.
47. Mahnken, *Technology and the American Way of War*, 157–73; and Shimko, *Iraq Wars and America's Military Revolution,* 40–45, 108.
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62. "Defence Spending in a Time of Austerity."
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64. Pugh, *Cost of Seapower,* 144.
65. Kagan, "U.S. Military's Manpower Crisis."
66. Augustine, *Augustine's Laws*, 14, 23.
67. Handel, "Numbers Do Count," 228.
68. Pugh, *Cost of Seapower*, 252.
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70. Augustine, *Augustine's Laws*, 43–44.

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80. Ibid., 1.
81. Pugh, *Cost of Seapower*, 143–44; and Augustine, *Augustine's Laws*, 53–59.
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83. Augustine, *Augustine's Laws*, 70.
84. Carl Conetta and Charles Knight, *The Readiness Crisis of the U.S. Air Force: A Review and Diagnosis* (Cambridge, MA: Commonwealth Institute, 1999).
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88. Freedman, *Revolution in Strategic Affairs*, 5.
89. Shimko, *Iraq Wars and America's Military Revolution*, 38.
90. Handel, "Numbers Do Count," 229, 44–45; Boot, *War Made New: Technology, Warfare, and the Course of History, 1500 to Today* (New York: Gotham Books, 2006), 431; and Fred Kaplan, "Dumb and Dumber: The U.S. Army Lowers Recruitment Standards . . . Again," *Slate.com*, 2008, http://www.slate.com/articles/news_and_politics/war_stories/2008/01/dumb_and_dumber.html.
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99. John J. McGrath, *The Other End of the Spear: The Tooth-To-Tail Ratio (T3R) in Modern Military Operations*, Long War Series Occasional Paper (Fort Leavenworth, KS: Combat Studies Institute Press, 2007).
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101. Scott Gebicke and Samuel Magid, *Lessons from around the World: Benchmarking Performance in Defense* (Pittsburgh, PA: McKinsey and Co., Spring 2010). According to the Defense Manpower Center, the combat troop share of the Army and Marines is approximately 25 percent.

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103. Gebicke and Magid, *Lessons from around the World*, 12.

104. McGrath, *Other End of the Spear*.

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107. Buley, *New American Way of War*, 104–5; and P. W. Singer, "Outsourcing War," *Foreign Affairs* 84, no. 2 (2005).

108. Mark Cancian, "Contractors: The New Element of Military Force Structure," *Parameters* 38, no. 3 (2008): 61; and P. W. Singer, *Corporate Warriors: The Rise of the Privatized Military Industry*, Cornell Studies in Security Affairs (Ithaca: Cornell University Press, 2003), 16. Many support functions were also shifted to the reserves.

109. Singer, "Outsourcing War," 122–23.

110. Singer, *Corporate Warriors*, 15.

111. Moshe Schwartz, *Department of Defense Contractors in Iraq and Afghanistan: Background and Analysis* (Washington: CRS, 2009); Singer, "Outsourcing War," 122; and Cancian, "Contractors."

112. The real total would be more like 400,000 when the training pipeline is included. Cancian, "Contractors," 73.

113. Ibid.; and Isenberg, "Budgeting for Empire," 17–18. This inability to increase the size of the military and the high demand for particular specialties also led to the use of "stop-loss" to prevent over 50,000 troops from leaving the service by the end of 2005.

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