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AEROSPACE AND DEFENSE PRACTICE

# Fiscal shock, combat awe

**The United States has traditionally cut defense costs in the wrong ways. In this edited extract from a new Aspen Strategy Group book, McKinsey's John Dowdy and Diana Farrell explain how the country can preserve its fighting power in the age of austerity.**

**John Dowdy and Diana Farrell**

Since World War II, the United States has been the world's largest defense spender by far. US wars in Iraq and Afghanistan in the past decade accelerated spending, driving it to historic heights and increasing America's global share of a $1.55 trillion market to 44 percent—more than six times the share of China, the second-leading spender.[1]

Today, the defense budget is set to decline dramatically. That's not unusual. In 1952, defense spending reached a post–World War II high of 15 percent of GDP. In the years after the Korean War, it fell by 45 percent. In the 1970s, following the end of the Vietnam War, total defense spending fell by 33 percent; again in the 1990s, as the Cold War came to a close, defense spending declined by 35 percent. All of these cuts were deeper than those currently planned. Another similarity is that each of those cuts came at the end of a major conflict.

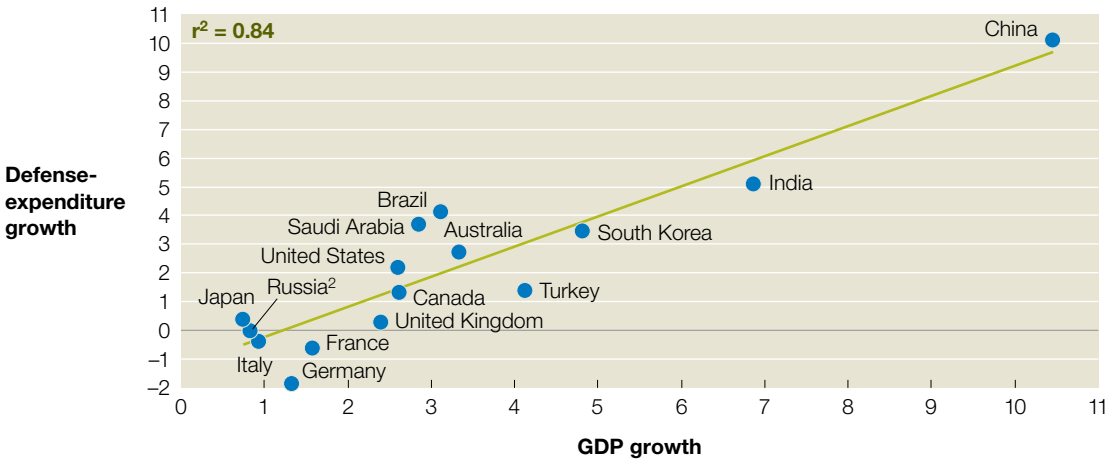
Meanwhile, the long-term trend line has been remarkably stable. America's dominant position in the defense-spending-league table since the end of the Cold War reflects the country's economic strength as much as its policy stance and external orientation (Exhibit 1). In the short term, the country adjusts its defense spending to reflect the threat level, but over the longer term, it has the defense forces it can afford.

Today's drawdown is different from previous versions. True, the cuts come as a major conflict winds down. But this time, we have austerity without peace. The withdrawals from Iraq and Afghanistan are fraught with instability, conflicts hot and cold continue in many parts of the world (for example, in the Korean peninsula), and new conflagrations continue to flare up (as in Mali and Syria). For militaries around the world, this is not

Exhibit 1

## Growth in military spending and GDP are correlated over the long term.

Major military powers' GDP and military-expenditure real growth rates,[1]
1991–2011 compound annual growth rate, %




r² is the proportion of variance explained by a regression.
[1]Includes the 15 nations with the largest defense budgets in 2011, representing ~83% of global defense spending.
[2]For Russia, 1992 defense spending used in place of 1991 due to data-availability issues.

Source: Stockholm International Peace Research Institute; McKinsey analysis

the austerity of choice. Instead it is austerity driven by national financial imperatives, though threat levels stay high.

### A flawed approach

In each of the three downturns in US defense spending since 1950, the approach to cutting costs has tended to result in disproportionate reductions in capability, far more than the budgetary cuts would imply. In the aftermath of the Vietnam War, when expenditures fell by 33 percent, the active fighter-aircraft inventory fell by 43 percent, from 4,004 to 2,299,[2] and the number of surface warships fell by 40 percent, from 304 to 182.[3] In addition to these reductions in force structure, serious shortages of qualified soldiers became a pervasive problem affecting unit readiness; in 1979, six of ten Army divisions stationed in the United States were deemed "not combat-ready."[4] The end of the Cold War brought similar budget cuts and a similarly disproportionate impact to force structure. While the so-called Base Force[5] budget was planned as a 10 percent reduction from previous levels, the decline was 35 percent in real terms. But US active fighter-aircraft inventory fell by 49 percent, from 3,057 to 1,553,[6] and the number of surface warships fell by 50 percent, from 223 to 111.[7]

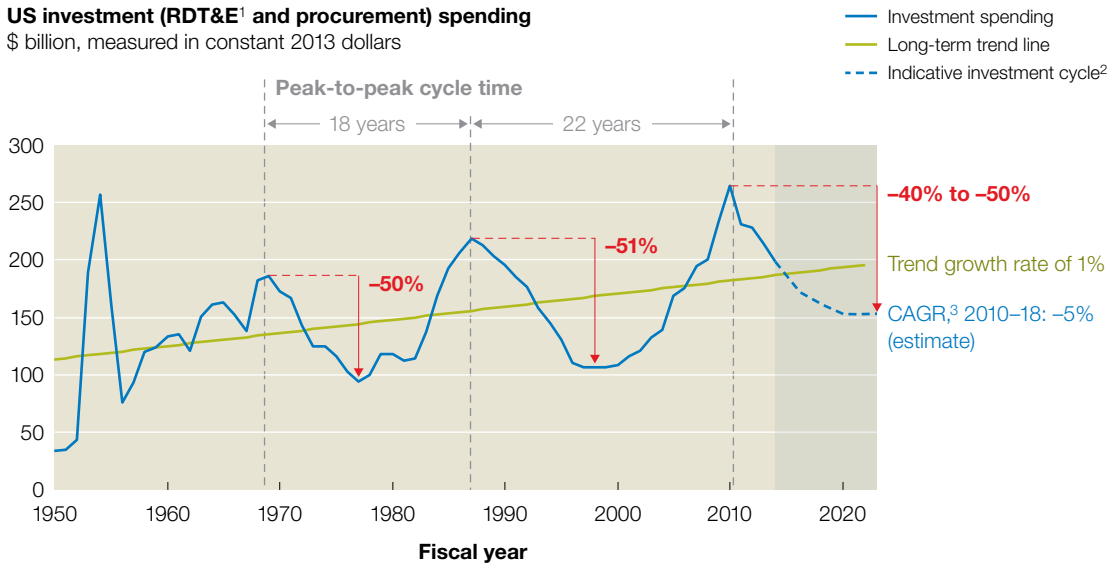
Why does this happen? At the risk of oversimplifying a complex process, defense planners tend to cut what they can. When governments need to save money quickly, they naturally and instinctively look first at cuts to the current-year budget, particularly training and maintenance, which seem straightforward and guaranteed to save money. However, cuts in these areas tend to be ineffective; there isn't enough spending to deliver the required savings, and over time such cuts "hollow out" a force, leaving it incapable of delivering combat power when needed.[8]

Militaries then look at reductions in force structure and reductions in equipment procurement. In the United States, which spends more on equipment than its NATO allies in Europe (more than 30 percent versus an average of 20 percent in Europe), the cuts tend to fall disproportionately on equipment. For example, in the 1970s and again in the 1990s, though overall defense spending fell by about 30 percent, equipment acquisition fell by some 50 percent (Exhibit 2).

But canceling or reducing the scope of equipment projects once they are under way does not save as much as governments hope. Although it might seem reasonable that cutting the number of ships, tanks, or aircraft by half should save half the money, this is not the case. A substantial proportion of the total cost is tied up in research and development. For example, the development costs for the F-22 Raptor accounted for $32 billion of the total $67 billion program cost.[9] When programs are canceled prior to full production, these sunk costs are lost entirely. If the number of aircraft is reduced, only the production cost is saved, and unit costs tend to increase as fixed costs are spread across a decreasing number of units. In some instances, total program costs can even climb as orders are chopped, especially as production volumes are stretched over longer periods of time.

Exhibit 2

## The industry should prepare for a significant cyclical decline in defense spending.




[1]Research, development, test, and evaluation.
[2]McKinsey projections assume $800 billion in total reductions to Department of Defense discretionary funding for 2011–21 (the midpoint between the president's budget and the Budget Control Act of 2011's "sequestration"), with 50% of $800 billion in cuts coming from procurement and RDT&E.
[3]Compound annual growth rate.

Source: Office of Management and Budget; US Department of Defense; McKinsey analysis

Disproportionate cuts to the investment accounts can also result in a loss of the technological dominance US forces have relied upon.[10] Although the United States has some of the most capable equipment in the world, equipment numbers remain at low, post–Cold War levels. And the equipment is aging. The current US Air Force fleet, whose planes are more than 26 years old on average, is the oldest in USAF history.[11] Recurring deployments are wearing out an already aging fleet of combat vehicles.

### Déjà vu all over again

Defense budget cuts are now well under way in the United States, and it appears that the traditional approaches are still in favor. Sequestration has already resulted in substantial cuts to readiness-related spending. Yet in a break with the traditional pattern, Defense Secretary Chuck Hagel launched the Strategic Choices and Management Review (SCMR) "to reassess the basic assumptions that drive the Department's investment and force structure decisions and to search for additional management efficiencies."[12] In their prepared testimony in front of the House Armed Services Committee to discuss the findings of the SCMR, Deputy Secretary of Defense Ashton B. Carter and Vice Chairman of the Joint Chiefs of Staff James A. Winnefeld Jr. emphasized that "a combination of carefully chosen efficiencies and compensation reforms, combined with various carefully and strategically chosen alternative approaches to cuts in force structure, investment, and readiness, could achieve sequestration-level cuts over time"[13] but would require increased flexibility in administering the cuts over more time. Given these dependencies, some critics continue to wonder whether and how it will be possible to preserve readiness, fulfill all of the missions deemed critical to the nation's security, and invest in all of the weapons spending those missions entail with a postsequestration budget $454 billion smaller than the Department of Defense (DOD) has today. In effect, these critics are asking whether we are in another plans–reality mismatch.[14]

## Why this time must be different

We have seen how, paradoxically, cutting frontline units and equipment programs is a costly way of reducing costs. Getting more output from defense expenditure requires a different approach—one that links all output back to the requirement, drives functional efficiencies, and eliminates unnecessary bureaucracy and overhead. To its credit, the department has attempted to cut overhead costs in the past and is planning to do so as part of the SCMR. But its record has been less than stellar. Then-Secretary Robert Gates referred to his experience doing this as "akin to an Easter egg hunt."[15] He found it nearly impossible to get accurate answers to questions such as "How much money did you spend?" and "How many people do you have?"

Our research and experience[16] with high-performing defense departments around the world suggests there is a clear template to follow. Using the traditional military virtues of pragmatism and ingenuity, these organizations have found ways to boost productivity and achieve the substantial savings needed (up to 20 percent of the defense budget, excluding pension costs) while also protecting combat power. Three steps can deliver real savings: clarifying the military's true requirements, making the military's support functions (especially procurement, logistics, and IT) more efficient, and reducing administrative costs.

### Clarify the military's true requirements

As countries reexamine their strategic posture, they also must redefine their expectations for their armed forces. The DOD is currently

engaged in this process through the SCMR. But the SCMR is a bottom-up review of the Pentagon's budget led by officials from the Cost Assessment and Program Evaluation group, rather than a bottom-up review of its strategy.[17] In this case, as often happens, discussions of strategy are uncoupled from decisions about budgeting and resource allocation.

Furthermore, even when changes in strategy result from these reviews, they often take far too long to be translated into detailed expectations for individual units. Militaries thus accrete redundant infrastructure, preparing for the new demands while never quite phasing out the infrastructure that is no longer needed. US forces have yet to fully adapt to the shift from the mandate to prevail in two major regional conflicts simultaneously to one that calls for defeating one adversary and denying a second while defending the homeland. Adapting forces to the changing demands of strategy requires first a clear strategic direction and then its rapid conversion into specific and detailed requirements for personnel training, equipment, logistics support, maintenance, stock holdings, and infrastructure at the level of individual units. Based on this, a plan can be developed for adapting each capability and for the force as a whole, which can then release resources that are no longer needed.

The United Kingdom has had some success at tackling this problem. When high-level policy shifted the focus from worst-case scenarios to the most likely scenarios, the Ministry of Defence (MOD) changed the way it repairs aircraft. "Depth" repairs are now conducted at a single location for each aircraft type, and only "forward" repairs are made at operational squadrons. As part of a comprehensive program of coordinated changes, this move helped cut in half the cost of operating Tornado aircraft.

### Pursue functional efficiencies

Although defense is unique in many respects, many of the challenges the DOD faces are no different from those faced by big businesses around the world. As the Defense Business Board points out, "there are world-class best business practices that are applicable to government and that could make a huge positive difference."[18] The biggest opportunities are in procurement, logistics, and information technology.

*Nonequipment procurement.* Procurement offers plenty of potential cost savings. The DOD spends $14 billion annually on such items as food, fuel, and spare parts for aircraft, ships, and vehicles. Some militaries are saving 12 to 20 percent on these items by, among other things, using a "category management" approach that encompasses all aspects of the management of a group of similar purchased goods.[19] In Israel, the Israel Defense Forces and the Ministry of Defense have begun to work in integrated procurement teams, which take full accountability for a category. Category managers in these teams start from initial requirements. Their work addresses five areas with potential for savings: detailed specifications—often the best way to achieve savings is by reducing "gold plating"; quantity—for example, many ministries buy too many high-end personal weapons compared with the numbers of troops eligible to receive them, as more basic weapons have been defined as sufficient for many troops; order size—many ministries buy multiple small batches rather than the true required number for a year or multiple years; negotiations with suppliers on price and contract terms; and the management of stocks, storage, and distribution after purchase. In many cases, especially in maintenance, category management also involves make-versus-buy decisions. Detailed work on six categories representing roughly one-third of spending

yielded annual savings of 8 to 10 percent. Based on this work, the Israeli government projects total savings of $250 million per year.[20]

*Logistics.* Many militaries have made substantial changes to their forces and how they operate, while the supporting logistics remain largely unchanged. Some forces have seen substantial improvements in productivity—up to 30 percent—by redesigning the flow of goods "from factory to foxhole" to eliminate waste. The UK MOD did some pioneering work in its revitalization of its Defence Logistics Organisation (DLO) from 2004 to 2007. An end-to-end approach identified and delivered savings of between 19 and 24 percent in equipment maintenance, repair, and overhaul activities. The planned savings (and quite a bit more) were delivered through a complex, multiyear, ministry-wide transformation program, involving more than 1,000 pan-departmental projects and affecting more than 20,000 MOD staff. The program resulted in new support arrangements for a wide range of platforms, including tactical aircraft, transport aircraft, ships, submarines, helicopters, surveillance assets, and armored fighting vehicles. Total savings through this four-year comprehensive redesign of support arrangements were £2.8 billion.[21]

Militaries can also capture more value from arrangements with their third-party logistics providers. With the growing prevalence of performance-based-logistics (PBL) contracts, more of the total support cost is outside the DOD's direct control. When set up properly, these contracts can deliver real savings. In the United Kingdom, the availability-based contracts for the Tornado fleet delivered substantial savings: the BAE Systems ATTAC contract saved the MOD £510 million over the first ten years, and the Rolls-Royce ROCET1 saved £136 million over five years.[22] But these contracts do not always represent good value. In 2008, the US Government Accountability Office conducted a review of PBLs and found that while in almost all cases performance was at or above the contracted level, the evidence for cost savings was unclear, and in some cases the PBL had cost more.[23] To ensure that PBLs deliver value, we have found it necessary to audit suppliers. In one international example, we found parts priced as much as 2.2 times the market rate. Subsequent negotiations reduced the total contract cost by 42 percent.

*Information technology.* Our work on IT with defense forces has shown that it is possible to increase the efficiency of the data architecture three to four times by clarifying the decision rights and authority held by individual program managers and system integrators. When responsibilities and controls are tangled and overlap, between 60 and 80 percent of resources are typically underutilized. After aggregating resources to share fixed costs, it is possible to drive labor productivity up (and in some cases to double it) by segmenting, consolidating, and streamlining work flows.

At around $33 billion annually, the DOD is the world's largest spender on IT by a factor of three, yet it struggles to achieve the scale benefits typically enjoyed by a $1 billion organization. Recently the department has begun to find ways to get better yield from its IT expenditures. The Office of the Under Secretary of Defense for Personnel and Readiness (P&R) launched a broad transformation program in 2011 to modernize and realize economies of scale. P&R identified more than $400 million in annual savings (more than 15 percent of its total IT budget) through data-center consolidation (including reductions in the number of sites, better utilization of servers and floor space, and reductions in real-estate costs);

productivity improvements (such as lowering desk-side support ratios and providing more remote support); and strategic sourcing (for example, rationalizing the number of software licenses and changing the frequency of hardware-refreshment cycles).

### Reduce administrative expenses

Since the end of the Cold War, most Western countries have failed to reduce administrative functions at the same rate they have reduced frontline forces. Headquarters and support functions have tended to shrink more slowly than the frontline units—partly due to organizational inertia (the people deciding on cuts are rarely those at the front line) and partly due to the loss of genuine economies of scale. In addition, the oversight added in recent years to help control costs has ironically driven administrative costs higher.

In its 2010 report on DOD overhead,[24] the Defense Business Board highlighted "an explosion of overhead work because the department has failed to establish adequate controls to keep it in line relative to the size of the warfight." Indeed, our analysis consistently shows that the productivity of DOD administrative functions is well below that of key allies and comparable public and private organizations. We see similar opportunity to improve the appropriate use of uniformed military personnel, civilians, contractors, reservists, and third-party providers for individual tasks. In the United States, some of the variance is inevitably caused by the more expeditionary nature of US forces (and dependence of some of its allies on the United States in this regard), but there is clearly an opportunity to improve.

A more comprehensive approach to administrative costs was taken in Denmark, where the military was reorganized from 2005 to 2007 to move from a static, defensive posture to one that could support expeditionary missions abroad. The Danish Ministry of Defence described the situation and the work it did: "The support structures, the tail, had grown out of proportion, and the operational structures, the teeth, had reached a level of close to irrelevance. The restructuring from scratch entails a change in emphasis in order to bring the priorities from 40 percent operational capabilities and 60 percent support structures to 60 percent operational capabilities and 40 percent support structure."[25]

While Denmark's ministry (a much smaller organization than the US DOD) had already started down the road of unlocking cross-service efficiencies (a topic discussed above), it extended this journey dramatically by creating further triservice organizations for both general support functions (HR, accounting, IT, and communications) and military support functions (logistics and maintenance). The transformation reduced support costs by a third.

## From what to how

A bipartisan group of defense analysts joined forces in June 2013 to petition the administration and the Congress to "ditch the politics of defense and focus on the management dilemma."[26] Despite ideological differences, the analysts agree on an agenda of changes, including a reduction of the civilian workforce similar to what we described above. The Center for a New American Security, one of the think tanks involved, also released a report in June 2013 that spells out its proposed cost-cutting agenda in more detail; it too presented some ideas that we endorse.[27]

However, as the signatories to the think-tank letter recognized, the "challenge has been getting Congress and the administration to admit change

is required and take action." The new ideas we described are not minor adjustments. The changes they entail are transformational, not incremental—requiring an intensive, programmatic series of initiatives (often cutting across several disciplines and organizational boundaries) characterized by major shifts in mind-sets, behaviors, and capabilities.

Successfully implementing this type of transformational change is not easy; indeed, the majority of transformation programs in both the public and private sector fail. Our recent survey of almost 1,000 leaders and senior employees in more than 30 US government agencies found that only 40 percent believed that their transformation programs succeeded.[28]

However, our experience with large-scale transformation programs in defense organizations around the world has taught us five lessons that can help contribute to the success of a defense transformation.

- Start at the sharp end. Defense leaders are rightfully concerned first and foremost with preparing, deploying, and sustaining forces to deliver operational effect. Change programs in defense that start with operational effectiveness create stronger engagement and are more likely to succeed than those focused primarily on cost reduction. The United Kingdom's work on end-to-end logistics serves as a good example. Rather than focusing primarily on cost reduction, the program set out to deliver a number of important operational improvements. These included reducing the deployed footprint, improving supply-chain performance, and increasing platform availability. By proposing to deliver a superior operational solution, the program secured the full support of operational commanders. In almost all of the areas investigated, it also delivered a more cost-effective solution. The DLO recognized that a better solution is usually also a cheaper one, though the converse is not always true. As a result of this work, for example, delivery time to bases in the United Kingdom and Germany decreased from 30 days to 7 days. In Afghanistan, customer wait time was reduced by 15 days.[29]

- Lead through the line. In a typical transformation program, a project team—working in relative isolation—defines the program's objectives, designs initiatives, and expects personnel on the ground to implement them. This is a mistake, particularly in military organizations where, in our experience, commanders often prefer to give up budget rather than authority. In contrast, leaders of successful defense transformations empower line personnel, set clear expectations of them, and hold them accountable for the transformation's success within the established chain of command. The UK's Defence Logistics Transformation Programme (DLTP) was particularly successful in this regard. Warfighters were embedded into each of the project teams and helped shape the specific recommendations. Suggested changes were then vetted with the appropriate frontline commanders, who were able to quiz their own embedded staff about the suitability of the resulting initiatives. An audit of the program by the UK Office of Government Commerce found "the DLTP has been well led and organized. The program appears to have been notably successful, through a structure of program boards, in obtaining buy-in at senior levels in the frontline commands whose full involvement in implementing the change will be vital to success."[30] Leading change programs "through the line" in this way capitalizes on the "can do" attitude of military culture, empowering officers to hit aggressive targets set through the chain of command.

- Resist the urge to reorganize; start with quick wins. When embarking on a transformation program, it can be tempting to focus first on reorganization. But an initial emphasis on roles, responsibilities, and reporting often delivers few results. Leaders of successful defense transformations resist the urge to reorganize and focus first on securing successes that can make a big difference to the momentum of a program. They specifically aim to achieve quick wins, often through targeted pilots, over the first three to six months. Many of these initial successes can then be turned into transformational change across the organization. One such example is a recent pilot at the UK MOD, a six-month trial of logistics transformation techniques in five areas (spanning tactical aircraft, tactical lift, and rotary lift). These pilot programs demonstrated immediate cost savings, contributing to £300 million in savings in the first year of the transformation. Just as important, the programs created the confidence, momentum, and initial capabilities to enable a rollout that eventually transformed the structures and practices of maintenance across the Royal Air Force.

- Expect (and plan to overcome) resistance to change. Large militaries are highly resistant to change as a result of their organizational size, complexity, and culture. In the United States, for example, in 2006 the Defense Business Board's Innovation and Cultural Change Task Group concluded, "The current defense enterprise promotes a risk-averse culture that is afraid to fail and strongly resists change."[31] Yet despite a general awareness of this resistance, even seasoned defense leaders underestimate the degree of inertia and resistance to change within their organization. Leaders of successful defense transformations take an end-to-end approach to overcome this inertia in two ways. First, they set a clear vision and ambition for the transformation—one that emphasizes the link to the organization's overall mission, clarifies why the program is necessary, and outlines a journey over the coming years that resonates within the organization. When the United Kingdom created the DLO, it set an ambitious goal to reduce costs by 20 percent while maintaining output, a target reached as promised within five years. The savings were required to fund a series of important equipment upgrades, which served to secure support from operational commanders. Second, this approach ensures a credible and visible commitment to the transformation from top-level leadership. The United Kingdom's end-to-end review of air and land logistics was jointly led by the vice chief of the defense staff and the MOD's second permanent undersecretary.

- Invest in building capabilities. Building the right capabilities is a prerequisite to achieving and sustaining change in any organization. Among US government leaders who reported limited success in their change efforts, 75 percent said that the right capabilities were not present.[32] In many defense ministries, leaders rise through the ranks based on a substantial body of excellent work that demonstrates mastery of core military and leadership skills critical to warfighting. But achieving and sustaining change often requires not military but management capabilities in fields such as project management, procurement, and product development. Successful transformation programs first define the core and functional capabilities required and then invest in building these capabilities using programs that follow best-practice adult-learning principles. Such approaches, which are familiar to the military from its combat-skill development, can be six to seven times more effective than conventional training courses. Take project management, for example, where a robust organizational capability can pare as much as 20 percent of costs in about half the defense budget. One defense organization used "learning by doing" programs to train several waves of project managers and leaders. Managers who successfully completed the training designed to build their project-management capabilities were able to cut costs on most projects by between 20 and 35 percent.[33]

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Today's belt-tightening may seem uniquely difficult, with defense budgets forced to be reduced even as major conflicts continue to erupt. Yet it's worth being reminded of Rudyard Kipling's timeless military principle, laid out in 1886 in "Arithmetic on the Frontier":

No proposition Euclid wrote,
No formulae the text-books know,
Will turn the bullet from your coat,
Or ward the tulwar's downward blow.
Strike hard who cares—shoot straight who can—
The odds are on the cheaper man.

[1] Stockholm International Peace Research Institute, sipri.org.
[2] Colonel James C. Ruehrmund Jr. and Christopher J. Bowie, *Arsenal of Airpower: USAF Aircraft Inventory 1950–2009*, Mitchell Institute Press, 2010, afa.org.
[3] "US Navy active ship force levels, 1886–present," Naval History & Heritage Command, history.navy.mil.
[4] Richard Halloran and Bernard Weinraub, "Nation's military anxiety grows as Russians gain," *New York Times*, September 21, 1980.
[5] The Base Force announced in 1990 was the embodiment of a new military strategy and force structure for the post–Cold War era. It was predicated on the assumption that the United States would not have to commit any significant forward-deployed forces—a recognition of the perceived drop in the threat level. See Lorna S. Jaffe, *The Development of the Base Force, 1989–1992*, Joint History Office, Office of the Chairman of the Joint Chiefs of Staff, 1993, dtic.mil.
[6] Ruehrmund Jr. and Bowie, *Arsenal of Airpower: USAF Aircraft Inventory 1950–2009*.
[7] "US Navy Active Ship Force Levels, 1886–present."

[8] Indeed, the term "hollow force" is an artifact of an earlier drawdown. General Edward C. Meyer, chief of staff of the Army (1979–83), is credited with introducing the term during a May 29, 1980, House Armed Services Committee hearing, in which he said: "Right now, as I have said before, we have a hollow Army. Our forward-deployed forces are at full strength in Europe, in Panama, and in Korea. Our tactical forces in the United States are some 17,000 under strength." The term came to mean not only shortages of experienced personnel but also shortages of training, weapons, and equipment that undermine military readiness.

[9] Jeremiah Gertler, *Air Force F-22 Fighter Program*, Congressional Research Service, 2013, fas.org.

[10] Steven Bowns and Scott Gebicke, "From R&D investment to fighting power, 25 years later," *McKinsey on Government*, March 2010, mckinsey.com.

[11] "Aging array of American aircraft attracting attention," *Defense Industry Daily*, February 6, 2013, defenseindustrydaily.com.

[12] Secretary of Defense Chuck Hagel's submitted statement on the FY 2014 budget request for the Department of Defense, House Budget Committee, June 12, 2013, budget.house.gov.

[13] Deputy Secretary of Defense Ashton B. Carter and Vice Chairman of the Joint Chiefs of Staff James A. Winnefeld Jr., prepared testimony, House Armed Services Committee, August 1, 2013.

[14] In 1980, Pentagon analyst Chuck Spinney gained national prominence for his critique of the defense budgeting process, *Defense Facts of Life: The Plans/Reality Mismatch* (republished in 1985 by Westview Press), in which he criticized what he described as the reckless pursuit of costly, complex weapon systems by the Pentagon without regard to budgetary consequences.

[15] Bob Brewin, "Gates and the defense budget Easter egg hunt," nextgov.com, May 25, 2011.

[16] For a fuller description of this work, see David Chinn, "Preserving combat power when defense budgets are falling," *McKinsey on Defense*, April 2013, mckinsey.com.

[17] James Jay Carafano, "Chuck Hagel begins knifing the Pentagon," *Washington Examiner*, April 7, 2013, washingtonexaminer.com.

[18] Minutes of the quarterly meeting of the Defense Business Board, July 2010, dodbuzz.com.

[19] Hans Arnum et al., "Big savings from little things: Non-equipment procurement," *McKinsey on Government*, March 2010, mckinsey.com.

[20] "Efficiency plan due to save defense system at least 100 million NIS a year," Israel Defense Forces, August 2009, dover.idf.il.

[21] *Defence Logistics Transformation Programme*, UK Ministry of Defence, April 2008.

[22] "ATTAC! Britain hammers out through-life support framework for Tornado fleet," *Defense Industry Daily*, October 24, 2012, defenseindustrydaily.com; Craig Woodhouse, "Rolls-Royce and MoD sign £690m contract," *The Independent*, April 7, 2010, independent.co.uk.

[23] *Defense Logistics: Improved Analysis and Cost Data Needed to Evaluate the Cost-effectiveness of Performance Based Logistics*, US Government Accountability Office, December 2008, gao.gov.

[24] Arnold Punaro, "Reducing overhead and improving business operations: Initial observations," Defense Business Board, July 22, 2010, dbb.defense.gov.

[25] General H. J. Helsø, "Transformation is key to armed forces' relevance," Danish Defence, July 2013, forsvaret.dk.

[26] Letter from the Defense Reform Consensus to Secretary Hagel et al., June 3, 2013, aei.org.

[27] Lieutenant General David W. Barno et al., *The Seven Deadly Sins of Defense Spending*, Center for a New American Security, 2013, cnas.org.

[28] Stacey Dietsch et al., "Leading transformational change in the public sector," McKinsey & Company, May 2013.

[29] Air Vice-Marshal Matt Wiles CBE and David Chinn, "Supply chain transformation under fire," *McKinsey on Government*, March 2010, mckinsey.com.

[30] UK Office of Government Commerce Gateway Review 888.

[31] Henry Dreifus et al., *Innovation and Cultural Change Task Group Report*, Defense Business Board, May 2006, dbb.defense.gov.

[32] Dietsch et al., "Leading transformational change in the public sector."

[33] Jonathan Kolodny, Adi Leviatan, and Dana Maor, "Project management in defense: The essential capability," *McKinsey on Defense*, Spring 2013, mckinsey.com.

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