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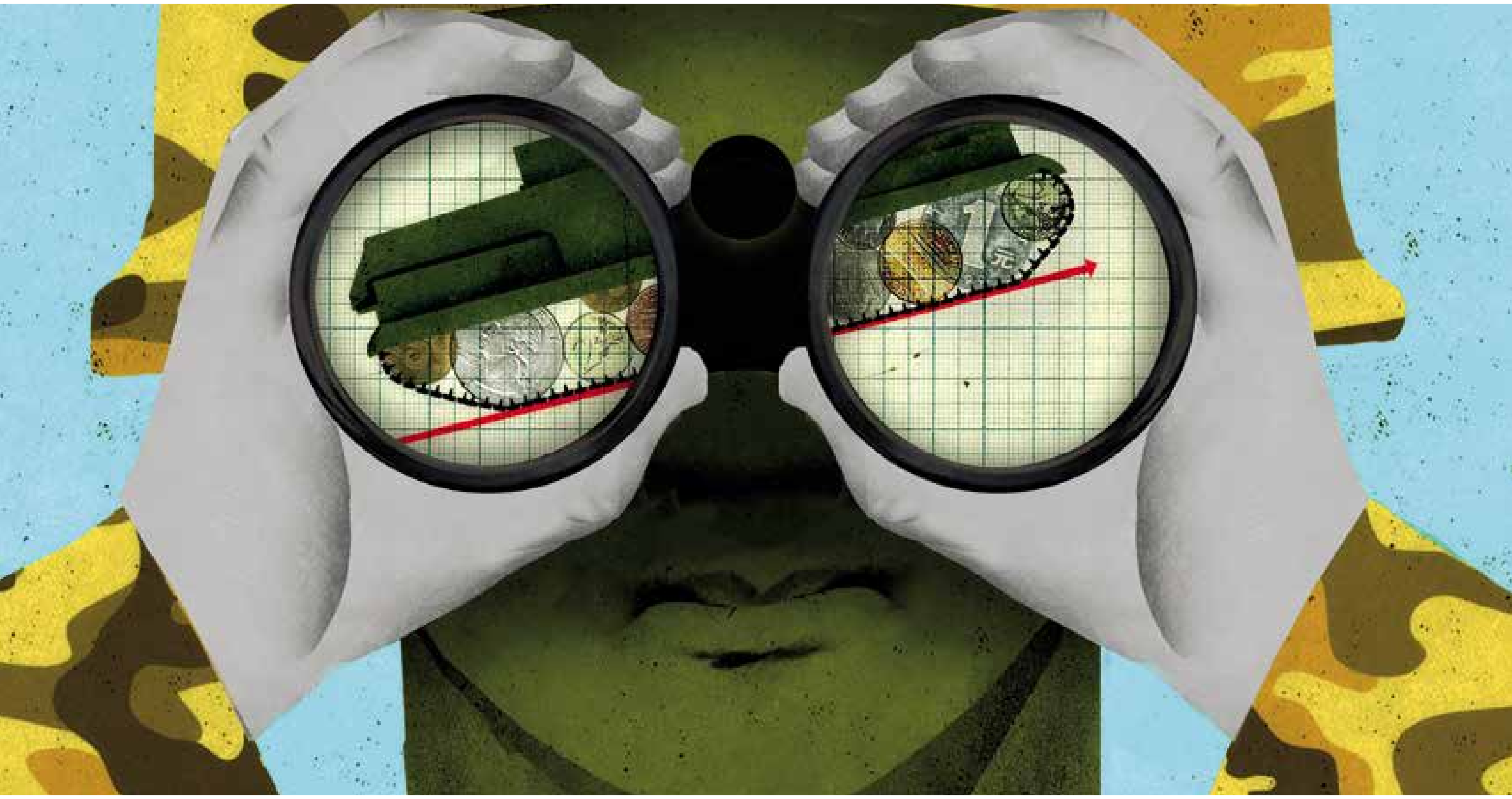
Defense



McKinsey on Government:
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Cover artwork by Brian Stauffer

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Introduction

Welcome to *McKinsey on Government*'s second special edition on defense. Much has happened since Spring 2010, when we published our first edition. Wars in Iraq and Afghanistan have wound down. Democratic movements in the Arab world have unseated long-standing rulers, and violent conflicts have erupted in Mali, Syria, and elsewhere. Unmanned weapons systems are changing battlefield dynamics.

Other publications have covered the foreign-policy and geopolitical implications of these conflicts. Here, we discuss some of the critical management changes that defense ministries and companies must make as a result of them, as well as broader economic trends. Managing the decline of defense spending is one such change: global defense spending leveled off in 2010 after more than a decade of growth, while threats are still quite real. In "Cut fat, not muscle: Preserving combat power when budgets are falling," we present field-tested ideas for squaring this circle.

Another important change is the shift in the global economic center of gravity. "Follow the money: Strategy, scenarios, and the global shift in defense power" quantifies the move in defense spending from West to East, which will have massive implications for government and industry. Two places where the economic future is arriving in a hurry are the United States and India; in separate articles, we look at the ebbing and rising tides of defense spending and the ways that government and industry can thrive.

A third area of rapid change in defense is in energy. In our interview with US Assistant Secretary of Defense Sharon Burke, she explains how the department is changing energy from a cost to a capability. A similar dynamic is taking place in the project-management work of some leading militaries. This essential capability is in short supply, and our article explains how to build the needed skills.

Even in a changing world, some things stay the same—including the challenges facing people in warfare. US Army Major General H. R. McMaster explains the immutable character of warfare to McKinsey's Andrew Erdmann and discusses how the Army is using change and continuity to become a stronger learning organization.

We hope you enjoy these articles and learn something from them—and we hope that we can learn from you, too. Write to us at McKinsey_on_Government@McKinsey.com and tell us what you think.

John Dowdy
Leader, Global Aerospace & Defense practice

Vivian Riefberg
Leader, Global Public Sector practice

Defense by the numbers

Defense economy

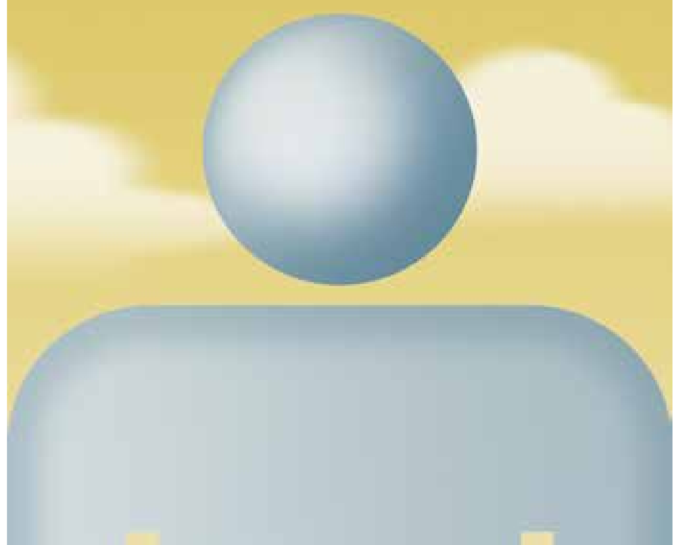
19th
The US Department of Defense (DOD) would be the world's 19th largest economy, with defense spending of $711 billion in 2011

19%
Decline of Western and Central European defense spending since its peak (2011 vs. 1988)

45%
Share of defense spending that emerging economies, including China and Russia, may account for by 2020 (vs. 23% in 2011)

1/5
Russia's defense spending, in comparison to Western and Central Europe's—down from about 1/2 near the end of the Cold War (1988)

People



77%
Size of armed forces of NATO[1] members compared with BRIC[2] countries

3 million
Number of DOD employees—about 1/3 more than the United States's largest private-sector employer, Wal-Mart

5.3 million
Number of employees of the world's two largest employers—the US DOD and China's People's Liberation Army

[1]North Atlantic Treaty Organization.
[2]Brazil, Russia, India, and China.

Readiness

$77 billion

DOD’s annual RDT&E[3] spending equals the R&D spending of the United State’s 12 largest corporations

28%

Amount of European forces that are deployable, compared with a NATO goal of 50% (and 70% in the United States)

43%

Share of US Air Force active-fleet aircraft that is over 24 years old

Future of defense

600x

Flight hours of US-operated UAVs[4] in peak year (2009, 600,000 hours) vs. 1987 (1,000 hours)

6x

The factor of growth in the number of lines of code (now 9.5 million) in the onboard software of the Joint Strike Fighter vs. the F/A-18 E/F

$15 billion

Annual spending of US DOD on fuel—roughly equal to France’s annual defense-procurement spending

[3] Research, development, test, and evaluation.
[4] Unmanned aerial vehicles.

Source: *Aviation Week*; budget accounts; Congressional Research Service; European Defence Agency; The International Institute for Strategic Studies; International Monetary Fund; NATO; Stockholm International Peace Research Institute; Teal Group Corporation; Thomson Reuters Datastream; *USAF Almanac 2012*; US Government Accountability Office

Cut fat, not muscle: Preserving combat power when budgets are falling

Defense ministries can cope with austerity. Here's how.

David Chinn

Across the Western world, defense budgets are undergoing substantial and far-reaching cuts. In most countries, the approach taken to effect these cuts has been to reduce the capabilities of armed forces: fewer military personnel, fewer weapons systems, and delayed modernization. But another approach, increasing productivity in defense, could achieve the substantial savings needed while also protecting combat power.

This article outlines the extent of recent defense budget cuts across the developed world and the challenge of making these cuts: as budgets have large fixed costs, even relatively small reductions lead to sizable cuts to military capability. The article presents a potential solution through which governments can increase defense productivity to reduce costs without cutting capability, using three primary levers: ensuring that forces are aligned with national military strategy, capturing functional efficiencies in all areas of spend, and reducing noncombat personnel. Collectively, these opportunities could potentially save 10 to 20 percent of total military budgets (excluding pension costs)—without reducing capability.

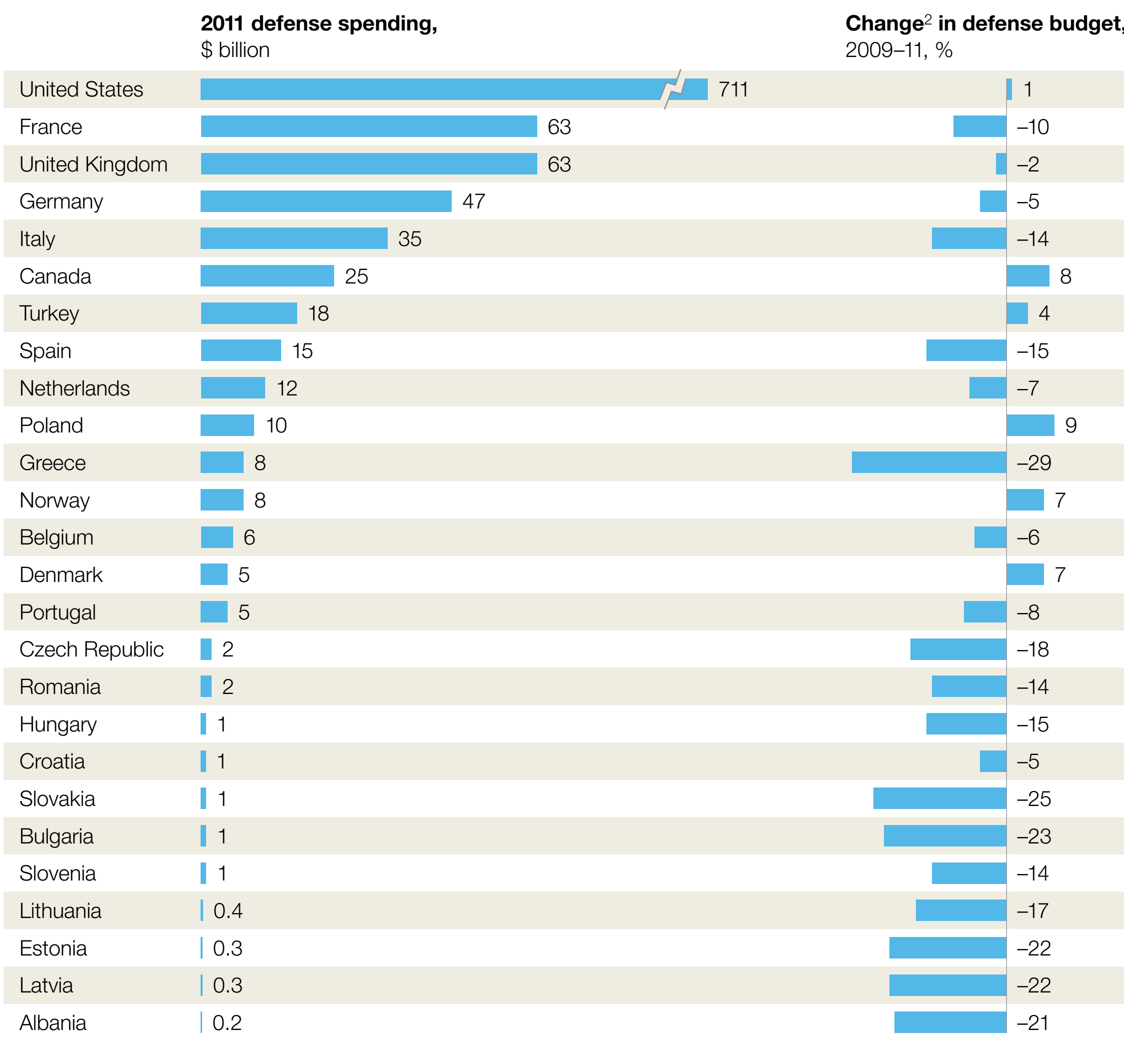
Austerity and its impact on defense budgets

In managing their budgets, even in times of plenty, defense ministries face two parallel tensions: the need to enhance military capability despite the state's competing needs to meet social and fiscal priorities, and the rapid inflation rate of the already high cost of modern military technology.

Added to these perennial tensions is a new challenge: governments have to reduce spending to balance budgets, reduce debt, and address rising health and welfare costs as populations age during a prolonged period of low growth, if not

Exhibit 1

From 2009 to 2011, NATO countries[1] have slashed budgets.



[1]North Atlantic Treaty Organization; excludes Iceland and Luxembourg due to lack of data.
[2]Constant 2010 dollars.

Source: Stockholm International Peace Research Institute

Previous periods of austerity came in times of peace. This time, we have austerity without peace, with conflicts hot and cold continuing in many parts of the world.

outright recession. Across the Western world, governments are grappling with the challenges of debt overhang, recession, and changing priorities—with recent economic news suggesting that full recovery is still elusive.

Governments facing budget challenges have universally responded to the challenge of austerity by cutting defense budgets, among others. For example, two-thirds of European countries have cut their defense spending since 2008, many by 10 percent or more. Regardless of the outcome of sequestration, committed US defense cuts of $487 billion over the next ten years represent an 8 percent reduction in spending.

Exhibit 1 shows the scale of the cuts that have already been made by the United States and other North Atlantic Treaty Organization (NATO) countries. The US budget is essentially flat, while the rest of NATO is down 6 percent from the peak—and there are more reductions to come. Countries are undertaking a range of actions to address the funding gap:

- *Realigning defense strategy with economic capacity.* The United States has reduced its aspiration from being able to fight two major wars simultaneously to being capable of defeating a major act of aggression in one theater while denying the objectives of—or imposing unacceptable costs on—an opportunistic aggressor in a second theater.

- *Reducing numbers of combat formations.* The United Kingdom has reduced its surface fleet of 23 destroyers and frigates to 19, and plans to reduce its army by one-fifth to 82,000 personnel; Germany plans to reduce its armed forces from 250,000 to 185,000.

- *Canceling new-equipment programs.* Germany has indicated that it will cancel its order of tranche 3B Eurofighter jets; the United States has cut some planned equipment programs, including those for the Medium Extended Air Defense System and the high-mobility multipurpose wheeled vehicle, or Humvee. Other programs, including the Ground Combat Vehicle, will likely be restructured.

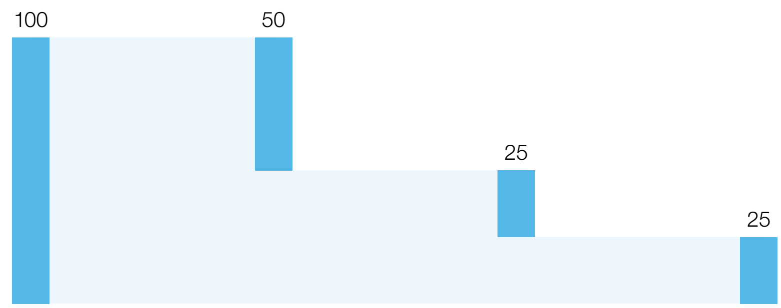
- *Retrenching from forward outposts.* The United States has indicated that it will dramatically reduce troops in Europe, including a 25 percent reduction in Army personnel; the United Kingdom will recall its armored division from Germany.

To be sure, this is not the first time that budgets have been slashed: US defense spending, for

Exhibit 2

Only a small portion of defense spending is variable in the short term.

Typical components of defense budget, %



	Total	Fixed or variable long term (>3 years)	Variable medium term (1–3 years)	Variable short term (<1 year)
Examples		• Salaries for military personnel • Depreciation	• Salaries for civilian personnel	• Fuel • Munitions • Overtime • Other consumables

Source: McKinsey global defense benchmarks

example, has been fairly cyclical, with roughly 20 years between peak and trough (see “Managing through the downturn: How the US defense industry can learn from its past,” on page 56). But one new feature is worth noting. Previous periods of austerity came in times of peace—the end of the Korean War, the end of the Vietnam War, the end of the Cold War. This time, we have austerity without peace; the withdrawals from Iraq and Afghanistan are not accompanied by peace, conflicts hot and cold continue in many parts of the world (for example, in the Korean peninsula), and new conflagrations flare up routinely (as in Mali and Syria). For militaries around the world, this is not austerity of choice, or the austerity that comes with recuperation after outsize commitments are ended; in fact, there is a massive need to invest to reinstate equipment worn out from Iraq and Afghanistan. Instead it is austerity driven by national financial imperatives.

When budgets are cut, there is a proportionately greater reduction in investment, resulting from the underlying structure of defense budgeting and the flexibility available to achieve reductions. McKinsey’s analysis of defense spending across more than 30 countries shows that defense budgets commonly have a large fixed component (Exhibit 2), with only one quarter of the budget flexible in the short term—typically the costs of training and spare parts. When governments need to save money, they naturally and instinctively look first at these short-term variable costs, and then at reductions in force structure and cancellations of equipment programs. Both seem straightforward and guaranteed to save money.

However, cuts in training and maintenance tend to be ineffective; there isn't enough spending to deliver the savings, and the cuts result in a force that is less effective than it was before. Over the long term, such cuts "hollow out" a force, leaving it incapable of delivering combat power when needed.

And cutting force structures is inefficient. Although cutting a unit typically saves the cost of personnel, their training, and their equipment maintenance, there is substantial investment in infrastructure and equipment that is simply lost. While it is possible to sell unwanted military equipment, the returns are often small. It is also typically the case that the headquarters and support functions 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.

Similarly, canceling or reducing the scope of equipment projects once they are under way does not save as much as governments hope. The cost of a combat aircraft, such as an F-22, includes the one-time development costs spread across all of the aircraft to be purchased. For the United States, the total R&D costs of the F-22 came to about $32 billion. If the program is canceled

Exhibit 3

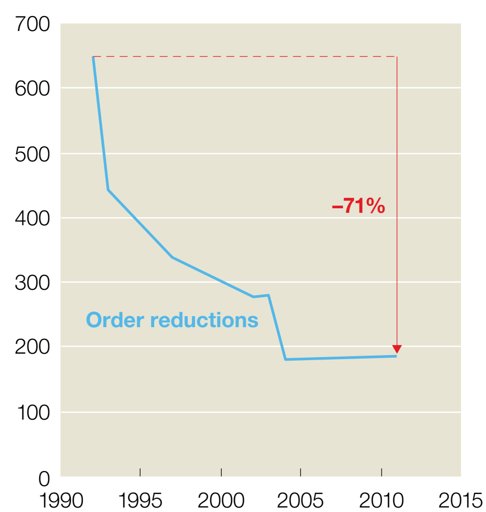
Cuts in volume lead to higher costs, which lead to canceled orders—the infamous 'death spiral.'

Over the past 20 years, F-22 unit costs have risen dramatically . . .

F-22 unit cost, $ million, constant 2010

. . . leading to order reductions that further drive up costs

Number of planned F-22s, aircraft



Source: Teal Group Corporation; *Defense Industry Daily*; selected acquisition reports, US Government Accountability Office; press search prior to full production that money is lost entirely. If the number of aircraft is reduced, development costs are spread across fewer aircraft, thereby increasing the cost per plane. This is the infamous "death spiral" that afflicts military-equipment acquisition. Exhibit 3 shows how the rising costs of F-22 aircraft since the early 1990s led to reductions in orders, which in turn further drove up unit costs.

Simply cutting frontline units is, paradoxically, a costly way of cutting costs. But there is a better way. McKinsey's work on defense budgeting and understanding the cost of military capabilities, on achieving efficiencies in support activities, and on military restructuring shows that there is a broader range of choices. Our benchmarking[1] reveals huge differences in efficiency and effectiveness across armed forces, and this in turn suggests that there are many options available to political and military leaders beyond cutting force structure.

Defense ministries and armed forces have found that savings of 10 percent of the total budget (excluding pensions) are achievable, and in some cases the opportunity can exceed 20 percent. Furthermore, the benefit is double: because they focus on eliminating waste and complexity, these types of savings, rather than reducing combat power, actually improve readiness, flexibility, and military capability. This is a message that all stakeholders want to hear: more effective, more responsive, less expensive military capabilities are possible, if defense ministries work through a series of approaches to realize savings before they cut essentials like training, maintenance, and especially combat power.

The rest of this article will examine three sources of potential savings, looking at examples from several countries: strategic realignment (which in the most extreme cases can save 50 percent of operating costs for affected equipment), functional efficiency (which can save from 10 to 30 percent of relevant spending), and noncombat-personnel reduction (which is typically 15 to 20 percent).

Realign strategies

In addition to resetting strategy, shrinking forces, and canceling programs, governments have been redefining what they want from their military forces by lowering the demands on the remaining forces. But too often forces have not adjusted to these changed requirements quickly enough. Simply put, having forces that are more capable or more ready than policy guidance demands is wasteful and comes at the cost of force structure, investment, or readiness.

Clarifying the true requirement of the military. As noted, as countries redefine what their armed forces are expected to be ready for, they are reexamining their strategic posture. This reexamination typically happens following major geopolitical changes, such as after the end of the Cold War and again after 9/11—for example, in the United Kingdom, with the Strategic Defence Review (SDR) in 1998 and SDR: A New Chapter in 2002. Most recently, the United Kingdom conducted the Strategic Defence and Security Review in 2010. Other countries, such as the United States, examine their requirements on a regular cycle (as in the Quadrennial Defense Review) but also look more broadly when circumstances require it, such as in the US defense department's defense strategy review in 2012.[2] Likewise, France is revisiting its white paper on national defense and security, which was last reviewed by the government of President

Nicolas Sarkozy after his election in 2007, and Germany has recently completed a comprehensive review of its defense strategy.

However, change in broad government policy often takes far too long before it is translated into detailed expectations for individual units. For instance, the layout of military bases in some European countries is still designed for redundancy in case of attack by the erstwhile Soviet Union. One example of adapting to changed requirements came about when the United Kingdom moved to prepare for "most likely" rather than "worst case" scenarios. This reduced its need for dispersed airbases, allowing it to scale back its aircraft support infrastructure. "Depth repairs" are now conducted at a single location—Royal Air Force (RAF) Marham for Tornado aircraft and RAF Cottesmore for Harrier aircraft—and now only "forward repairs" are made at operational squadrons.[3] As a result, along with a number of other changes, the cost of operating Tornado aircraft was halved. But many countries have not made the adjustment across all areas to adapt to new requirements and policies.

Adapting forces to the changing demands of government policy requires first ensuring that the strategic direction is clear, and then converting the strategic direction 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, thereby releasing no-longer-needed resources.

Moving to different readiness profiles. Budgeting for defense is a real challenge for both ministries of defense and treasuries, as it is hard to connect budget levels to military outputs—to a large extent because it is hard to quantify military outputs. Individual capabilities (for example, antisubmarine warfare) are often considered to be all or nothing: either you maintain the capability or you abandon it completely. However this is not truly the case: militaries can adopt any of several readiness profiles, from very high readiness (for example, deployable in minutes or hours) to complete mothballing, with years required to return to full readiness.

By creating defined readiness levels and understanding in detail the implications of moving from one level to another for each force element, it is possible to create a much more open debate and a much more flexible defense budget. In the most extreme case, countries such as Switzerland and Israel that depend heavily on reserves for the bulk of their combat power are able to make personnel flexible while reducing the life-cycle cost of equipment by keeping it in humidity-controlled storage (thus avoiding rust and slowing down the frequency with which it needs to be maintained). The United Kingdom has adopted a variant of this approach called whole-fleet management, in which training and operational fleets are separated, with the operational fleet maintained as a reserve fleet.

Unlocking cross-service efficiencies. Procurement, logistics, IT, and administrative support share many commonalities, across the services. To benefit from these commonalities many militaries have moved to create single cross-service organizations. Prominent examples include the Defense Logistics Agency in the United States, Defence Equipment and Support in

the United Kingdom, the Defence Acquisition and Logistics Organization in Denmark, and the Defence Materiel Organisation in Australia. The benefits of these cross-service groups stem not only from economies of scale but also from economies of skill—more capable and specialized functions are often both more efficient and more effective. Some countries have not taken such steps yet—sometimes from fear of change or inertia, sometimes because high levels of threat and military activity make it hard to take the risk of such major change, and sometimes because the funding and authority structure creates powerful incentives for keeping fully integrated individual services.

The scale of the opportunity is enormous. The UK Defence Logistics Organisation set a goal to reduce costs by 20 percent while maintaining output, a target reached as promised within five years. However, in this case as in others, simply creating a combined organization did not deliver all of the savings. It required concerted effort to rationalize processes, develop skills, and drive out duplication.

Improve functional efficiency

Armed forces have many support functions similar to those in commercial companies, and many of the tools of operational excellence developed in the private sector are both applicable and proven in the military arena. Three of these are discussed below.

Improving non-equipment procurement. An earlier article, in *McKinsey on Government*'s first special issue on defense,[4] added up the "big savings from little things" and explained how defense ministries can save up to 20 percent in non-equipment procurement—a category that typically accounts for 25 to 40 percent of the whole budget. Thus, better procurement of these items can provide up to 3 to 4 percent savings on the total budget.

Keeping the forces supplied with food, water, and fuel, paying rent and utilities costs, and carrying out maintenance and similar activities consumes the majority of the procurement spending of most armed forces. Those forces that have made a substantial effort to manage this spending while maintaining quality have achieved savings of between 12 and 20 percent. Even more important, these savings can be achieved without substantial personnel changes or disruption and often within, or with relatively small changes to, the existing organizational structures.

One best practice in defense ministries and armed forces is to move away from a narrow view of procurement focused on commercial contract negotiation and toward a "category management" approach that encompasses all aspects of the management of a group of similar purchased goods. In Israel, the Israeli Defense Forces and the Israeli Ministry of Defense have recently begun to work in integrated procurement teams, with each team taking full accountability for a category.

The work of category managers is driven from initial requirements and addresses five aspects of managing the category: 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 basic weapons will suffice for many troops; order size—many ministries err by buying 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, category management also involves make-versus-buy decisions.

In Israel, the defense ministry's procurement initiative has targeted annual savings of 2 percent of the defense budget. Its cross-functional category-management teams are structured to ensure that best practices are embedded, and the teams are held accountable to the chain of command, so that improvement is sustained over time. Implementation is under way and has already delivered substantial savings.

Streamlining end-to-end logistics. The support of equipment and personnel, through supply chains and maintenance capabilities, is an area of substantial cost that presents a significant opportunity for efficiency improvements. Logistics often have a complex mixture of third-party arrangements for support, along with military and civilian staff. The field is also complicated by the increasing technological complexity of much military equipment, and the concomitant rise in costs to maintain it.

Many militaries have made substantial changes to their forces and how they operate, while the logistics to support those forces has remained largely unchanged. Others have highly inefficient maintenance processes and suboptimal stock management, warehousing, and distribution. Yet others have made commercial arrangements for maintenance that deliver neither the quality and timeliness of output required nor the expected cost savings.

Actions that can be taken to streamline logistics include the wholesale reconfiguration of facilities and processes, which typically reduces the number of echelons and facilities and increases industrial involvement. Some forces have seen substantial improvements in productivity—up to 30 percent in a few months—from adopting comprehensive end-to-end process redesign, looking "from foxhole to factory" to eliminate waste and optimize the flow of repair processes. This typically shortens cycle times, increases quality, and substantially reduces manpower. This approach therefore delivers more and better military output at a lower cost.

One success story, documented by the UK National Audit Office, is the transformation of the UK Ministry of Defence's Tornado and Harrier fleets. In the case of Tornado, the Ministry of Defence was able, over the course of five years, to reduce the cost per flying hour by half, while maintaining the same level of operational and training activity. While not all militaries can enjoy this kind of improvement, the opportunities are substantial.

However, militaries are at a disadvantage in sustaining these types of savings when compared with commercial organizations. Militaries typically have high levels of staff turnover connected with job rotations—staff officers often have two-year postings, which is long enough to learn the job and start a change process but not long enough to build capabilities, embed change, and ensure it is sustained. Also, there are typically poor or no incentives to create efficiency; incentives often focus on short-term performance and immediate availability rather than turnaround time and cost reduction. Too often, military-improvement projects deliver prize-winning results in the short term, only to degrade to similar or worse performance within a few years. The results that are sustained are the ones that come from improvements embedded into the operations, training, and leadership culture before success is declared.

Improving life-cycle support models. There is increasing interest in contracted support for military equipment. In both commercial and military settings, it is common to buy aircraft engines with a "power by the hour"–type arrangement, in which a fixed annual payment is made based on the number of flying hours rather than paying for maintenance and spare parts when required. This can include the provision of replacement engines when an engine is sent for repair. The most comprehensive form of contracted support is sometimes called availability contracting, in which the contractor commits to deliver a specific output, say, a certain number of flight hours per year. In its most sophisticated form, contractors deliver available equipment as the output. The United Kingdom presents two recent examples: the Air Tanker Ltd. consortium commits to provide a number of flying hours to the government customer, and KBR—the US

The results that are sustained are the ones that come from improvements embedded into the operations, training, and leadership culture before success is declared.

engineering, construction, and private-military-contracting company, which owns and operates a fleet of heavy-equipment transporters (HETs)—provides the British Army with delivered vehicles, both at home and for overseas operations. HET drivers are reservists; KBR trains them for military roles such that when deployed they become uniformed personnel.

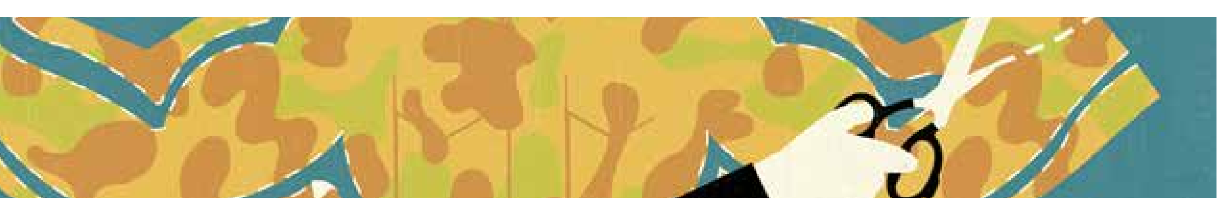
At their best, these arrangements provide ministries of defense (MODs) with access to best-practice industrial capabilities, dependable equipment, and good value for money. But these good results are not common. Inevitably, over the 25-to-40-year life of military platforms, the requirements will change. Through a poor understanding of these requirements and an insufficient understanding of the underlying costs, an MOD can lock itself into rigid contracts in which suppliers' incentives are misaligned with the MOD's. For example, in the United States, a 2008 Government Accountability Office review of performance-based logistics (PBL)—another term for these types of contracted support arrangements—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. The Department of Defense confirmed this in two studies in 2011 and 2012 and is taking steps to collect more comprehensive data on costs.

Some MODs have seen substantial improvements in the life-cycle costs of modern platforms through detailed and sophisticated cost modeling against a reliable baseline, an energetic challenge of assumptions, redesign of support requirements and arrangements, and careful alignment of incentives with suppliers. This needs to be sustained with adequate ongoing contract management and an ongoing focus on rigorous analysis and regular renegotiation.

Reduce administrative, support, and headquarters personnel

As militaries change their structures and reduce the number of combat units over time, as all Western countries have done since the end of the Cold War, administrative functions tend not to be pared down at the same speed. Indeed, McKinsey's benchmarking analysis[5] demonstrates substantial variance in the ratio of combat personnel to noncombat personnel (often called the tooth-to-tail ratio), with clear room for improvement in most countries. But this ratio must be interpreted with care. It is appropriate to compare only those countries with similar strategic postures; expeditionary forces will need levels of support that are different from static defensive forces.

Some of the changes that enable reduction in administrative, support, and HQ personnel are well-known: outsourcing of support functions, introduction of modern IT systems to automate financial- and personnel-management activities, and combining similar functions into centralized and more efficient shared services. Many armed forces have been successful in introducing these. However, in some cases, the promised benefits are not realized.



HQ and administrative activities often include a fair amount of low-value work. Over time, elaborate and sometimes unnecessary procedures tend to accumulate, culminating in unread reports and duplicated staff work. When HQ costs are cut, often the number of staff is reduced but the amount of work to be done remains the same. When this is the case, the pressure to increase staff numbers will be hard to resist over time. Through a disciplined process of activity-value analysis, which identifies and eliminates unnecessary activity, substantial time can be freed up for redeployment or cost reduction.

One example of this is in Denmark, where the military was reorganized from 2005 to 2009 to move from a static, defensive posture to one that could support expeditionary missions abroad. While Denmark's ministry of defense had already started down the road of unlocking cross-service efficiencies (a topic discussed above), it extended this journey dramatically, creating further tri-service organizations for both general support functions (HR, accounting, IT, communications) and military support functions (logistics and maintenance). The transformation reduced support costs by a third, shifting the balance between spending on operational activities and spending on support functions from 40–60 before the transformation to 60–40 after it.

Even where manpower numbers have been reduced, the cost of providing personnel and veterans with the health care and pensions they have earned through their national service has become a major element of defense budgets. When he was US secretary of defense, Robert Gates said that "health-care costs are eating the defense department alive." He was referring to the tripling of those costs since 2001 to a total of roughly $50 billion in 2011—more than the defense budget of France. If governments don't get these costs under control while continuing to fulfill their obligations to active personnel and veterans, it is likely that the scale of budgetary reductions required will be hard to achieve in some countries.

• • •

The pressure on national budgets is severe, and it is unlikely to lessen over the next decade. Armed forces will likely continue to be required to reduce budgets even while demands on their combat readiness remain high. But there are ways to reduce spending while maintaining or even increasing combat readiness—ways that are in keeping with the traditional military values of ingenuity and pragmatism.

[1] Scott Gebicke and Samuel Magid, "Lessons from around the world: Benchmarking performance in defense," mckinsey.com, March 2010.
[2] *Sustaining US Global Leadership: Priorities for 21st Century Defense*, US Department of Defense, January 2012.
[3] *Transforming Logistics Support for Fast Jets*, UK National Audit Office, July 17, 2007.
[4] Hans Arnum et al., "Big savings from little things: Non-equipment procurement," mckinsey.com, March 2010.
[5] Gebicke and Magid, "Lessons from around the world."

David Chinn is a director in McKinsey's London office.

How militaries learn and adapt: An interview with Major General H. R. McMaster, United States Army

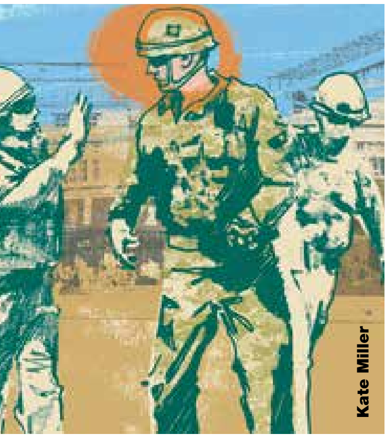
An experienced combat commander and leading expert on training and doctrine assesses recent military history and its implications for the future.

Andrew Erdmann

Major General Herbert Raymond (H. R.) McMaster is the commander of the US Army Maneuver Center of Excellence at Fort Benning, Georgia. A facility for military training, doctrine, and leadership development, the center works with forces that specialize in defeating enemies through a combination of fire, maneuver, and combat and then conducting security operations to consolidate those gains. In a December 2012 interview with McKinsey's Andrew Erdmann, General McMaster talks about how the US Army has evolved, how war itself has—or hasn't—changed, what we have learned from the wars in Afghanistan and Iraq, and what the Army must do to prepare the next generation of leaders and soldiers for warfare in the future.

***McKinsey on Government*:** *Your experience in combat has ranged from the last great tank battle of the 20th century—the Battle of 73 Easting in February 1991—to counterinsurgency in Tal Afar, Iraq, to fighting corruption in Afghanistan with Combined Joint Interagency Task Force Shafafiyat from 2010 to 2012. Looking back on nearly 30 years in the military, what has changed, and how have you adapted?*

H. R. McMaster: I think the biggest surprise has been the broadening of the range of conflicts we've found ourselves in since I first entered the Army in the 1980s. Obviously, there was a lot of instability during the Cold War, but there was also a certain degree of predictability. The



primary mission of our armed forces at that time was to deter aggression by the Soviet Union and its allies. Today, that's no longer the case. We now need a much wider range of capabilities, including the ability to operate in complex conflicts that require the close integration of military, political, and economic-development efforts.

One great feature of the Army is that it gives us the opportunity not only to have very intense formative experiences but also, consistent with the adult-learning model, to reflect on those experiences and prepare for the next level of responsibility. This type of learning is what helps us gain the breadth and depth of knowledge that allows us to adapt to unforeseen challenges and circumstances.

McKinsey on Government: *You are a scholar of military history. How has your study of military history influenced your career?*

H. R. McMaster: I think the study of military history has been the most important preparation for every position I've had in the last 12 years or so. It's important to study and understand your responsibilities within any profession, but it's particularly important for military officers to read, think, discuss, and write about the problem of war and warfare so they can understand not just the changes in the character of warfare but also the continuities. That type of understanding is what helps you adapt.

I think the American tendency—and I'm sure this is often the case in business as well—is to emphasize change over continuity. We're so enamored of technological advancements that we fail to think about how to best apply those technologies to what we're trying to achieve. This can mask some very important continuities in the nature of war and their implications for our responsibilities as officers.

The study of military history helps identify not only these continuities but also their application to the current and future problems of war and warfare. This type of study helps us make a grounded projection into the future based on an understanding of the past. It helps us reason by historical analogy while also understanding the complexity and uniqueness of historical events and circumstances. This is what Carl von Clausewitz believed: that military theory will serve its purpose when it allows us to take what seems fused and break it down into its constituent elements.

As one of my favorite military historians, Sir Michael Howard, suggested, you have to study history to get its analytic power in width, in depth, and in context: in width, to see change over time; in depth, by looking at specific campaigns and battles to understand the complex causality of events that created them; and then in the context of politics, policy, and diplomacy. Studying history is invaluable in preparing our officers for their future responsibilities.

McKinsey on Government: *You mentioned the continuities of war. What are some examples of things that remain unchanged?*

H. R. McMaster: First, war is still an extension of politics and policy. I think we saw that both in Iraq and Afghanistan; we initially failed to think through a sustainable political outcome that would be consistent with our vital interests, and it complicated both of those wars.

Second, war is an inherently human endeavor. In the 1990s, everyone was quoting Moore's law and thought it would revolutionize war. We saw this in some of the language associated with the "revolution in military affairs" and "defense transformation." We assumed that advances in information, surveillance technology, technical-intelligence collection, automated decision-making tools, and so on were going to make war fast, cheap, efficient, and relatively risk free—that technology would lift the fog of war and make warfare essentially a targeting exercise, in which we gain visibility on enemy organizations and strike those organizations from a safe distance. But that's not true, of course.

This links closely to another continuity of war—war is not linear, and chance plays a large role.

One other continuity is that war is a contest of wills between determined enemies. We often operate effectively on the physical battleground but not on the psychological battleground. We fail to communicate our resolve. I think, for example, the reason the Taliban regime collapsed in 2001 is largely because every Afghan was convinced it was inevitable. But much of what we have done since then—at least, as perceived by Afghans—raises doubts about our long-term intentions. This is not a criticism of policy. Rather, it highlights the need for us to be cognizant that war is a contest of wills.

Finally, we often start by determining the resources we want to commit or what is palatable from a political standpoint. We confuse activity with progress, and that's always dangerous, especially in war. In reality, we should first define the objective, compare it with the current state, and then work backward: what is the nature of this conflict? What are the obstacles to progress, and how do we overcome them? What are the opportunities, and how do we exploit them? What resources do we need to accomplish our goals? The confusion of activity with progress is one final continuity in the nature of warfare that we must always remember.

McKinsey on Government: *What have been the Army's greatest successes in organizational adaptation during the past 25 years? What are some of the enduring challenges, and how might those be overcome?*

H. R. McMaster: The wars in Iraq and Afghanistan were not at all what we had anticipated—they weren't fast, cheap, or efficient. They were extremely complicated politically, and

We confuse activity with progress, and that's always dangerous, especially in war. In reality, we should first define the objective, compare it with the current state, and then work backward.

Major General H. R. McMaster

Vital statistics
Married, with 3 children
Lives in Fort Benning, Georgia

Education
Graduated from US Military Academy at West Point and earned an MA and a PhD in military history from the University of North Carolina at Chapel Hill

Career highlights
US Army Maneuver Center of Excellence
(June 2012–present)
Commanding general

Combined Joint Interagency Task Force Shafafiyat (Transparency)
(2010–12)
Commander in Kabul, Afghanistan

US Army Training and Doctrine Command
(2008–10)
Director of concept development and learning

Multinational Force–Iraq
(2007–08)
Special assistant to commander in Baghdad, Iraq

3d Armored Cavalry Regiment
(2004–06)
Commander in Fort Carson, Colorado, and Tal Afar, Iraq

Fast facts
Decorations include the Silver Star Medal, the Legion of Merit, the Bronze Star Medal with Oak Leaf Cluster, and the Purple Heart Medal

Author of the best-selling *Dereliction of Duty: Lyndon Johnson, Robert McNamara, The Joint Chiefs of Staff, and the Lies that Led to Vietnam* (1997)

they demanded sustained commitment, as well as the integration of multiple elements of national power. But I think once we confronted the realities of those wars and realized the kinds of mistakes we had made, we adapted very well from the bottom up. That goes against what has emerged as the conventional wisdom about the war, but I think it's true.

The challenge now is to get better at deep institutional learning. This is what you'll hear people in the US military call DOTMLPF, meaning changes in doctrine, organization, training, material, leadership and education, personnel, and facilities. We need the kinds of integrated solutions that acknowledge the complex nature of the environments in which we are working and that take into account the determined, adaptive, and often brutal nature of our enemies. In this context, our doctrine is still catching up. We have the counterinsurgency manual, the stability-operations manual, and the security-force-assistance manual, but I don't think we have put the politics at the center of those manuals.[1] So, for example, we assume in our doctrine that the challenges associated with developing indigenous security forces are mainly about building capacity, when, in fact, they're about trying to develop institutions that can survive and that will operate in a way that is at least congruent with our interests.

What's going to be really important for the Army, and for our military in general, is what we've learned from the past 12 years of war. We need to use what we've learned to make a grounded projection into the near future and to inform our understanding of the problem of future armed conflict. Once we understand that problem, we then need to reshape our doctrine, educate our leaders, conduct the necessary training, develop combat capabilities, and design the right evolutions within our organization. To do so, we need to put aside narrow, parochial interests and avoid slipping back into our enamorment with exclusively technological solutions to the problem of future war.

McKinsey on Government: *How do you think our land forces will evolve, and what do you see as the greatest challenges to the US Army's future success?*

H. R. McMaster: There's no single greatest challenge to the Army's future success. We are facing a broad range of challenges and emerging enemy capabilities, which will increasingly involve technological countermeasures. Our enemies will try to disrupt our ability to communicate by going after our networks, for example. We have to be prepared to counter those types of attacks, and we have to build redundancy into our forces so that we can operate if our capabilities are degraded.

Ultimately, all the threats to our national security are land based. We therefore have to be prepared to operate in a broad range of physical environments and terrains. To do that, we need to retain combined-arms capabilities and indirect-fire capabilities, as well as access to our Air Force, Navy, and our engineers—together, they give us freedom of movement and action.

One challenge we are seeing more frequently is state support for proxy forces, or nonstate organizations that have many of the capabilities that were once associated only with nation-states. For example, Hezbollah has antitank capabilities, mines, and roadside bombs. It has missiles and rockets, and it has weaponized unmanned aerial vehicles. We will need to continue to defeat nations that threaten our interests, but more and more, we also have to deal with proxy forces or networked enemy organizations that have the kinds of advanced capabilities once held only by nation-states.

But rather than picking certain countries or certain areas, we have to look more broadly at our enemies' emerging capabilities. We know that our enemies are going to employ traditional countermeasures: dispersion, concealment, intermingling with civilian populations, deception. We know that the application of nanotechnologies is going to reduce the signature of these forces, which means we're going to have to fight for information in close contact with enemy organizations and with civilian populations. The enemy can't beat us on the open battleground, so they're going to operate in restrictive terrain or urban areas. How we fight in cities is going to be important. We're going to need to maintain our mobility, our engineer capability, and our ability to defeat shoulder-fired antiaircraft weapon

systems. We also see emerging longer-range rocket and missile capabilities, as well as chemical weapons and other weapons of mass destruction.

McKinsey on Government*: *The US Army today has a deeply experienced, battle-tested corps of officers and noncommissioned officers. What are the essential qualities of Army leaders in the next 10 to 20 years?

H. R. McMaster: At the Maneuver Center, we're working on a strategy that identifies what competencies our leaders need and then looks at how, where, and at what point in their careers we train and educate them. The "how" increasingly involves cutting-edge technologies that allow us to offer more effective distance learning and collaboration between leaders. We also want to cultivate within our leaders a desire for lifelong learning and to provide them with the tools necessary for informal self-study and collaborative study across their careers. (For more, see "A reading list for military professionals" on page 24.)

First and foremost, we need leaders who can adapt and innovate. As Sir Michael Howard has said—and I'm paraphrasing—we're never going to get the problem of future war precisely right. The key is to not be so far off the mark that you can't adapt once the real demands of combat reveal themselves, and you need leaders who can adapt rapidly to unforeseen circumstances. They need to be able retain the initiative as well as sustain the types of campaigns that require a broad range of capabilities—rule of law, development of indigenous forces, and military support for governance, for example.

The human dimension of war is immensely important for the Army as well; we need leaders who are morally, ethically, and psychologically prepared for combat and who understand why breakdowns in morals and ethics occur. In *The Face of Battle*, John Keegan said that "it is towards the disintegration of human groups that battle is directed."[2] So how do you protect organizations against that kind of disintegration? I think there are usually four causes of breakdowns in moral character—ignorance, uncertainty, fear, or combat trauma. It is important to understand the effects of those four factors on an organization and then educate soldiers about what we expect of them. We need leaders who have physical and mental courage on the battlefield, of course, but also the courage to speak their minds and offer respectful and candid feedback to their superiors. Our leaders can't feel compelled to tell their bosses what they want to hear.

McKinsey on Government*: *What about our soldiers? How are we helping them learn?

H. R. McMaster: What's great about soldiers who join the Army is that they expect it to be hard, and they're disappointed if it's not. They want to be challenged. This is a self-selecting, highly motivated group of people. Soldiers tend to

A reading list for military professionals

H. R. McMaster shares his recommendations, including books on innovation, selected histories of military campaigns, and memoirs.

General grounding

There are several essential reads for professionals involved in military affairs:

Carl von Clausewitz, *On War*. The author uses a dialectical approach to understanding war without being prescriptive.

Michael Howard, *War in European History*. This book is excellent, as is anything by this author.

Elting Morison, *Men, Machines, and Modern Times*. The author discusses the limitations of emerging technologies—specifically, he argues that instead of taming our environment, technology has further complicated it.

Williamson Murray, *The Making of Strategy: Rulers, States, and War*. This book helps connect military action to strategy.

Thucydides, *The History of the Peloponnesian War*. The Greek historian shows that the drivers of war—fear, honor, self-interest—haven't changed over time.

Innovation and the world wars

Much has been written about World War I, World War II, and the interwar period—and about how these events changed the nature of war. The following are favorites:

Marc Bloch, *Strange Defeat*

Robert A. Doughty, *The Breaking Point: Sedan and the Fall of France, 1940*, and *Pyrrhic Victory: French Strategy and Operations in the Great War*

Timothy T. Lupfer, *Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War*

Williamson Murray, *Military Innovation in the Interwar Period*

Memoirs and biographies

It is important to understand how leaders have adapted and thought about war and warfare across their careers. *The Autobiography of General Ulysses S. Grant: Memoirs of the Civil War* is perhaps the best war memoir ever written. The following are some other significant titles:

Carlo D'Este, *Patton: A Genius for War*

David Fraser, *Knight's Cross: A Life of Field Marshal Erwin Rommel*

Matthew B. Ridgway, *The Korean War*

Selected histories of military campaigns

For selected histories of wars and military campaigns, the following are some of my favorites; I've also included recommendations on contemporary threats:

Ancient warfare

Donald Kagan, *The Peloponnesian War*

Seven Years' War

Fred Anderson, *Crucible of War: The Seven Years' War and the Fate of Empire in British North America, 1754–1766*

The American military profession and the American Revolution

David Hackett Fischer, *Washington's Crossing*

Don Higginbotham, *George Washington and the American Military Tradition* and *The War of American Independence*

Civil War

James McPherson, *Battle Cry of Freedom: The Civil War Era*

Franco–Prussian War

Michael Howard, *The Franco–Prussian War: The German Invasion of France 1870–1871*

World War II

Rick Atkinson, *An Army at Dawn: The War in North Africa, 1942–1943*; *The Day of Battle: The War in Sicily and Italy, 1943–1944*; and the forthcoming *The Guns at Last Light: The War in Western Europe, 1944–1945*

Gerhard Weinberg, *A World at Arms: A Global History of World War II*

Korean War

T. R. Fehrenbach, *This Kind of War*

David Halberstam, *The Coldest Winter: America and the Korean War*

Vietnam War

Eric Bergerud, *Red Thunder, Tropic Lightning: The World of a Combat Division in Vietnam*

Harold G. Moore and Joseph L. Galloway, *We Were Soldiers Once . . . And Young: Ia Drang—The Battle That Changed the War in Vietnam*

Iraq

Michael R. Gordon and Bernard E. Trainor, *Cobra II: The Inside Story of the Invasion and Occupation of Iraq* and *The Endgame: The Inside Story of the Struggle for Iraq, from George W. Bush to Barack Obama*

Afghanistan

Peter Tomsen, *The Wars of Afghanistan: Messianic Terrorism, Tribal Conflicts, and the Failures of Great Powers*

Contemporary threats to international security

Peter Bergen, *The Longest War: The Enduring Conflict between America and Al-Qaeda*

Victor Cha, *The Impossible State: North Korea, Past and Future*

David Crist, *The Twilight War: The Secret History of America's Thirty-Year Conflict with Iran*

Bruce Riedel, *Deadly Embrace: Pakistan, America, and the Future of the Global Jihad*

Our multinational partners are invaluable for their perspectives, but we also need strong partnerships with indigenous leaders. As in business, we need negotiation competencies and the ability to map stakeholder interests.

define themselves based on other people's expectations of them, and we have to keep those expectations high.

As with our leaders, we need our soldiers to be able to adapt. At the Maneuver Center, we immerse our soldiers in complex environments, and as we train them on fundamentals, we also test their ability to observe changes in the environment and to adjust as necessary so they can accomplish their mission. We call this "outcome-based training and evaluation." Rather than using a checklist of individual capabilities, we are evaluating them on their ability to innovate and adapt to unforeseen conditions. We're trying to build into our training the kinds of things soldiers encounter in combat—uncertainty, bad information, and casualties, for example. Before we would say, "Go to point A and wait for instructions." Now we'll say, "You have to get to five or six points in the amount of time you have available—you pick which order you want to do it in." This means they have to analyze the terrain, the routes between the points, and the sequencing of the points themselves.

In addition to the fundamentals of combat, our soldiers really have to live the Army's professional ethics and values. They must be committed to selfless service, to their fellow soldiers, to their mission, and to our nation. That also involves, obviously, respect for and protection of our Constitution and understanding their role in that context. They also need to understand the environments they're operating in. For example, we're dealing with a wartime narcotics economy, essentially, in Afghanistan; that's a big driver of the conflict there. We need to educate our soldiers about the nature of the microconflicts they are a part of and ensure that they understand the social, cultural, and political dynamics at work within the populations where these wars are fought.

Our soldiers also have to recognize how being in persistent danger can affect organizations and be able to identify warning signs. They have to be good at grief work and be able to support one another when they lose a fellow soldier. This can't be achieved through standard training alone—this has to be done through reading, thinking, and discussing as well.

***McKinsey on Government*: When you think about future conflict, how does the ability to work well with allies and partners fit into the equation?**

H. R. McMaster: I think it's immensely important that we're adept at working as part of multinational teams. Transnational terrorist organizations use mass murder of innocent people as their principal tactic, and so they are a threat to all civilized people; we have to work together to defeat those threats. Terrorist organizations use the complex cultural-political dynamics of microlocal conflicts to their benefit. They use ignorance to foment hatred, and then they use that hatred to justify violence against innocent people. They pit communities against one another, and then they portray themselves as patrons and protectors of one of the parties in the conflict. You can see it in Mali, in northern Nigeria, and in Yemen. And you certainly see it in Syria, in what is becoming a humanitarian crisis of colossal scale. You can also see it along the border between the predominantly Kurdish and Arab regions in Iraq, in Afghanistan, and in portions of Pakistan.

I think we're always going to have to operate as part of a multinational force. To do so, we have to understand the history and the culture of each of these conflicts and of the microconflicts in each subregion. Obviously, our multinational partners are invaluable for their perspectives, but we also need strong partnerships with indigenous leaders. As in business, we need negotiation competencies and the ability to map stakeholder interests in particular. When we're partnering with somebody we need to understand several things: their interests, how they align with our interests, how to build relationships based on mutual trust and common purpose, and how to use those relationships to work together to accomplish the mission. ○

[1] Headquarters, Department of the Army, *Counterinsurgency*, FM 3–24, December 2006; *Stability Operations*, FM 3–07, October 2008; *Security Force Assistance*, FM 3–07.1, May 2009 (armypubs.army.mil).
[2] John Keegan, *The Face of Battle: A Study of Agincourt, Waterloo, and the Somme*, New York: Viking, 1976.

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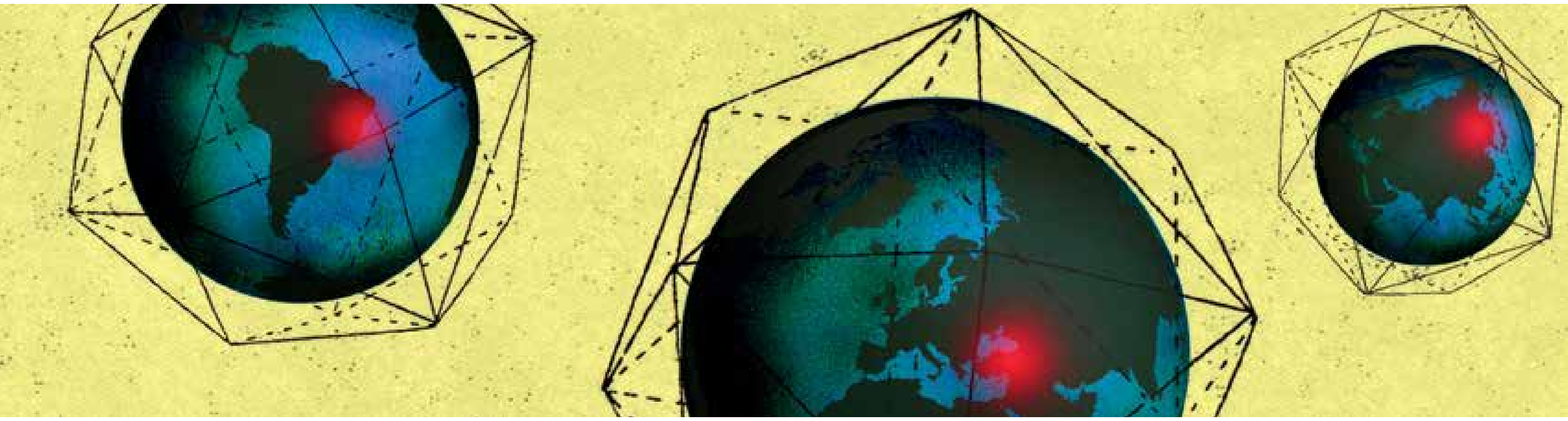


Follow the money: Strategy, scenarios, and the global shift in defense power

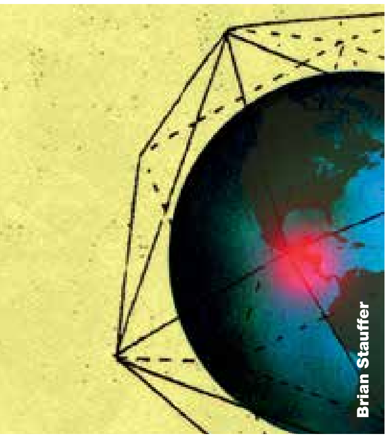
As the strategic landscape shifts, an economic-scenario approach can help defense organizations grapple with uncertainty.

Jonathan Ablett and Andrew Erdmann

The art of strategy, in defense as elsewhere, involves understanding possible futures to inform present decisions. Change, volatility, and uncertainty are perennial challenges to the defense strategist and are likely to increase in the coming years. Formulating strategy in these conditions will test planners in the public and private sectors alike.

To succeed, decision makers should look behind the headlines of the day to ask the right questions about what will affect their organization in the future. This requires considering the deeper underlying trends that will reshape the strategic landscape in the years ahead. Foremost among them is the shift in global economic power. Although often commented upon by economists and pundits, many strategists focused on defense issues have not fully internalized this historic shift and its implications.

Here we offer a perspective on how strategists in defense organizations and aerospace and defense companies should approach this challenge. First, we describe how the profound shift in economic power since the end of the Cold War has already reshaped the world's strategic landscape, including the distribution of global defense spending. The potential evolution of these economic dynamics is fundamental to strategy. Predicting their future is, of course, impossible. Instead, we offer something more modest and practical: a new approach to scenario planning that is rooted in a deep understanding



of global economics. Such an understanding reveals the potential for unexpected scale and pace in the shift of defense spending from the United States and its treaty allies[1] to emerging economies.

The strategic landscape reshaped, 1991–2012

The past 20 years saw dramatic changes on the battlefield, even as some features endured, and the beginnings of an equally dramatic shift in economic power. In combination, these movements have altered the strategic landscape, and provide a glimpse into the future.

Continuity and change in military operations

For the world's defense and security organizations, history certainly did not end with the collapse of the Soviet Union and the cessation of the Cold War in 1991. We have since seen conflict on almost every continent, from the last major tank battle of the 20th century at 73 Easting in the Gulf War to numerous wars, clashes, and insurgencies in Europe, Asia, Africa, and the Americas. Since the attacks of September 11, 2001, attention has focused on the greater Middle East—Afghanistan, Iraq, and, increasingly, the struggles for control and influence in the aftermath of the Arab Spring.

The tempo of military operations has been relentless. Since 1991, for instance, the United States has embarked upon a new military intervention roughly every two years. North Atlantic Treaty Organization (NATO) forces have been at war in Afghanistan for over a decade. South Korean and Japanese forces have deployed for the first time to the Middle East. Meanwhile, the United Nations has launched a new peacekeeping operation every six months. Moreover, the duration of most of these operations has increased to five to ten years.[2]

Innovations in military technology and operations have marked these past two decades of conflict. Precision-guided munitions have evolved and demonstrated their effectiveness in conflicts beginning with the Gulf War and continuing in Kosovo, Afghanistan, and most recently NATO's Operation Unified Protector in Libya in 2011. Advanced missiles now pose particular threats to capital ships and fixed bases. Unmanned aerial vehicles (or remotely piloted air systems) are now standard components in many militaries' intelligence, surveillance, and reconnaissance (ISR) tool kits, and they increasingly serve as weapons platforms as well. Harnessing big data and employing advanced analytic techniques are other features of 21st century ISR. Cyberwarfare has moved from theory to practice.[3]

Militaries today confront adversaries who employ a full spectrum of tactics, from conventional to irregular and even criminal ("hybrid war"). Modern navies, for instance, cope with traditional and unconventional foes, including Somali pirates and asymmetrical threats such as terrorist suicide speedboats. Air forces are investing in fifth-generation fighters, even as they continue to provide workhorse logistical support for operations in the field. And for foot soldiers, despite the numerous technical advances in communications and equipment, the past decade has been largely spent relearning the lessons of counterinsurgency: "Walk. Stop by, don't drive by … Situational awareness can only be gained by interacting face-to-face, not separated by ballistic glass or Oakleys."[4] *Plus ça change, plus c'est la même chose.*

The power shift begins

Concurrent with these tactical and operational developments, tectonic plates moved at a deeper strategic level. A profound shift in economic power began during this period—one that has already manifested itself in the distribution of traditional "hard" military power among the great powers. This shift will continue to reshape the strategic landscape in the years ahead.

Future historians will likely point to 2007–08 as an inflection point in global history. For the first time in over two centuries—since the start of the Industrial Revolution—the majority of the world's economic growth took place in the developing world, driven in large part by China, India, and other Asian economies. In addition to favorable demographics and reforms to open emerging economies, increasing urbanization—especially in China—drove much of this growth. Significantly, 2008 was also the first time ever that a majority of people lived in cities. The pace of urbanization is staggering. More than 1.3 million people migrate every week to urban areas. And this historic migration will likely continue unabated for the next two decades, mainly in the emerging economies of Asia, Latin America, and, increasingly, Africa.[5] The global economic crisis that began in 2008 accelerated this shift in economic power from developing to emerging economies, as the BRIC countries (Brazil, Russia, India, and China) weathered the storm well and the developed economies of the United States, Europe, and Japan suffered and remain vulnerable more than four years later. Between 2009 and 2012, China's economy grew over 30 percent and India's 22 percent in real terms, whereas Germany's grew 7.9 percent and the United States's 7.1 percent.[6] And in 2008, for the first time, a Chinese company led the world in international patent applications.

Taken together, economic and demographic forces drove the most rapid shift in human history in what the McKinsey Global Institute (MGI) calls the "economic center of gravity"—the geographic midpoint of global economic activity (Exhibit 1). MGI projects this movement to continue, at a slightly slower pace, for the next 15 years or so, when, by this measure, most of the regional imbalances ushered in by the Industrial Revolution will have been erased.

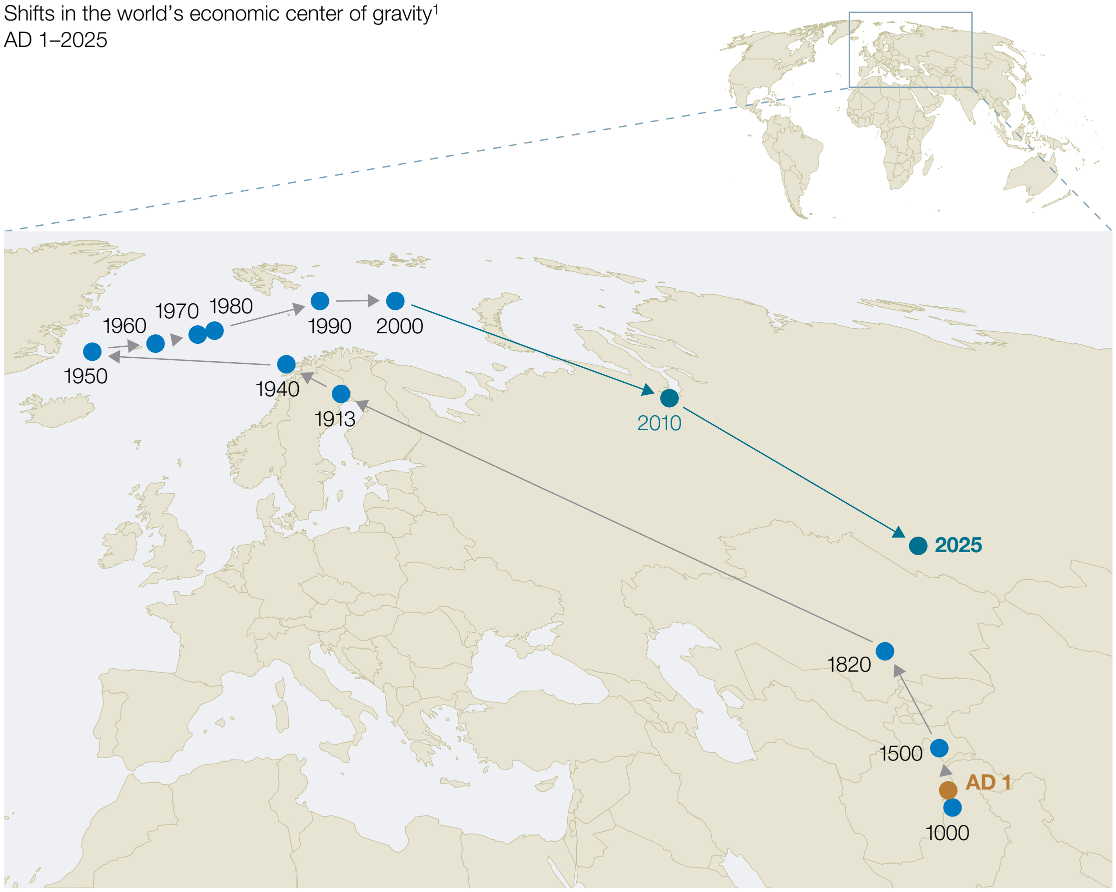
Future historians will likely point to 2007–08 as an inflection point in global history. For the first time in over two centuries the majority of the world's economic growth took place in the developing world.

These economic trends have already started to reshape the global landscape of defense spending. To be sure, a nation's assessment of its security threats plays a critical role in shaping its defense spending in the near term. That said, a major country's military power flows in large part from its underlying economic strength over the medium to long term: the faster a country's economy grows, the more likely its defense spending will increase as well. Despite widely different geopolitical complexities and economic dynamics, the countries with the

Exhibit 1

The ten years from 2000 to 2010 saw the fastest-ever shift in the world's economic center of gravity.

Shifts in the world's economic center of gravity[1]
AD 1–2025



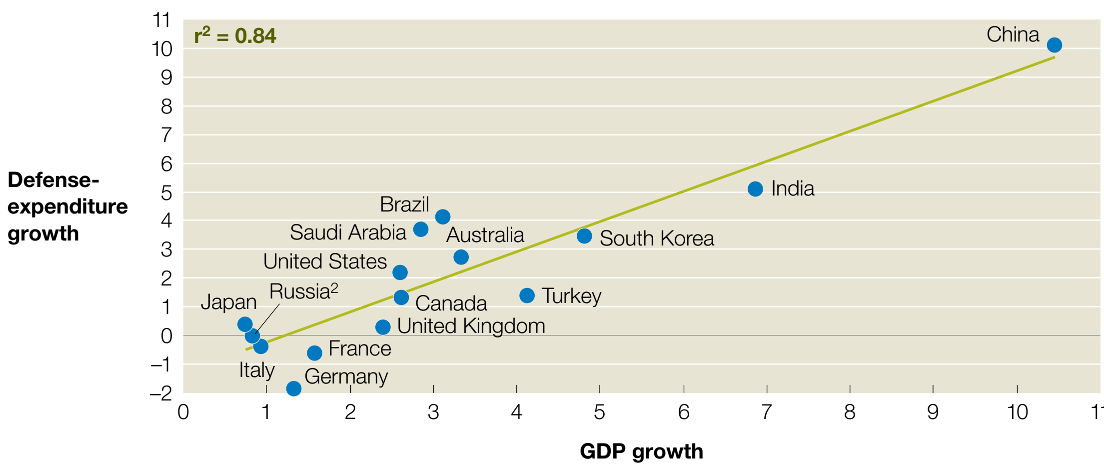
[1]Calculated by weighting national GDP by each nation's geographic center of gravity; a line drawn from the center of the earth through the economic center of gravity locates it on the earth's surface. For detailed analysis, see Richard Dobbs et al., *Urban World: Cities and the Rise of the Consuming Class*, McKinsey Global Institute, June 2012, pp. 61–72.

Source: University of Groningen; McKinsey Global Institute analysis of data compiled by Angus Maddison

Exhibit 2

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, %



[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: McKinsey's Global Growth Model; Stockholm International Peace Research Institute

largest defense budgets, which account for the vast majority of the world's defense expenditures, have fit this pattern since 1991 (Exhibit 2).

Other more subtle shifts in national power were also taking place between 1991 and 2011. R&D expenditures in all major economies nearly doubled in constant 2011 dollar terms, rising from roughly $740 billion in 1991 to $1.5 trillion in 2011. But just as we saw in defense spending, countries' R&D investments mirrored trends in their overall economic growth. Europe and Japan's combined share of global R&D expenditures declined by 11 percent in the 20 years after 1991. Meanwhile, China increased its share of global spending to 9 percent from 1 percent during the same period. Developing countries are thus emerging as true competitors to the developed economies not only with regard to their economies' sheer scale but also their innovation and technical prowess.[7] R&D spending matters: a country's R&D investments are strongly correlated with the quality of the military's equipment 25 years later.[8] This suggests that in the future, developing countries will narrow the gap in quality between their military equipment and that of developed countries.

Glimpses of the future

We have seen these dynamics play out around the world since 1991. Sustained operations and the increasing costs of modern weapons platforms have proved too much for many Western governments and their publics as they manage the aftermath of the global economic crisis and structural strains in their aging societies. For example, the United Kingdom's 2010 Defence

Exhibit 3

Developing countries have closed the gap in defense spending since the end of the Cold War.

1991 and 2011 annual defense spending, $ billion,[1] %

Non–US treaty partner

	1991	2011	CAGR,[2] 1991–2011	Global rank 1991	Global rank 2011
United States	439	675	2.2	1	1
China	18	126	10.1	9	2
Japan	57	61	0.4	5	3
France	68	60	–0.6	2	4
United Kingdom	56	59	0.3	6	5
Russia	58	57	0.0	4	6
Germany	66	45	–1.9	3	7
Saudi Arabia	19	39	3.7	8	8
India	14	37	5.1	17	9
Italy	36	33	–0.4	7	10
Brazil	14	31	4.1	16	11
South Korea	15	29	3.5	13	12
Australia	15	26	2.7	12	13
Canada	18	23	1.3	10	14
Turkey	12	15	1.4	19	15

[1] All figures are in constant 2011 dollars, converted from historical data expressed in constant 2010 dollars, then adjusted for recent inflation and exchange-rate movements. See endnote 10 for more on the calculation method. For Russia, we used 1992 figures, as 1991 data were not available.
[2] Compound annual growth rate.

Source: McKinsey's Global Growth Model; Stockholm International Peace Research Institute; McKinsey analysis and Security Review declared bluntly that its "inherited defense spending plans . . . [are] completely unaffordable" and that it needs to "confront the legacy of overstretch."[9] France's earlier national-security review analyzed the changing strategic context and new priorities and thus, through a different logic, reached similar conclusions. The US Department of Defense (DOD), under Secretary of Defense Robert Gates, launched its own efficiencies campaign, which has accelerated under his successors. The planned reductions in the US defense budget in the next decade are literally on the scale of some countries' GDPs. Other Western militaries are undergoing similar retrenchments. At the same time, however, China, other East Asian countries, India, Brazil, and other emerging economies have continued to increase not only their defense expenditures in real terms, as shown in Exhibit 3, but also, in many cases, the sophistication of their own defense industries.

Today, the United States remains the world's preeminent military power in scale, sophistication, battle-tested experience, and global reach. US defense spending in 2011 was more than five times that of the next highest defense spender, China. America's traditional allies also occupy important positions in the global defense landscape. Japan, France, and the United Kingdom ranked third, fourth, and fifth in defense spending in 2011. The momentum, however, is unmistakable: emerging economies are positioned to displace the other developed economies in the top tier of defense spenders. China's rise in defense spending is starkest. In 2011 it spent $126 billion, more than twice as much as the countries that are the next largest spenders: Japan, France, the United Kingdom, and Russia.[10] Chinese authorities announced in March 2013 that they plan to increase defense spending another 10.7 percent in 2013.[11]

The direction is clear. Developed economies—and the world's leading military establishments historically—have experienced relative decline vis-à-vis the major developing economies since 1991. Yet the scale, scope, and pace of change of the shift in economic power cannot be simply extrapolated from the recent past to understand the future. Instead, strategists will require a new approach to manage this era's particular strategic uncertainties.

An economic-scenario approach

Scenario planning is an established tool for business and defense strategists.[12] Done right, scenario planning accounts for the major variables or drivers that could shape the future, in sufficient depth and vividness to enable strategists to draw out potential implications for the strategy and plans of their organizations. Scenarios are not meant to be predictive or comprehensive, covering all possible futures. Rather, the goals are to define a range of possibilities and identify important continuities among them, as well as significant uncertainties or risks that a strategy should address. Such an analysis, in turn, helps to frame critical questions and generate strategic insights that then shape the strategic decisions of today and adaptation tomorrow.

Today, defense scenarios typically start with geopolitical, security, or more operational assumptions or with a statement of guiding objectives (such as "Counter violent extremism, deter and defeat aggression, strengthen international and regional security, and shape the future force"; "US forces must be prepared to fight 'two and a half' wars simultaneously"; or "Blue Force must be ready to counter Red Force in country X"). For example, the US DOD's recent strategy documents—the February 2010 *Quadrennial Defense Review Report* and the February 2011 *National Military Strategy of the United States*—briefly review the changing strategic environment but do not offer alternative scenarios. The importance of this era's economic forces, however, suggests that a different approach, one with a more explicit grounding in these new economic realities, is needed. National-security strategies typically do not explore the full implications of the shift in economic power now under way.[13] The approach outlined here is designed to address this gap. The development of rich, sophisticated scenarios for the future course of the global economy provides its starting point. These scenarios, in turn, enable the mapping of changes in countries' economic power in relative and absolute terms. The trends most immediately relevant for defense and security organizations—especially levels of defense spending and R&D investment—are then built upon these economic foundations.

We use a set of economic scenarios for the next decade built with McKinsey's Global Growth Model (GGM)[14] to illustrate this approach. The GGM is a database and modeling tool that supports the construction of detailed economic scenarios down to the country level. Its variables span GDP and more than 100 others, including demographics, education levels, public debt, R&D investments, and urbanization rates.[15]

The baseline economic scenarios employed here are predicated on the assumption that major developed and emerging economies will develop with different growth rates—namely, developing economies will tend to grow at a significantly higher rate than developed economies. We emphasize these different outcomes and groups because, broadly speaking, the challenges faced by countries in each group are similar. Generally, advanced economies have struggled not only with the aftermath of the 2008 downturn but also with meeting their aging populations' multifaceted challenges. Meanwhile, emerging markets have tried to sustain or accelerate growth through export promotion, the allocation of capital, continued economic reform, urbanization and industrialization, and other tactics.

The relative performance of these different groups of economies thus describes a range of four principal scenarios. The GGM scenarios

are bounded by emerging markets' growth rates (between 3 and 7 percent per year from 2013 to 2022) and advanced economies' growth at 1 to 3 percent annually. These growth rates define four broad-based scenarios shown in Exhibit 4: Global Growth Renewed, Advanced Economies Rebound, Emerging Economies Lead, and Global Lost Decade.[16]

Together, these scenarios portray different potential future international landscapes and balances of economic power among the major economies. They make clear that the stakes are extraordinarily high for the health of the entire global economy. While growth continues across all scenarios, the difference in total global real GDP between the most favorable scenario ($100 trillion, under Global Growth Renewed) and the least favorable one ($84.5 trillion, under Global Lost Decade) is a staggering $15 trillion per year in 2022. That is roughly equivalent to the US economy today.

Exhibit 4

Four scenarios describe possible paths for the global economy from 2013 to 2022.

Developed world
Strong

Scenario 2
Advanced Economies Rebound

Developed economies steadily resolve challenges of debt and aging labor forces' drag on productivity

Emerging markets are not able to sustain growth due to the weight of internal imbalances and face persistent economic and financial crises

Scenario 1
Global Growth Renewed

Developed economies are able to spur innovations in business, policy, and technology that lead to renewed growth; emerging economies become sources of their own demand

Economies remain vulnerable to near-term shocks and long-term resource volatility, though both are smaller in magnitude than today

Big emerging markets
Moderate

Big emerging markets
Very strong

Scenario 4
Global Lost Decade

Developed and emerging markets are unable to resolve their individual and collective structural challenges, gradually slowing growth

The world experiences multiple major economic and financial shocks

Scenario 3
Emerging Economies Lead

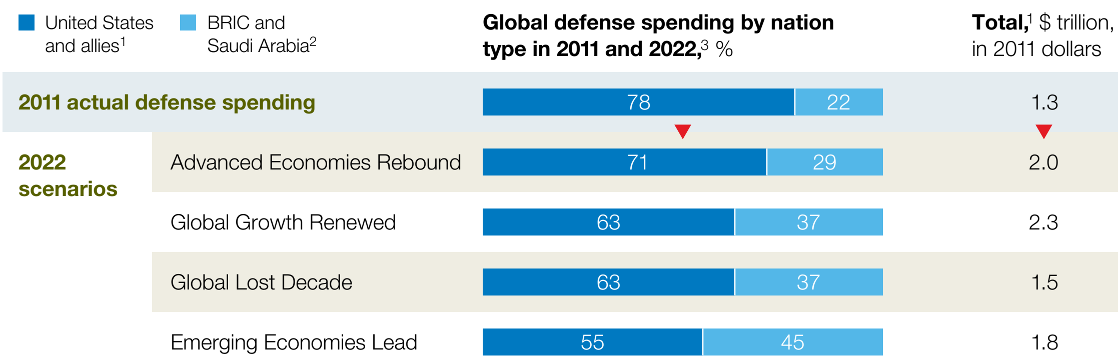
Debt and labor-force challenges persist in developed economies, while emerging markets sustain growth rates through successful shift to domestic-led economies

Emerging markets are increasingly resilient in the face of developed-world crises

Developed world
Weak

Exhibit 5

A substantial share of global defense spending will shift away from the United States and its traditional allies.



[1]Includes the United States and its allies among the top 15 defense spenders (Australia, Canada, France, Germany, Italy, Japan, South Korea, Turkey, the United Kingdom, and the United States).
[2]Includes Brazil, Russia, India, China, and Saudi Arabia.
[3]Includes the 15 nations with the largest defense budgets as of 2011, representing ~83% of global defense spending.

Source: McKinsey's Global Growth Model; Stockholm International Peace Research Institute; United Nations Statistics Division

The scenarios also have quite different outcomes for the relative distribution of economic power among countries. Across all scenarios, the US economy remains the world's largest economy. China's rapid growth continues, but by 2022, it still does not equal the size of the US economy today. The absolute gap between the two narrows more or less depending on the scenario. The other major developing economies follow a similar pattern; Europe and Japan experience steady growth in the most favorable scenarios and stagnation in those that are less favorable.

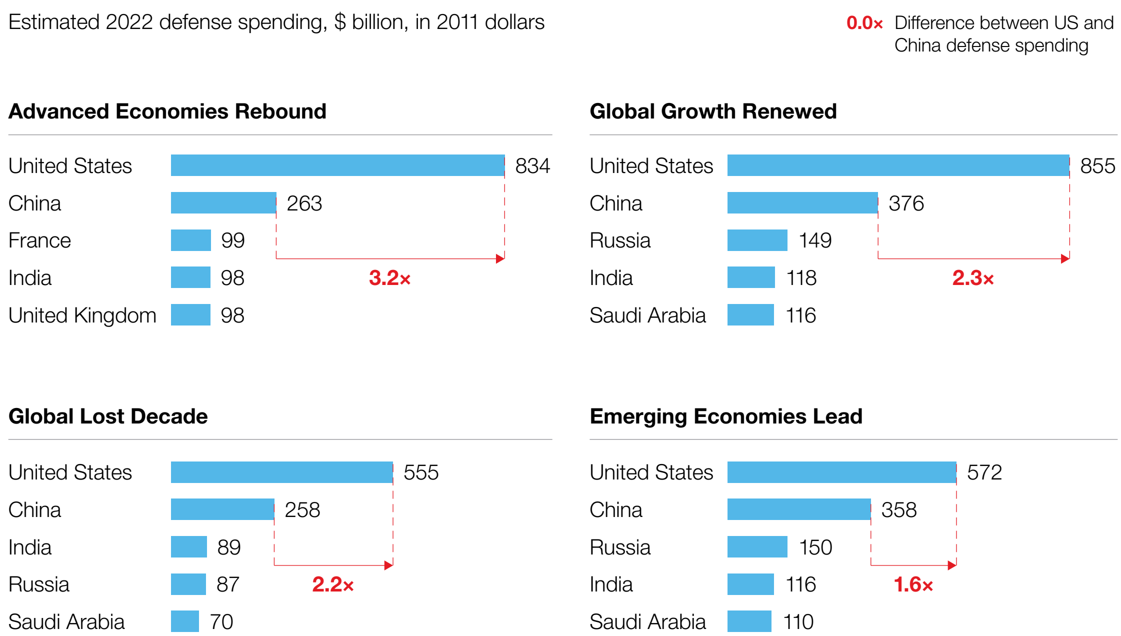
Defense-spending scenarios to 2022

The four baseline economic scenarios paint very different possible futures for the world's major economies—and thus for their self-confidence, internal political stability, and the vision of their roles internationally. Geopolitical relations (for example, strains among past allies over burden sharing or opportunities for new alignments among rising powers) would also vary under the different scenarios.[17]

To understand these implications, we analyzed global defense spending under the economic scenarios. We focus our analysis on the top 15 defense spenders in 2011. These countries account for the lion's share of global defense spending under any scenario (that is, nearly 85 percent in 2011) for the sake of simplicity. As mentioned, growth in countries' defense spending is strongly correlated (r-squared equals 0.84) with their underlying economic growth over longer periods of time. Therefore, we use each scenario's estimate of countries' real GDP and a country-specific correlation between defense spending and GDP to derive the percentage of each nation's real GDP devoted to defense spending in 2022 under each scenario.[18]

Exhibit 6

The difference between the two biggest defense spenders varies widely by scenario.



Source: McKinsey's Global Growth Model; Stockholm International Peace Research Initiative; McKinsey analysis

The likely changes in countries' relative share of global defense spending between 2011 and 2022 are striking (Exhibit 5). If we divide the 15 countries studied into the United States and its 9 treaty allies, and the emerging BRIC countries and Saudi Arabia, we see that while the US and its allies still account for the majority of defense spending in all scenarios in 2022, their relative advantage is eroded in all scenarios by emerging markets' higher rates of economic growth. Most dramatically, in the Emerging Economies Lead scenario, the United States and its treaty allies' relative advantage in global share of defense spending falls by 23 percentage points in a decade, dropping to 55 percent by 2022.

The scenarios likewise suggest dramatic shifts in defense spending in absolute terms. Defense spending in the BRIC countries and Saudi Arabia will increase significantly in all scenarios—from roughly $290 billion in 2011 to between approximately $550 billion and $830 billion by 2022 (in constant 2011 dollars). The fate of the United States and its major treaty allies' defense spending is mixed, however. When the major developed economies fare well, their combined defense spending increases from a little over $1 trillion in 2011 to more than $1.4 trillion in 2022; when they fare poorly, in the Global Lost Decade and Emerging Economies Lead scenarios, their combined defense spending falls below $1 trillion by 2022.

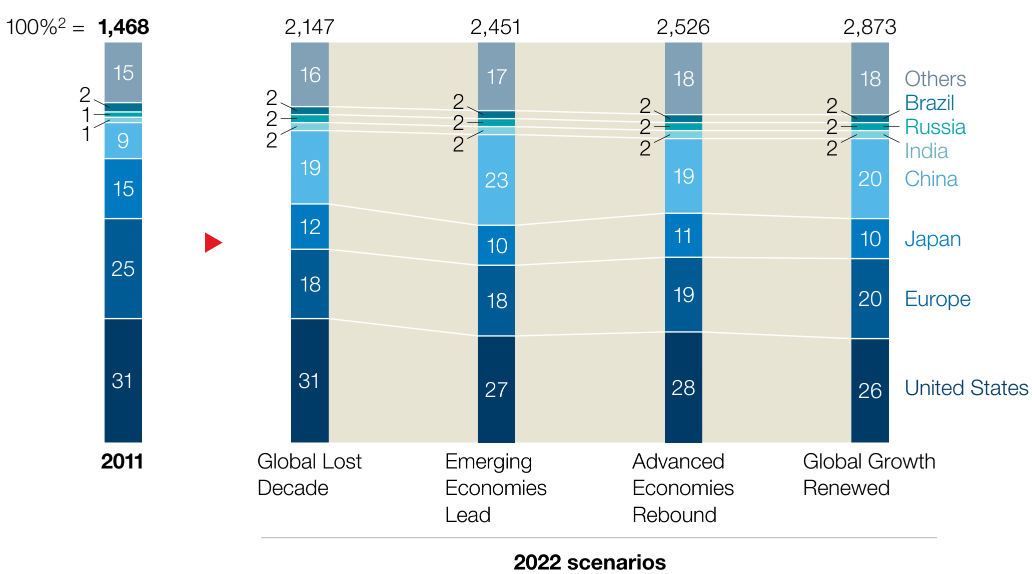
Exploring these scenarios for individual countries again shows shifts in defense spending away from the developed economies. Consider the top five defense spenders in each scenario (Exhibit 6). The United States and China maintain their one-two positions in total defense spending in all scenarios. In those scenarios in which US economic growth remains sluggish throughout the coming decade, its defense spending falls more than 15 percent in real terms. The United States's relative advantage in defense spending over China, however, declines significantly from 5.4x in 2011 to between 3.2x and 1.6x in 2022. India enters the ranks of the world's top five defense spenders in all scenarios (see "A bright future for India's defense industry?" on page 44). Russia and Saudi Arabia round out the top five defense spenders in three of the four scenarios. Only in the Advanced Economies Rebound scenario do France and the United Kingdom—two of the US treaty partners—remain in the top five.

Considering total R&D investments across the different countries provides a rough measure of the dynamism of high-technology industries and innovation, and, as noted above, an indication of long-term trends in the quality of the military equipment the country makes (Exhibit 7).

Exhibit 7

The combined European, Japanese, and US share of global R&D investment will shrink in any scenario.

Global real R&D investment,[1] 2011 and 2022 scenarios, %, $ billion, in 2011 dollars



[1]Government, private-sector, and academic investment in research and development.
[2]Some figures do not sum to 100%, because of rounding.

Source: McKinsey's Global Growth Model; OECD

Our scenarios show overall R&D investments tracking the trends seen in defense spending but at different rates. The United States retains its leadership position but by less than before, as emerging economies gain ground on the United States and its traditional allies. Most important, China's investments in R&D accelerate in the next ten years; in all scenarios, China more than doubles its share of global R&D investment. In the coming decade, we should expect China to place second only to the United States in total R&D investments, just as it became the world's second-biggest defense spender in the previous decade. China's rise in R&D is stunning: in all scenarios, it will increase its share of global R&D from roughly $1 of every $100 in 1991 to $1 of $5 spent in 2022. In doing so, it surpasses both Europe and Japan; their investments grow slowly in all scenarios. That said, Europe and Japan will remain major centers of global R&D into the 2020s because of their relatively robust starting point. Meanwhile, Brazil, India, and Russia also gain share, though at a much slower pace than China, and they will continue to lag behind Europe and Japan by a significant margin in 2022 (for example, Japan's R&D spending will remain roughly five times India's across the scenarios).

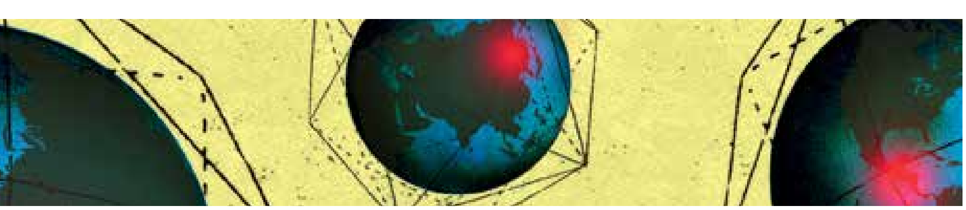
This economic-scenario approach enables strategists to assess other underlying factors should a particular analysis require it. These include public-debt burdens (for instance, high for most developed economies, with exceptions such as Australia), subtle variations among some countries' relative performance (for example, South Korea consistently punches above its weight with regard to defense spending and R&D), education levels (for instance, other countries continue to narrow the US lead in average number of years of education per person), and demographic trends.[19]

From using scenarios to framing the right questions

Decision makers in ministries of defense and corporate boardrooms require analytic tools to help them manage uncertainties. Without them, they risk falling prey to misguided confidence in a single, clear, but almost certainly erroneous prediction of the future, or they will be forced to rely on their gut. The economic-scenario approach outlined here is one such tool for the strategist's tool kit.

The economic-scenario approach highlights how the global strategic landscape may change in the coming decade. Such scenarios can help organizations identify the specific potential opportunities, risks, trade-offs, and outcomes that their strategies should consider.

From a defense official's perspective, such questions could include the following:



Ministries of defense and corporate boardrooms require analytic tools to help them manage uncertainties. Without them, they risk falling prey to misguided confidence in a single, clear, but almost certainly erroneous prediction of the future.

- What does it mean for the United States when the defense spending of its traditional treaty allies will continue to decline in relative, and perhaps absolute, terms? What capabilities might these allies be able to deploy in the future? What new security relationships might be needed to manage the shifting balance of defense power? What might be the implications of such shifts for US force structure, overseas basing, and diplomacy?

- What does it mean for European countries' role in the world as their relative share of defense power shrinks? Will NATO's role in the world correspondingly retract? Will NATO's "out of area" operations become a thing of the past? Will individual European countries have effective expeditionary forces in the 2020s, or will limitations force them to decide among increased dependence on US support (for example, logistical and lift support), increased defense cooperation within Europe, and disengagement from traditional areas of influence such as Africa? What might be the implications of these different scenarios for the future affordability of independent nuclear-deterrence forces in France and the United Kingdom?

- What does the wide range of possibilities for US defense spending in 2022 mean for Asian countries? How will such uncertainties shape their defense postures and diplomacy toward the United States, and one another?

- What does it mean for emerging countries that for the next decade the United States will remain the global leader in military spending and R&D investments despite those countries' rapid growth? How relevant will European powers be in their strategic calculus? What security relationships should they prioritize to cope with the shifting strategic landscape?

From an aerospace and defense executive's perspective, such questions could include the following:

- Which markets will matter most for a company's growth in the next ten years? What should be the relative balance among developed and developing markets in its portfolio?

- What does the possible emergence of India and Saudi Arabia among the world's top five defense spenders suggest for a company's strategic priorities?

- How should a company manage the diversity of regulations and laws related to technology transfer, intellectual property, and local content provisions as it seeks to expand into specific developing markets? How should it manage its defense and civilian aerospace businesses in such markets in light of other diplomatic and commercial considerations? What innovative joint ventures, mergers, or other collaborations will fuel growth among aerospace and defense companies based in different countries?

- How should a company manage the wide range in potential US defense-spending futures in the coming decade (that is, a difference of roughly $300 billion in annual defense spending between high and low scenarios in 2022)?

- How should a company leverage the continued robust R&D base in Europe, Japan, and the United States to serve both developed and developing aerospace and defense markets?

- How will developing countries' aerospace and defense industries "go global" and compete directly against more established Western players in defense markets around the world in the coming decade? What are the implications for Western companies' strategies, operations, and costs if many systems are produced for emerging markets?

- What should be a company's global manufacturing footprint in light of these trends and uncertainties in the coming decade?

- What skills and talents will a company need to succeed in the changed global defense landscape?

Asking the right questions is the starting point for any strategy. We are now living through an unprecedented shift in global economic power. No one can predict precisely what this means for our future. Robust economic scenarios, however, can help strategists frame the right questions and trade-offs for their organizations, which is more helpful than aspiring to predict that which defies prediction.

[1] Nations with which the United States has signed a collective-defense arrangement (state.gov).

[2] See James Dobbins, "Guidelines for nation builders," *Strategic Studies Quarterly*, Fall 2010, p. 15 (au.af.mil/au/ssq).

[3] For comprehensive surveys of such recent military developments, see The International Institute for Strategic Studies, *The Military Balance: 2011*, *The Military Balance: 2012*, and *The Military Balance: 2013*.

[4] See Commander, NATO International Security Assistance Force/US Forces–Afghanistan, "Counterinsurgency guidance," August 1, 2010.

[5] See two reports from the McKinsey Global Institute, *Urban World: Mapping the Economic Power of Cities*, March 2011, and *Urban World: Cities and the Rise of the Consuming Class*, June 2012 (mckinsey.com); see also United Nations, *World Urbanization Prospects, The 2011 Revision*, March 2012 (un.org).

[6] Statistics on economic real growth are drawn from McKinsey's Global Growth Model (GGM).

[7] GGM, December 2012.

[8] Steven Bowns and Scott Gebicke, "From R&D investment to fighting power, 25 years later," defense special issue, *McKinsey on Government*, Spring 2010, pp. 70–5.

[9] *Securing Britain in an Age of Uncertainty: The Strategic Defence and Security Review*, October 2010, p. 15 (gov.uk).

[10] We employ the Stockholm International Peace Research Institute (SIPRI) historical defense-spending data set throughout these analyses for consistency and transparency. The SIPRI data set we used covers the 1988–2011 period, is measured in constant 2010 dollars, incorporates iterative revisions to maintain historical continuity for individual countries, and employs consistent defense-spending definitions across countries when appropriate (instead of relying upon only reported ministry-of-defense figures). For more, see sipri.org. We converted the SIPRI data into constant 2011 US dollars using economic data from the GGM. The conversion accounts for the variance between our 2011 global rankings and SIPRI's, which are estimated in constant 2010 US dollars.

[11] "China boosts defense spending as military modernizes arsenal," *Bloomberg News*, March 5, 2013.

[12] The literature on scenario planning is now a veritable library. On the early development of scenario planning at Royal Dutch Shell Group, see Peter Cornelius, Alexander van de Putte, and Mattia Romani, "Three decades of scenario planning at Shell," *California Management Review*, Fall 2005, pp. 92–109; Art Kleiner, "The man who saw the future," *strategy+business*, Spring 2003 (strategy-business.com); Peter Schwartz, *The Art of the Long View: Paths to Strategic Insight for Yourself and Your Company*, New York: Doubleday, 1996; Pierre Wack, "Scenarios: Uncharted waters ahead," *Harvard Business Review*, September–October 1985, pp. 73–89; Pierre Wack,

"Scenarios: Shooting the rapids," *Harvard Business Review*, November–December 1985, pp. 139–50; Ian Wylie, "There is no alternative to . . . ," *FastCompany*, July 2002 (fastcompany.com). See also Paul J. H. Shoemaker, "Scenario planning: A tool for strategic thinking," *Sloan Management Review*, Winter 1995, pp. 25–40, and Charles Roxburgh, "The use and abuse of scenarios," mckinseyquarterly.com, November 2009.

[13] For an exception to this pattern, one that explores the forces shaping the international environment in the next two decades and integrates them into four scenarios with deliberately robust economic foundations, see the US National Intelligence Council, *Global Trends 2030*, December 2012 (dni.gov).

[14] For more on the GGM, see mckinsey.com.

[15] For a detailed introduction to the baseline global economic scenarios and the technical capabilities of the GGM, see Jonathan Ablett, Lowell Bryan, Luis Enriquez, and Sven Smit, *Global Economic Scenarios for the Next Decade: Uneven Recoveries and Diverging Prospects*, December 2012; the paper is available from the authors of this article.

[16] Recent experience has highlighted the fact that the fates of economies within each of these two groups could also diverge (for instance, the United States could recover while the eurozone fragments; China may prosper while India falters). We limit this illustration to the four core scenarios. For additional scenarios centered on potential variations in China and Europe's economic fortunes, see Jonathan Ablett, Lowell Bryan, Luis Enriquez, and Sven Smit, *Global Economic Scenarios for the Next Decade: Uneven Recoveries and Diverging Prospects*, December 2012, available from the authors of this article. More extreme "black swan" events—such as renewed financial contagion, currency collapses, or a prolonged spike in global energy prices—can also be modeled with this technique, depending on an organization's specific strategic challenges.

[17] Our analysis here does not incorporate such geopolitical, political, and cultural elements. Such elements can be integrated along with the economic to provide richer, more robust, and more vivid scenarios that are tailored to a specific organization's context and opportunities. For a discussion of some of the methodological considerations behind this approach and an example of an integrated economic-political-geopolitical scenario based on the GGM, see Andrew Erdmann, "Managing economic, political, and geopolitical uncertainty in the era of geo-economics," The International Institute for Strategic Studies Geo-economics and Strategy Programme Conference, Manama, Bahrain, March 2012 (iiss.org).

[18] To illustrate this economic-scenario approach, we employ simple, consistent assumptions based on historical data for each country (percent GDP committed to defense) to establish the ranges of their defense budgets under the different scenarios. These assumptions reflect the historical correlation between GDP growth and defense-spending growth, as detailed previously. We take a country's historical high percent GDP committed to defense as measured during any five-year period between 1992 and 2010 for which we have consistent SIPRI data, and we then use that to estimate its defense budget in those scenarios where the country's economy does well (for example, use the United States's historical high percentage of GDP committed to defense under the Global Growth Renewed and Advanced Economies Rebound scenarios). Conversely, we employ the lowest five-year average for percent GDP committed to defense to estimate defense spending in those scenarios where the country's economy does not perform well (for instance, use the United States's historical low percentage of GDP committed to defense under the Global Lost Decade and Emerging Economies Lead scenarios). These are relatively conservative, not predictive assumptions. Prolonged economic difficulties, for example, could lead countries to shrink defense expenditures even more dramatically than during the post–Cold War drawdown. Conversely, the emergence of new strategic threats could lead some countries to historically high levels of defense spending.

[19] Across scenarios, for instance, developed economies will confront challenging demographics as their populations age and the burden of growth is shouldered by a smaller portion of the population. Japan, in particular, will be under considerable strain. At the same time, China's demographics with respect to dependency ratios are becoming more challenging—though still favorable in this decade relative to developed economies—while Brazil and India's continue to improve.

The authors wish to thank Cody Newman for his assistance with this article.

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A bright future for India's defense industry?

The stars might be aligning for India's defense sector. Here's what the government and industry can do to seize the moment.

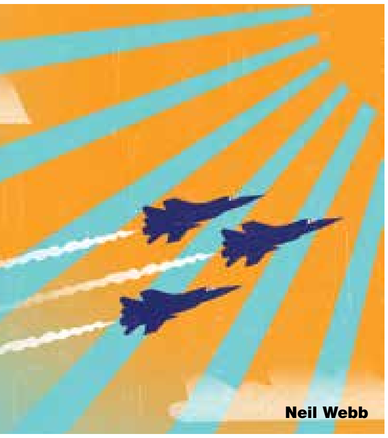
Brajesh Chhibber and Rajat Dhawan

India's defense industry, which has grown substantially in recent years, seems headed for even better days. Growth in domestic demand should continue to be robust, the government has a clear vision for an indigenous defense industry, the country's attractiveness to global defense companies is rising due to shrinking global defense budgets, and there is tremendous export potential in engineering services and component sourcing.

The way forward is not without some significant obstacles, however. In particular, the government's new purchasing procedures must prove their mettle, and broadening and shifting the nation's strategic alignments will be challenging. For their part, defense firms will have to learn to manage some uniquely Indian requirements.

To build tomorrow's industry, India's Ministry of Defence and its contractors might look to mature markets such as France and the United Kingdom, as well as to developing markets such as South Korea, and apply some of the ideas pioneered there. One essential move is to decide on core capabilities and focus efforts on building these in India. Other steps include improving the talent market, building skills in the government and private companies, and ensuring open and inclusive access to defense markets.

If the government and its partners embrace the challenge, India in 2020 will have a vibrant



industry capable of meeting not only its domestic needs but also the needs of other nations. That would give India a greater degree of self-reliance, of course, and contribute to a stronger trade balance and substantial job creation.

A decade in review

India's defense market saw robust growth over the past decade. Government capital spending quadrupled from $3 billion in 2000 to $12.2 billion in 2010.[1] By this measure, India was the sixth-biggest spender on defense worldwide from 2000 to 2010.

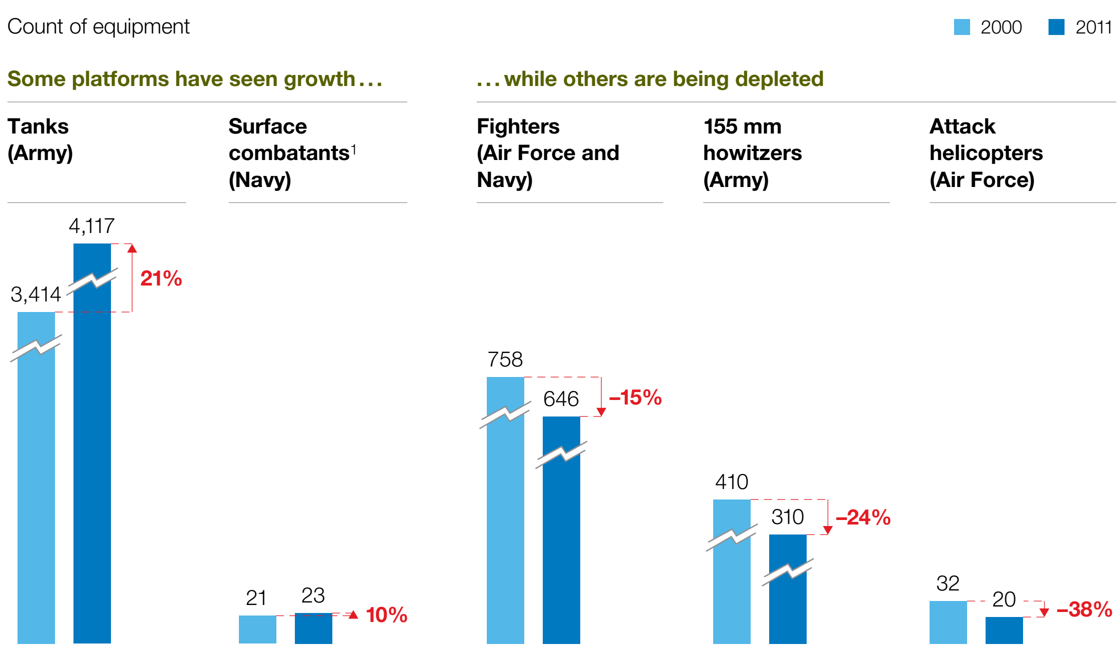
Most capital spending was done through intergovernmental purchases, which are typically noncompetitive, bilateral agreements. These accounted for approximately 70 percent of the total from 2000 to 2010. India increasingly looked beyond its traditional supplier, Russia, for weapons procurement and began to include France, Israel, the United Kingdom, and the United States in the mix. However, even with increased purchases, equipment levels in several key categories have declined over the last decade due to rising obsolescence and delayed procurement (Exhibit 1).

These intergovernmental purchases often include a significant role for defense public-sector undertakings (DPSUs)[2]—Indian companies that are licensed to produce the contracted equip-

Exhibit 1

Inventory has declined for several platforms.

Count of equipment



[1]The surface-combatants category includes destroyers, frigates, and corvettes, but not submarines.

Source: *The Military Balance*, The International Institute For Strategic Studies, 2000 and 2011 editions

Exhibit 2

The Defence Procurement Procedure, or DPP, guides standard procurement.

Indian defense purchasing includes 3 components

	Description	Requirement
1 Standard procurement (DPP)	• Forms the basis of most capital purchases to ensure the best quality at the lowest price • Includes 4 types of contracts[1]: buy, buy and make, buy and make (Indian), and make • Upgrades are available to get classified in 1 of the above categories	• Indigenous content can offset requirements in other contracts
2 Intergovernmental agreement	• Includes procurement from friendly countries for geostrategic advantage and based on intergovernmental agreement: – Equipment purchases that benefit Indian armed forces but are based on suppliers' contracting practices – Procurement of in-service platforms	• Not required to meet DPP • Deals could be negotiated to include offsets for DPP
3 Strategic deals	• Includes procurement driven by strategic partnerships or major diplomatic, political, economic, technological, or military benefits	

[1]"Buy" includes equipment purchases that are put to a tender that is either global or limited to Indian vendors. In "buy and make," a contract is awarded to a foreign vendor; some procurement is from outside India, but equipment is produced or manufactured in the country. In "buy and make (Indian)," a contract is awarded to an Indian vendor; some procurement is from outside India, but equipment is produced or manufactured in the country. In "make," systems are designed, developed, and produced indigenously.

Source: Defence Procurement Procedure, 2011, India Ministry of Defence; McKinsey analysis

ment. For example, a large proportion of the Indian Air Force's fleet of Russian Sukhoi Su-30 MKI fighter jets was manufactured under license by Hindustan Aeronautics Limited (HAL) in India through the transfer of designs and subsystems from the Russian original-equipment manufacturer (OEM). DPSUs also undertake new development; they have, for example, created Agni and Prithvi missiles and Arjun tanks. Currently, DPSUs are the only defense firms with a sizable presence in the country, and they are highly vertically integrated, a factor that weighs against the development of an elaborate base of defense suppliers.

However, growing demand has attracted many new industry participants—Indian firms such as Larsen & Toubro, Mahindra, and Tata, as well as global "primes" and OEMs such as BAE Systems, Boeing, and Israel Aerospace Industries. These companies have started to build market positions in air, land, naval, and communication systems. While this development could make the industry more dynamic, it has not yet significantly altered the industry's structure, which remains tilted toward DPSUs.

An important development in the last decade was the creation of the Defence Procurement

Although progress from the Defence Procurement Procedure was modest at first, it has picked up in recent years; approximately $4.3 billion worth of offset contracts have been signed and launched since 2007.

Procedure (DPP) in 2002; it has since seen many revisions and amendments. The objectives of the DPP are to bring structure and transparency to procurement and to build the capabilities of India's nascent defense industry through offset obligations—requirements that contractors source the equivalent of 30 percent of the foreign-exchange value of the contract from Indian defense suppliers (Exhibit 2).

DPP has been in place for about ten years, and though progress was modest at first, it has picked up in recent years; approximately $4.3 billion worth of offset contracts have been signed and launched since 2007, most by India's Air Force. As noted, most of India's purchases are from other governments and thus are not eligible for DPP. That said, procurement seems to be shifting toward a DPP-led competitive process. The recent deal for medium multirole combat aircraft (MMRCA), under negotiation with Dassault for the company's Rafale jets, is a good example of an at-scale order (approximately $10 billion) put out for competitive bid. While this is a good sign for the program, all things considered, it is still too early to judge DPP's impact in driving efficiency in the procurement process.

The next phase of growth

We expect India's $12 billion defense market to continue its strong growth trajectory through 2020.[3] By that time, capital-equipment spending is expected to reach between $18 billion and $20 billion[4]—the second-highest growth rate among the top 15 countries ranked by defense spending. India will continue to be a large net importer of defense hardware; indeed, its import intensity will continue to be one of the highest among countries that procure at similar levels.

India's domestic demand likely will be set by five factors:

- Changing geopolitical scenarios on India's borders may necessitate continual augmentation of its defense equipment.

- New procurement will be necessary to replace obsolete equipment and to reach inventory levels required for combat readiness.

- Internal security requirements will likely drive demand for homeland-security equipment.

- Strong underlying economic growth would allow for increased government spending on defense.

- The entry of new companies in the market would increase competition and innovation, further driving growth.

Put it all together, and India's spending will total approximately $150 billion[5] in the short term (Exhibit 3). Naval platforms will account for the largest share, driven by the need to augment the depleted strength of equipment (particularly submarines and aircraft carriers) and by the new strategic naval mandate for "blue water" capabilities, which will require nuclear submarines, additional aircraft carriers, and landing platforms.

Exhibit 3

Platform spending will likely total nearly $150 billion by 2017.

		Potential spending,[1] $ billion	**Main orders expected**
Air	Combat/trainer	26.3	Medium multirole combat aircraft and other fifth-generation aircraft, Mirage upgrade, MiG-29 upgrade, Jaguar engine upgrade, basic trainer
	Support	15.8	Transport aircraft, aerial tankers, long-range maritime patrol aircraft, midrange maritime reconnaissance aircraft, Phalcon AWACS,[2] mini AWACS
	Rotary	9.1	Light-utility helicopters replacing Chetaks for Navy, multirole helicopters for Navy, attack, heavy lift, light utility, light combat
Land	Fighting vehicles	15.8	Arjun main battle tank (MBT), T-90 MBT, light tank, futuristic infantry combat vehicle
	Artillery	4.2	155 mm towed guns, 155 mm ultralight guns, 155 mm self-propelled tracked guns, 155 mm self-propelled wheeled guns
	Missiles	3.4	Javelin antitank guided missiles, CBU-105 sensor-fuzed weapon, short- to medium-range surface-to-air missile, Agni-V, MICA
	Infantry systems	1.1	Futuristic Infantry Soldier as a System (eg, weapons, helmet, visor, clothing)
Sea	Surface combatants	20.8	Aircraft carrier: Project 71; destroyer: Project 15B; frigate: Project 17A and 17B; corvette: Project 28A
	Submarines	46.7	Nuclear: Arihant follow-on, Scorpene, Project 75I, special, midget
	Support	4.1	Landing platform dock, landing ship tank, landing craft utility
C4ISR[3]		0.3	Navy 3-D radar, radar-jamming integrated electronic warfare systems

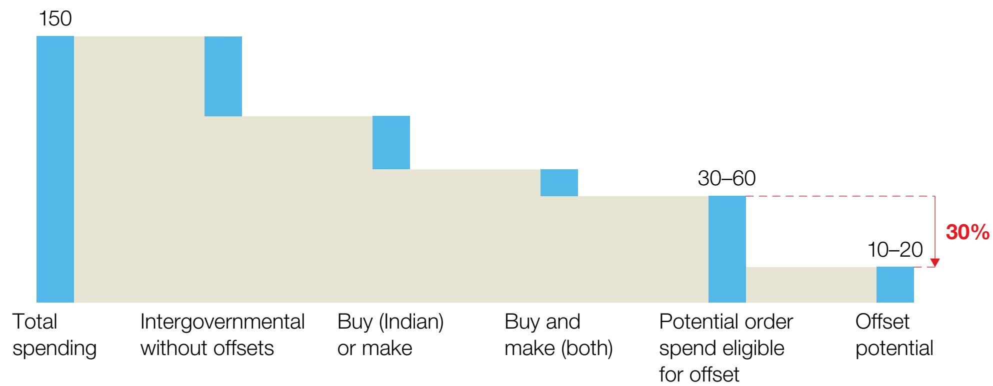
[1]Total includes $1.1 billion of infantry equipment not detailed in the chart.
[2]Airborne warning and control systems.
[3]Command, control, communications, computers, intelligence, surveillance, and reconnaissance.

Source: Literature search; McKinsey analysis

Exhibit 4

Offsets could spur growth.

Defense spending eligible for offsets through 2017, estimated, $ billion



Source: Defence Service Estimates, India Ministry of Defence; *Economic Survey 2009–2010*, India Ministry of Defence; *Report of the Thirteenth Finance Commission (2010–2015)*; Union Budget of India, India Ministry of Finance; McKinsey analysis

Upgrading the Indian Air Force's capabilities will drive the second-largest portion of spending. The Air Force plans to increase its "eyes in the sky" by acquiring airborne warning and control systems, augment its strategic and tactical lift capabilities by strengthening its transport fleet, and acquire new fighter platforms such as MMRCA and fifth-generation aircraft. Land forces are primarily looking to acquire tanks, combat vehicles, and artillery, and they are building a network-centric infantry through the Futuristic Infantry Soldier as a System program.

In addition to these big procurement programs, offset obligations under the DPP could become an opportunity worth $10 billion to $20 billion for the domestic industry, based on the current order pipeline (Exhibit 4). As noted, the basic intent of the offset policy is to build a domestic defense-manufacturing base. The most recent amendment to DPP, made in July 2012, added multipliers for the offset credits created in deals with micro-, small, and midsize enterprises and for the acquisition of specific technology by the Defence Research & Development Organisation. New rules also add homeland- and coastal-security equipment to the list of eligible products and services and offer more time for contractors to bank their offset credits.

Uniquely Indian requirements

Taken together, these programs provide a significant opportunity to industry suppliers. In addition to operational and commercial strengths, capturing the opportunity successfully will require a strategy that is informed by awareness of three essential characteristics of the next wave of Indian defense spending.

First, in the next three to five years, most of the big contracts announced in recent years will be awarded, providing a window of opportunity to

Exhibit 5

Cost savings and discharge of offset obligations will likely boost a nascent export market.

● • Size of dot indicates strength of factor

Growth drivers	Engineering services	Components
Cost efficiency • Talent and other factor costs are available at 50–60% of the costs in developed markets • Players can access quality components, with substantial savings on a landed-cost basis	●	●
Discharge of offset obligations • Multinational original-equipment manufacturers with Indian defense contracts can discharge their offset obligations by sourcing military-grade components and services from India	●	●
Access to engineering talent • There are shortages of engineers in multinationals' home markets • India has a small but growing pool of qualified engineers	●	•
Stronger business outcomes • Time to market can be shortened • Increased productivity or yield could result • Waste in operations can be reduced	•	•

suppliers. This will represent an upswing in India's strongly cyclical defense demand, and it is a rare and perhaps unique exception to the downturn in the global aerospace and defense market, which many expect to persist for at least the next few years.

While Indian procurement is cyclical, it is also uneven—a second characteristic. Large programs are often slowed by contracting challenges. Smaller programs will likely move through the process relatively quickly.

Finally, intergovernmental orders are likely to continue to account for most spending, although they may become less common.

The beginnings of an export market

The domestic industry seems poised for another period of rapid growth. Moreover, India has the potential to become an attractive destination for governments and companies around the world that need engineering services and components. Collectively, these opportunities could total $6 billion to $10 billion by 2020[6] (of which we estimate $2 billion to $4 billion will be for engineering services and $4 billion to $6 billion for components).

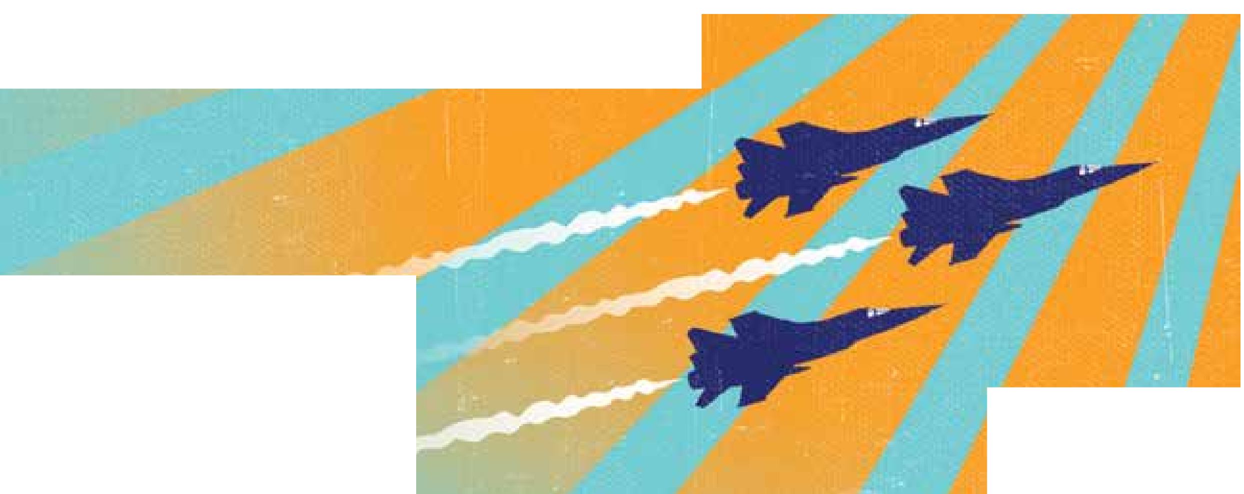
Both opportunities leverage two of India's key advantages: its lower cost base for manufacturing and its small but growing pool of skilled engineers (Exhibit 5). Shrinking defense budgets in Western countries and the resultant pressure on OEMs to "do more with less" could make India's low-cost manufacturing and labor services more attractive. And engineering-services sourcing and component sourcing can be used to fulfill offset obligations for multinational firms that win big weapons contracts.

The preferred business model for engineering services will likely be captive centers of competence and joint ventures due to the strategic and intellectual property–intensive nature of the work. A few examples have already emerged—these include a captive unit of Safran, a French defense major; BAeHAL, a joint venture between BAE Systems and HAL; and an engineering-services partnership between Rolls-Royce and Tata Consultancy Services.

For component sourcing, India could draw on its strengths in the auto-components industry and target three sets of components: highly varied, low-volume, and skill-intensive parts, such as aerostructure components and armor plates; those that require a higher degree of engineering, especially manufacturing engineering, such as complex castings, forgings, and fabricated parts; and components with embedded software, such as communication and navigation electronics. A few examples are already emerging in this field; Tata and Boeing have partnered to produce defense-related aerospace components, and Tata and Sikorsky have teamed up to assemble Sikorsky S-92 helicopter cabins for civil and military use.

For the export dream to come true, some critical supports are needed—especially talent availability, infrastructure, and sound regulation. India will have to build its stocks of aerospace and defense expertise: although India is one of the world's largest producers of engineers (about 350,000 per year), only 4,000 or so are aeronautical experts. In addition, the government could help pave the way for the required infrastructure to be built quickly by putting enabling policies in place, and export approvals must be more readily forthcoming.

A third, smaller export opportunity merits a mention: the chance to sell to countries with requirements similar to India's. The nation currently has defense-supply relationships with smaller South Asian countries such as Bhutan, Nepal, and Sri Lanka. Other emerging markets also beckon; for example, India recently



supplied Dhruv helicopters, designed and manufactured by HAL, to Ecuador. The key to unlocking these markets is to deliver the right quality of platforms, of the right "vintage" (that is, one, two, or three generations behind the leading edge), at a disruptive price point. It is here that India, with its record of frugal engineering, could have a unique advantage.

2020: Toward a sustainable industry ecosystem

India is in an unusual and perhaps unique position to build a vibrant local defense-industry ecosystem that could support both domestic and export demand, yielding material benefits to the industry and the nation. Self-reliance is the sine qua non in defense, in India and elsewhere, and developing a vital industry is a big step in that direction. Today, the country makes huge payments for equipment imports; a vital domestic industry could right this trade imbalance. And a thriving industry will create jobs in both manufacturing and engineering services.

So the goal is worthy. But how can it be achieved? As India sets out, it can look to other countries whose defense markets were once at a similar stage of evolution and later went on to build a robust domestic industry. France and the United Kingdom did it some time ago; Israel and South Korea are doing it now. Most of these countries made five moves.

Choose core capabilities. Successful countries made explicit choices about competencies and capabilities for their domestic industry, based on their strategic needs and operational requirements (Exhibit 6). Some of the elements

Exhibit 6

Successful countries made explicit choices on core military capabilities to develop themselves, and they procured the rest.

	Potential core capabilities
Land	• Propulsion systems • Armor protection
Sea	• Hull technologies • Propulsion (air-independent propulsion/nuclear) • Weapons systems • Electronics
Air	• Aerostructures • Propulsion (jet engines) • Electronics • Missiles
C4ISR[1]	• Communications • Surveillance • Network aggregation

Which strategic capabilities must be retained in-country?
- Core to defense of the country
- Require constant availability
- Will provide strategic influence

Ministry-of-defense domain

Where does the country have natural advantages?

Which capabilities will have broader benefits for local industry and job creation?

[1] Command, control, communications, computers, intelligence, surveillance, and reconnaissance.

India is in a position to build a vibrant local defense-industry ecosystem that could support both domestic and export demand.

that might guide these choices include the desired level of readiness of a country's forces and the desired vintage of weapon systems.

Accelerate capability building. Once capabilities were chosen, these countries took steps to speed up their development. One common move was to shape procurement procedures, in particular highly specific offset policies, to encourage capability building in their chosen domains. For India, that may mean further revisions to the DPP.

Enable the optimal industry structure and conduct. Successful countries established a level playing field for all industry participants, including global OEMs, domestic private players, and government-owned defense entities. Some did this by raising limits on foreign direct investment. Equality of opportunity makes market participation more attractive for multinationals, which can invigorate the local industry with world-class practices, processes, and technologies.

In this context, the restriction that limits foreign ownership of Indian defense entities to 26 percent could be viewed as a bottleneck by multinationals, which naturally want to ensure appropriate controls on the flow and use of their intellectual property by partners. The current foreign-direct-investment policy does allow for a higher ownership percentage, to be determined on a case-by-case basis; however, most recent proposals have been denied. Defense is a strategic sector—there is none that is more so—and governments need to ensure proper checks and balances before opening it up to foreign participation. At the same time, India might also weigh the considerable benefits of foreign participation, including access to state-of-the-art technology, to ensure that the domestic industry's desired progress is not delayed.

Improve procurement processes. Successful countries rationalized their procurement processes to ensure simplicity, clear accountability, and speedy decision making.

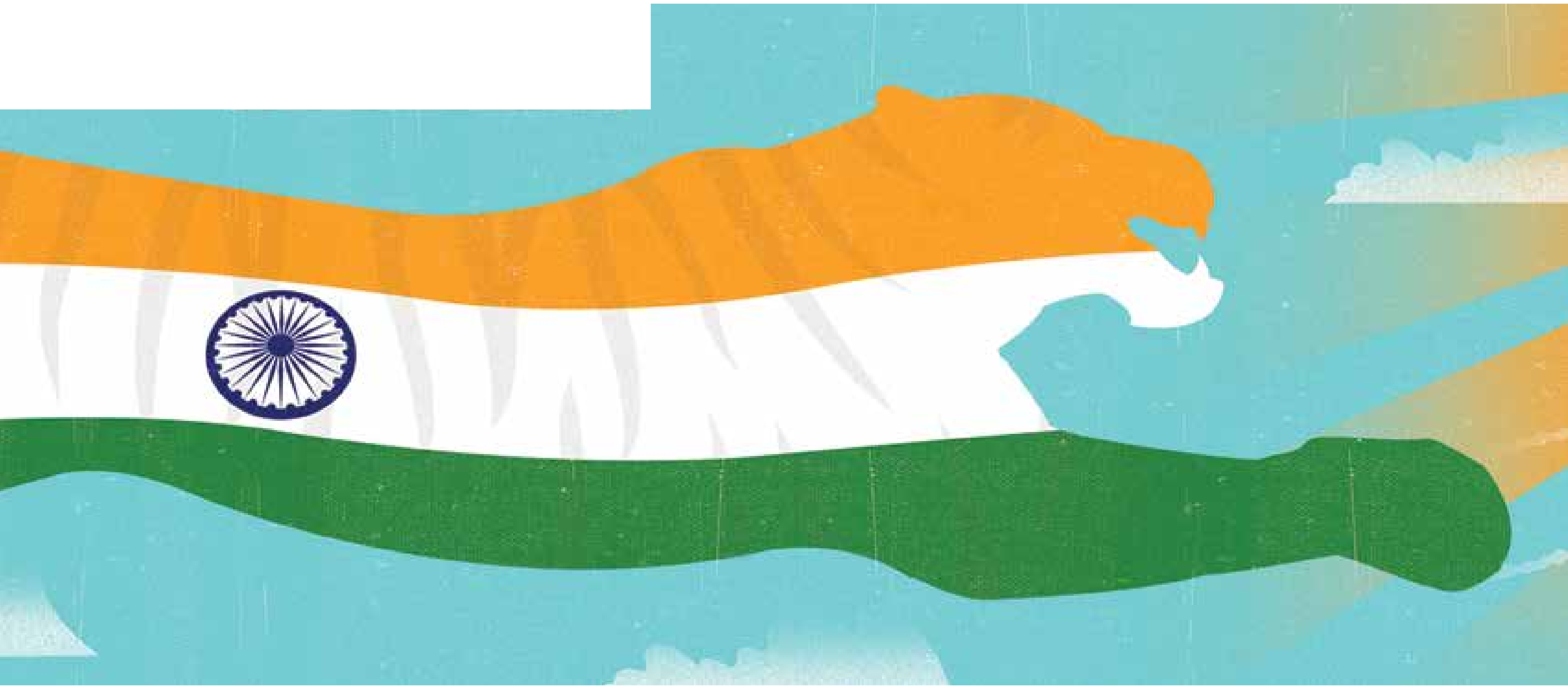
Drive a performance orientation in government defense entities. These countries invested in their defense ministries and other groups, transforming several key agencies to support the market's requirements.

A balancing act

India's journey to a world-class defense industry has begun, but for the foreseeable future, it is likely to remain one of the largest importers of defense hardware in the world. As such, it is already diversifying its supplier base, courting countries such as France, the United States, and others while also seeking to maintain close ties with its long-term trusted supplier, Russia.

India's close strategic relationship with Russia (and earlier with the Soviet Union) was bolstered by its partner's willingness to share top-of-the-line platforms and technologies. Over time, India expanded its base to countries like France and Israel, again driven by their willingness to share the desired platforms and technologies. Of late, India has had some issues with its suppliers related to prices, availability of spares, and so on; as a result, it is again expanding its supplier pool. India is now exploring possibilities with some Western countries, particularly the United States.

These are early days for India's expanding network of defense relations. The country's movements will be guided by changes in its geopolitical situation, especially as India builds deeper relationships with countries such as France and the United States and sees how these countries fare as trusted suppliers. These movements have the potential to spark substantial changes in India's strategic relationships and ultimately in the balance of trade in the global defense industry. Will supply relationships with countries such as France and the United States serve to strengthen India's political ties with Europe and America?



Will India emerge as a defense exporter in its own right? What would this mean for India's role in the region and beyond? The next decade of development bears watching.

• • •

Already, India's defense sector has picked up some best practices, for instance, giving initial form and shape to a structured procurement process and putting in place an offset program. The government is continually refining and reforming this procurement process and fine-tuning its requirements to reach best-in-class performance. It is an arduous task; there is much to do and little time in which to do it. But the benefits are compelling, both for India and the defense companies chasing the opportunity. As the journey unfolds, it will no doubt offer useful lessons for other countries at the start of their own journeys to self-reliance in defense.

[1] To convert India's accounting terms to those used elsewhere, fiscal year 2001 government-expenditure numbers are presented as 2000 numbers; similarly, fiscal year 2011 numbers are presented as 2010 numbers.
[2] Defense public-sector undertakings include BEML, Bharat Dynamics Limited, Bharat Electronics Limited, Goa Shipyard Limited, GRSE, Hindustan Aeronautics Limited, Hindustan Shipyard Limited, Mazagon Dock Limited, Mishra Dhatu Nigam Limited, and Ordnance Factory Board.
[3] Estimates based on data from Teal Group Corporation and several government sources including Defence Service Estimates, the Ministry of Defence, the Finance Commission, the Union Budget, and the Economic Survey.
[4] In real terms, using constant 2010 prices.
[5] Representing all known programs, including some recently ordered but not yet fully delivered.
[6] In real terms, using constant 2010 prices.

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Managing through the downturn: How the US defense industry can learn from its past

Companies that assertively managed their portfolio thrived in the last budget downturn. The same strategy will work again today, but companies must be mindful of the new context.

Kevin Dehoff, John Dowdy, and John Niehaus

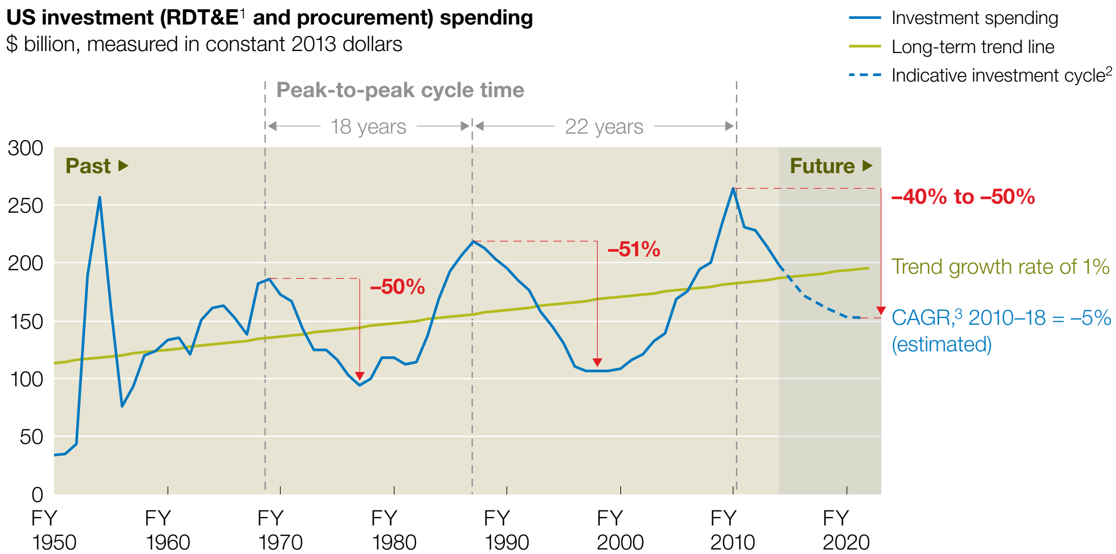
As more than a decade of war nears an end, and the US budget faces acute challenges, the Department of Defense (DOD) is cutting its investments in the development and procurement of modernized capabilities. A "down cycle" in military spending is in fact well under way, its depth and length uncertain. Yet, the investment budget has been through similar downturns before. Companies that act decisively to capitalize on today's realities, rather than merely doing "less of the same," will be rewarded in the near term. Firms that adjust to the cycle will also be better positioned over the long haul, when the cycle in all likelihood reverses as a necessary wave of new programs and investments to modernize the military emerges. Positioning the industry to create more affordable mission solutions, pursuing new pockets of growth, and actively reshaping the portfolio of businesses are principal strategies for both industry and government in the face of the downturn.

The cycle turns

Since World War II, the United States has been the world's largest defense customer 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]

Exhibit 1

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

However, the winding down of two wars and acute pressure to reduce the national debt burden after the country's biggest financial shock since the Great Depression have cast a long shadow over the US defense budget. Planned reductions in DOD spending will exceed $487 billion over the next ten years, and there may be more cuts in store.[2]

Even before these developments, the down cycle was already well under way: since the fiscal year 2008 "peak," the DOD's investment accounts—procurement and research, development, test, and evaluation—have declined by 25 percent. Combine these trends with the latest pressures, and it is clear that the DOD is facing a protracted budget "trough." Although many uncertainties remain, preparing for a sharp reduction in DOD investment-account spending is prudent (Exhibit 1).

The budget contraction is increasingly visible. Since 2008, several major defense programs have been canceled and others restructured, including the Future Combat System (FCS), Combat Search and Rescue Helicopter (CSAR-X), Expeditionary Fighting Vehicle (EFV), Presidential Helicopter (VH-71), Next-Generation Cruiser (CG-X), Armed Reconnaissance Helicopter (ARH), and Global Hawk Block 30 programs, to name just a few. Further, the DOD has taken action to shift more risk to suppliers.

These changes have already begun to affect the defense industrial base. Multiples for the shares of pure-play defense firms began to decline in 2006—well before the financial crisis. Shares of pure-play firms now trade at the lowest multiples in 20 years, and significantly below those of firms that also have commercial businesses (Exhibit 2).

In the last down cycle in defense spending, following the end of the Cold War and the fall of the Berlin Wall, then–secretary of defense William Perry encouraged the industrial base to consolidate, and consolidate it eventually did, with many household names merging or disposing of their defense assets. But more recently, the DOD has made it clear that it does not support another round of mergers given the current degree of consolidation in the industry, at least among the biggest prime contractors.[3]

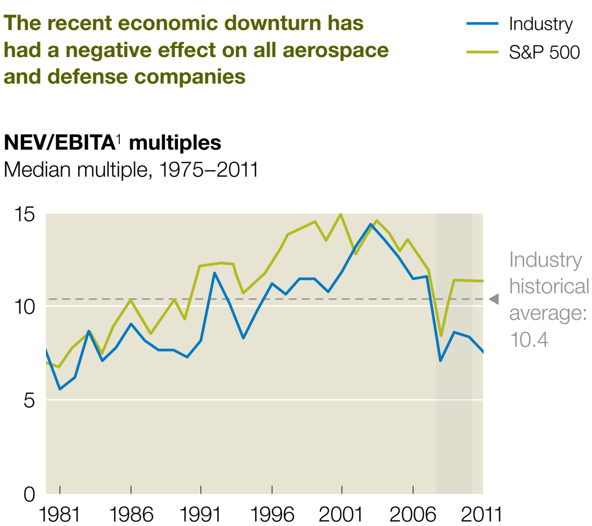
As a result, industry and government leaders are grappling with difficult questions: what can top management do in the face extraordinary external pressures? What can the DOD do to encourage the right choices in industry? We argue that a good

Exhibit 2

Defense companies suffered in the downturn, especially pure-play firms.

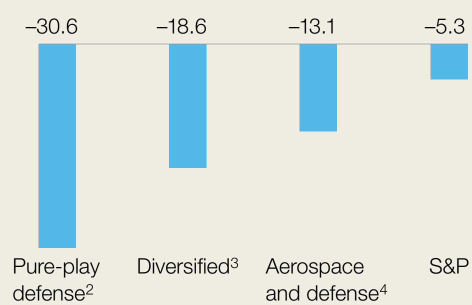
The recent economic downturn has had a negative effect on all aerospace and defense companies

NEV/EBITA[1] multiples
Median multiple, 1975–2011



Pure-play defense companies have been hit much harder than diversified players

Decline in NEV/EBITA multiples
Difference between 2008–10 average and 1980–2007 average, %



[1]NEV: net economic value; EBITA: earnings before interest, taxes, and amortization.
[2]Pure-play defense players: BAE Systems, General Dynamics, L-3, Lockheed Martin, Northrop Grumman, and Raytheon.
[3]Diversified players: Harris, Honeywell, ITT Exelis, Oshkosh, Textron, and United Technology Corporation.
[4]Aerospace and defense players: ATK, Boeing, Goodrich, McDonnell Douglas, and Rockwell Collins.

Source: McKinsey Corporate Performance Analysis Tool (outliers have been removed) place to begin is with an assessment of the strategies of the defense companies that emerged the strongest from the post–Cold War market.

Lessons learned from the previous cycle

Between 1985 and 1998, the DOD reduced spending on a scale similar to that of today. DOD investment fell 52 percent from peak (1985) to trough (1995), and it did not start to recover until the late 1990s. We analyzed the publicly announced strategies and high-level indicators of financial performance of major defense firms through the cycle. The analysis is necessarily qualitative, as the huge wave of consolidation that characterized the end of the cycle made the performance of individual firms obscure.
In general, we can say that industrial companies responded in one of three ways:

- *Pursuing comprehensive business repositioning.* Led by their corporate center, these companies assertively restructured their portfolio of businesses. They moved early and decisively to build at-scale advantage in new businesses (often through acquisitions), as well as in businesses they retained. Some exited other businesses. By the end of the cycle, several firms in this category had portfolios of businesses that bore little resemblance to their lineup ten years earlier. These firms embraced the down cycle as an opportunity; further, they were in a better position than others to benefit when the cycle turned up again, after September 11, 2001. Broadly speaking, these firms generated superior financial performance throughout the cycle.

- *Optimizing the core franchise.* These companies largely maintained their corporate strategy (making fewer acquisitions and divestitures) and put to one side the question of which businesses they should be in. They improved their core businesses by consolidating and rationalizing excess capacity. When the market began to grow again, they had to optimize their portfolio of businesses under less-than-optimal conditions; some had to make acquisitions at higher valuations, while others had to sell underperforming businesses at low prices. At the end of the cycle, these companies' mix of businesses was largely the same as before.

- *Weathering the storm.* These companies did not consolidate operations or overhaul their portfolios. Instead, they focused on overcoming profitability problems and turning around troubled programs, as well as winning pivotal—but relatively scarce—large new programs.
To be sure, all companies devoted some effort to performance improvement and cost reduction, but these firms led the way. Their success and survival depended heavily on winning major programs and waiting for the down cycle to reverse.

Our key finding from the analysis is unambiguous. Active portfolio management was the single most important strategy of defense companies in the last down cycle. In a period of deep uncertainty, buyers and sellers came together to produce extraordinary consolidation, and both parties were successful. Defense companies that managed their portfolios to systematically divest assets generated substantial surplus cash, rapid stock appreciation, and sizable dividends, which resulted in the highest total returns to shareholders.
Buyers who purchased the right assets were positioned for competitive advantage in the next up cycle, rationalizing industry structure and excess capacity while acquiring distinctive capabilities. Conversely, firms that waited to move paid the price: their eventual

M&A was done at higher multiples, and the greater expense of these moves hobbled their firms for years afterward.

Investors rewarded active portfolio management where it created value. Many investors maintained a longer-term perspective and believed that the defense market would rebound; they also believed that consolidation would provide economic benefits to all stakeholders by reducing excess capacity and lowering fixed costs.

By 1997 (two years after the trough), most of the available assets had been acquired, and governmental encouragement for additional major mergers effectively ended. By that time, however, defense-equity multiples had expanded 50 percent (Exhibit 3)—well before the up cycle was fully under way.

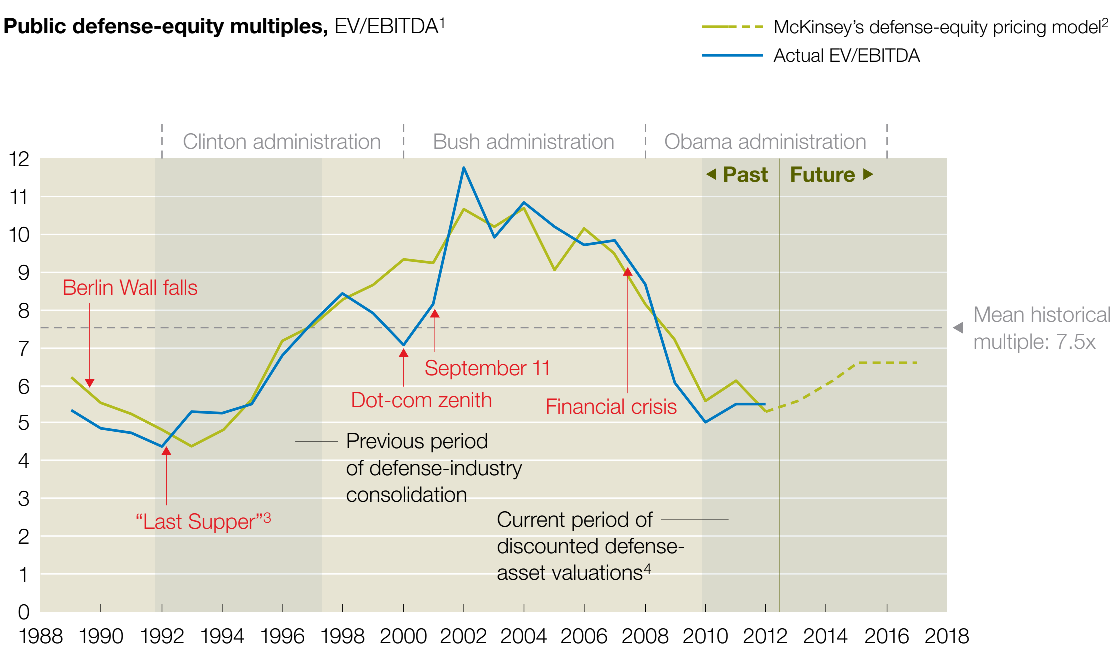
The new strategic agenda

The strategy that emerged from the last cycle will likely be just as valid in the current

Exhibit 3

Multiples for defense stocks rose considerably from the start of the last consolidation.

Public defense-equity multiples, EV/EBITDA[1]



[1]EV: enterprise value; EBITDA: earnings before interest, taxes, depreciation, and amortization; average EV/EBITDA multiple based on Merrill Lynch Defense Index.
[2]Projection based on McKinsey's defense-equity pricing model and investment-account projections.
[3]The "Last Supper" was a 1993 meeting between the secretary of defense and defense-industry executives, in which the industry was urged to consolidate.
[4]Discounted relative to historical multiples and comparable with those during the previous consolidation.

Source: Merrill Lynch Equity Research; McKinsey analysis one. However, we should note four differences between today and the early 1990s:

- Today's downturn will probably last longer. Fiscal pressure—caused by the mounting federal deficit and complicated by persistent growth in mandatory entitlements—will likely prolong the reductions in defense spending.

- Absent dramatic changes in threat levels, new defense programs will be few and infrequent.

- Primary growth in demand will be outside the United States and largely concentrated in the developing world.

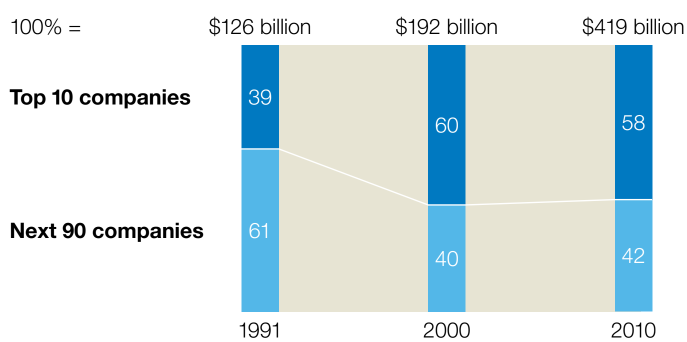
- The potential for consolidation and industry rationalization is much more limited today. The 10 largest companies now command 58 percent of the total revenue of the top 100 players, compared with 39 percent in 1991 (Exhibit 4). Additionally, the number of players in major defense systems is much smaller—in missiles, for example, there are 3 at-scale competitors today, in contrast to 13 in 1990.

To deal with these complications and to sustain a strong industrial base for the future, the DOD and its suppliers might consider a strategy with three bold steps: reimagining the business portfolio, the winning play in the last cycle,

Exhibit 4

The global defense sector is highly concentrated today.

Revenue of the top 100 defense companies worldwide,[1] %



	1991	2000	2010
Number of prime contractors	16	6	6
% of top 100 companies that still exist in 2010	19	46	100

[1] Revenue figures are expressed in constant 2010 dollars; 100% indicates the total defense-related revenue of the top 100 companies in the industry.

Source: Defense News 100; US Budget GDP Deflator; US Department of Defense will be vital, but so too will be developing the right capabilities to build products that the customer can afford. And firms will need to take steps to find new areas of growth, especially in overseas markets. We argue that this three-pronged strategy can help firms prevent the precipitous early drops in financial performance that the sector experienced in the early 1990s and can position the sector for strong performance in the future.

Affordability

Industry and government have long struggled to check the relentless growth in the costs of developing and producing modern weapons systems. Many measures have been tried only to be abandoned; costs continued their inexorable rise. Recently the DOD has taken steps to break the back of this problem; it now seeks to cap costs by stating what it can afford to pay—and making clear its intention not to pay more. Consider the US Air Force's Long-Range Strike Bomber program; Air Force leadership has said that this program's success requires an average procurement unit cost of not more than $550 million.[4] Explicitly capping costs to emphasize affordability is a new step, one that the industry acknowledges but for which it is ill prepared.[5] To succeed in this new world, industry should first commit to the new rules, including the "must cost" nature of defense contracts and the implications for the relationship with its customer. Firms must then transform their business model, capabilities, and culture to build products that the customer wants and can afford, and ensure that cost cuts stick. If firms can get this right, it will not only enhance their chances of winning a contract but also improve the probability that the program receives its funding in the first place.

To make the shift to affordability, firms must make a sweeping array of changes in their business models, and especially the following capabilities (Exhibit 5). They should start with the change in the customer relationship. What the government seeks, and the nation needs, industry is naturally obliged to deliver. The government has made changes in acquisition policy in a way that places much of the burden of change on the industry—and shifts more risk to it.

Industry leaders should extend a helpful hand while simultaneously making it clear that a true peer-at-the-table partnership with government is required to craft affordable, high-value mission solutions.

Exhibit 5

Defense companies must transform their business models.

	From . . .	To . . .
Customer relations	• Arm's-length relationships with marginal level of trust • Poor communications and lack of transparency • "Conspiracy of hope" that leads to cost and schedule overruns	• A true partnership with high level of trust • Joint problem solving, with each side contributing its distinctive expertise • Mutual and objective assessment of probable costs and time-certain schedules
Product development	• Protracted, ambitious development with uncontrolled scope • "Generational leaps" in technology	• Rapid, time-bounded development • Incremental, product-line approach to technology • Life-cycle-requirements outlook
Production and manufacturing	• Designed around optimistically high volumes • Long production runs	• Flexible, but designed for lower volumes • Agile production cycles
Supplier-relationship management	• Optimized for suppliers' capabilities • Fixed supplier base • Reactive approach to supplier management	• Optimized for cost, flexibility, and speed • Agile and global supplier strategy • Collaborative supplier relationships
Organization	• Organizational structure shaped by large platforms • Heavy infrastructure and allocated support costs absorbed by business unit	• Lean infrastructure and support driven by business requirements and affordability • Talent management to develop leaders and maintain critical skills

But industry must also recognize that, with this change, government is asking for the industry's help; it sees that it cannot lead alone and needs the industry's commitment to enable transformation. For example, it is industry and not government that is in the best position to judge what is technically feasible in a given time horizon and cost range.

Industry should engage government and make clear its belief that the relationship should change. In our recent survey of industry leaders, many said that they are hoping for greater transparency, simplification and acceleration of processes, and more open dialogue and collaboration with the government customer (see "Defense outlook 2015: A global survey of defense-industry executives" on page 68). Industry leaders should extend a helpful hand while simultaneously making it clear that a true peer-at-the-table partnership is required to craft affordable, high-value mission solutions. In practice, this might mean a requirements-setting process that looks more like commercial business models, with mechanisms that enable industry to effectively challenge ideas that are inconsistent with cost and schedule constraints. It is both reasonable and essential for industry to aim for a partnership of equals in the formulation of complex mission solutions.

This imperative is equally critical for government. While avoiding industry capture is important, it is also true that only a collaborative approach

can lower costs while continuing to drive innovation. Government simply doesn't have the information it needs to effectively manage development and procurement costs, and the only way to get it is through increased cooperation. By appropriately managing incentives, government buyers can capture these collaboration benefits.

Product development is at the heart of the affordability transformation. Product development must change, moving away from a protracted process that aims for the most exquisite technical solutions and toward rapid and time-certain development models, in which affordability and risk reduction are critical performance parameters.

Production and manufacturing systems that are designed around optimistic volume projections and long production runs should be shelved in favor of low-volume (and thus more realistic) flexible manufacturing approaches with shorter production cycles.

Supplier relationships used to be formed almost entirely on the basis of suppliers' ability to meet mission requirements. In the future, suppliers' ability to meet cost targets and deadlines, and their flexibility in rapidly accommodating changes in programs, will be just as important. Frequent changes in programs also mean supplier relationships should become more collaborative, so that suppliers can better anticipate requests for changes. Many traditional defense suppliers will likely find this very challenging. Defense companies will have to establish a global base of suppliers, casting a wide net to improve competition and add redundancy.

Organizations today are often structured in units corresponding to the company's legacy acquisition programs. These programs, contracted on cost-plus terms, encourage a bloated infrastructure and inflated costs. In the new world of affordable systems, companies will need not merely to cut these costs but to restructure the organization in ways that match the customer's needs. This will also serve them well in adjacent and international markets, as we discuss below, where the old and expensive platform-centric structure will likely prevent the firm from moving with the needed agility, deftness, and entrepreneurialism.

The shift to affordability will also mean big changes in roles and responsibilities. For example,

industry program managers will need to raise their game. With so many programs plagued with burgeoning costs and hidden risks to the enterprise, program management must reduce overhead and get better at identifying and mitigating a comprehensive set of project risks. (Government too should improve skills in this area, as we explain in "Project management in defense: The essential capability" on page 74.) More broadly, critical technical and leadership skills can erode rapidly in a down cycle, as the most experienced engineers, scientists, and program managers retire and attracting the next generation of engineers and leaders can be difficult. Moreover, the shift to affordability requires a profound change in corporate culture. Taken together, these issues bespeak the need for a redesign of the talent strategy at many defense companies.

Growth

With the US defense budget declining and fewer new franchise programs cropping up, companies must sharpen their ability to identify growth opportunities. Although almost all defense sectors will shrink, companies should scour the landscape for the relatively high-growth segments that remain. They should seek those that are suitable for investment and provide opportunities to build an advantaged position at scale.

The search should start by considering the shift of national-security focus and the associated reallocation of budget. Most notably the "pivot to the Pacific" emphasized in recent revisions to the National Military Strategy prioritized certain investment capabilities and force-structure levels. Intelligence, surveillance, and reconnaissance systems; undersea and surface ship capabilities; long-range strike aircraft; strike missiles; missile defense; electronic warfare; and capabilities needed to operate in sophisticated anti-access/area-denial threat environments are in demand, while capabilities needed to support deployed ground forces are on the wane.

Firms can also look overseas for growth. Many emerging markets were unscathed by the financial crisis and stand to benefit from growing economies and intrinsic defense-investment capacity. (For more on the opportunities in these markets, see "A bright future for India's defense industry?" on page 44 and "Follow the money: Strategy, scenarios, and the global shift in defense power" on page 28.) This has no doubt prompted the DOD to emphasize

While it is almost impossible for defense companies to time acquisitions and divestitures perfectly, those that are well prepared—and ready to deal—will likely benefit most.

exportability in its recent Better Buying Power 2.0 initiative. This is an unambiguous growth opportunity.

However, the challenge of international defense markets is often underestimated. Offset requirements, national politics, complications with local partners, and significant differences in US trade law relative to international competitors add complexity. Perhaps most important, there are often four or more competitors bidding on the most lucrative opportunities rather than the two or three customarily involved in DOD procurement. In this light, joint ventures, alliances, and partnerships with international companies may provide an answer. A partner with market access and critical capabilities, including an understanding of the customer and product and technology know-how can help US firms gain a foothold in these markets and increase their market share on economically attractive terms.

Portfolio management

As noted, US defense-company equity multiples are at generational lows—and they could dip lower still, given the potential for further reduction in the DOD's investment accounts and for broader fiscal crisis in the United States. While the low multiples no doubt produce sleepless nights for CEOs, the flip side is that companies have an opportunity to acquire other defense assets now at what may be seen as bargain prices by the end of the decade.

We also see other opportunities to actively manage the portfolio. Many companies have built up portfolios over the past 20 years without sufficient attention to rationalizing them. As a result, they contain a mix of some very healthy businesses and others that are challenged. With little chance for more megamergers that would remove unproductive capacity from the industry, companies are going to have to do it themselves, either by selling less attractive businesses, substantially restructuring them, or spinning them out. We have begun to see some of this already, with Northrop Grumman spinning off its shipbuilding business in March 2011 to form Huntington Ingalls Industries, and SAIC announcing its intention to split into two separate companies. We can expect to see many more such moves to rationalize and restructure portfolios.

For both acquisitions and sales, a sober examination of the competitive landscape, market dynamics, and the future environment is essential. Nothing should be off the table, and long-held assumptions should be challenged; management and the board should consider acquiring and divesting assets, large and small.

However, dabbling in investments and acquiring subscale position is unlikely to yield significant results. Rather, a company's portfolio strategy should focus on at-scale positions that establish competitive advantage. While it is almost impossible for defense companies to time acquisitions and divestitures perfectly, those that are well prepared—and ready to deal—will likely benefit most.

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For 50 years, the US defense industry has led the world in creating the most advanced weapon systems, technologies, aircraft, and vehicles. Today, the leaders of these companies must apply to their own organizations the very ingenuity that has kept America's military dominant. History shows that the time to act is in the depths of the downturn. Adhering to business as usual, trying on different and conflicting strategies, or merely riding out the storm have not worked well. Defense firms have succeeded in past cycles and will do so again. We believe that firms that embrace the strategies we have defined will find success in the current downturn, and when the cycle turns, as it almost certainly will, they will have an advantage over the long term.

[1] Data on share of global defense spending are provided by the Stockholm International Peace Research Institute.
[2] President Obama's fiscal 2013 budget called for a $487 billion reduction in defense spending. An additional $500 billion in defense-budget reductions may be required by 2021 under the Budget Control Act of 2011 (BCA). Such "automatic sequestration" reductions under BCA would hit defense spending the hardest, according to the Congressional Budget Office.
[3] Yochi J. Dreazen, "Pentagon: No more big defense mergers," *National Journal Daily*, June 15, 2011 (nationaljournal.com).
[4] The Pentagon's fiscal year 2013 budget sent to Congress in February 2012 called for 80 to 100 aircraft, at a unit cost of not more than $550 million.
[5] Almost all industry leaders we polled in our December 2012 global survey of defense-industry executives expect the shift to affordability, but two-thirds say their companies are not ready for it.

The authors wish to thank Daniel Pacthod for his contributions to this article.

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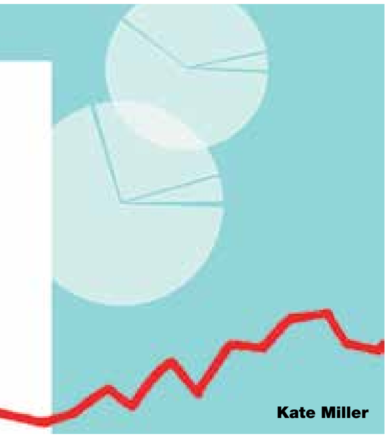
Defense outlook 2015: A global survey of defense-industry executives

Today's leading defense executives offer their insights.

John Dowdy and Melanie Taylor

In December 2012, we surveyed a small group of senior executives from leading aerospace and defense companies around the globe, 20 in total, to find the pulse point of the industry: what will the next three years hold? We invited executives to share their views on topics such as market outlook and overall trends, industry restructuring, and growth prospects. About three-quarters of the executives surveyed were C-level leaders at their organization—CEO, COO, CFO, CMO, or president—while the others were vice presidents or general managers. Our sample was geographically diverse, with two-thirds of executives from Europe and the Middle East; one-third were from the Americas. Most lead companies or divisions with at least $5 billion in revenues.

Respondents agreed on many topics, especially the somber outlook for global defense spending. With only one exception, executives see global spending declining over the next three years. They see the defense industry changing, and they are all taking measures to adapt. Leaders are preparing to meet the challenge of evolving customer needs, especially the quest for affordable products, and expect to be active in corporate restructuring. Companies intend to find growth in international markets such as India and the Middle East. Finally, executives see growth potential in commercial aerospace, services, unmanned systems, and cybersecurity, with interesting differences of opinion on the relative attractiveness of these opportunities.



A shrinking market

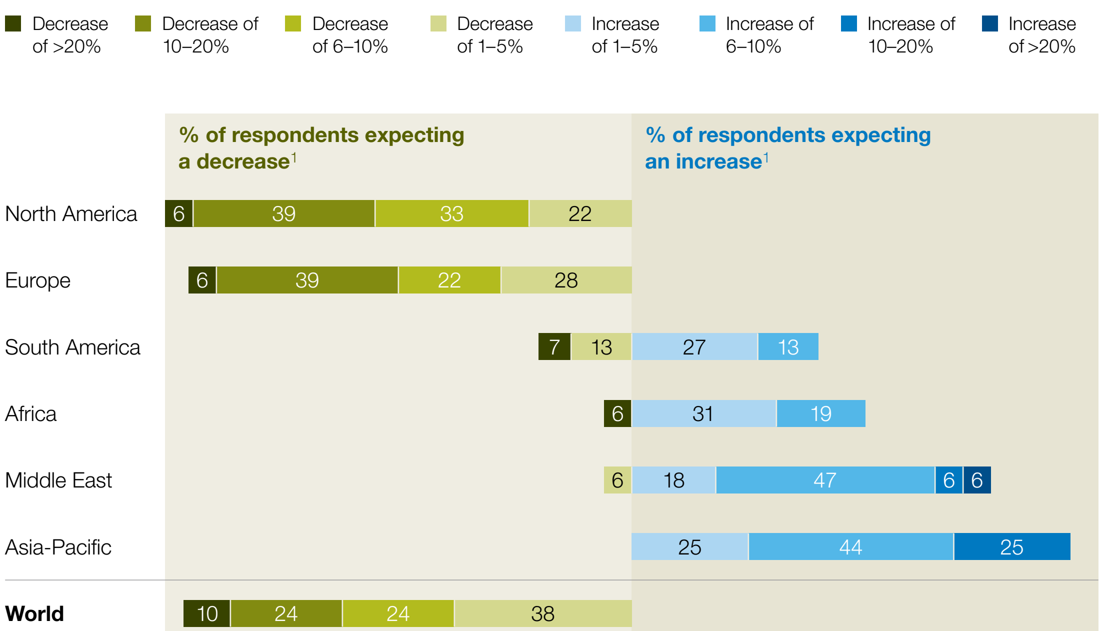
When asked about the outlook for the global market, the near-universal expectation is for a decline, but executives disagree on the extent of the slump. About two-fifths believe that global market revenues will decrease between 1 and 5 percent, and one-fifth see a decline of more than 20 percent. The rest expect something in between.

We also asked respondents about the outlook in the markets in which they are active, and found some clearly delineated differences. Asia-Pacific and the Middle East were seen by most as pockets of moderate growth, offsetting moderate to significant decreases in Europe and North America. South America and Africa were largely predicted to either remain the same or have slight increases (Exhibit 1).

To understand how regional shifts might affect the nature of global competition, we questioned executives about the decline in defense spending in established markets and the rise in emerging markets. Would this shift in spending be accompanied by a commensurate shift in the structure of the industry? Would new globally competitive players emerge,

Exhibit 1

Expected changes in defense spending vary for different regions of the world.



[1] Respondents who answered "no change" are not included. Figures do not sum to 100%, because of rounding.

Source: Dec 2012 McKinsey survey of defense-industry executives using their lower cost structures as a springboard to global prominence? Almost two-thirds of respondents—admittedly, mostly from more established markets—said they did not expect to see a new competitive global player emerge; instead they thought that companies in emerging markets would continue to function mainly as low-cost manufacturers or suppliers. If any of these companies do manage to emerge as global players, it would have significant implications for the global industry structure.

The changing nature of the defense business

The survey results make it clear that defense-industry leaders believe their companies must change the way they do business; the question is how to do it. Almost all survey respondents believe that defense customers will change their focus from procuring the systems with the highest possible performance to ones that are more affordable. However, only two-thirds of the defense-industry executives surveyed think that defense suppliers will be able to change their internal processes to deliver more affordable, rather than exquisite, products.

When we asked respondents what changes they would like to see in government defense procurement, many cited a desire for greater transparency, simplification and acceleration of processes, and more open dialogue and collaboration. Respondents also hoped for a clearer strategy backed by a long-term plan, and for increasing consistency. One executive wrote that government should "truly embrace commercial practices, especially in manufacturing—and move away from congressionally influenced manufacturing decisions." Others hoped that government would "make it simpler in the specifications," "recognize the fragility of the industrial base and allow consolidation to occur," and "drive harder bargains." One executive said a desired change would be "more open collaboration between industry and departments of defense early in the requirements and acquisition process. The littoral combat ship, for all its warts, can provide a model for industry innovation and leveraging R&D."

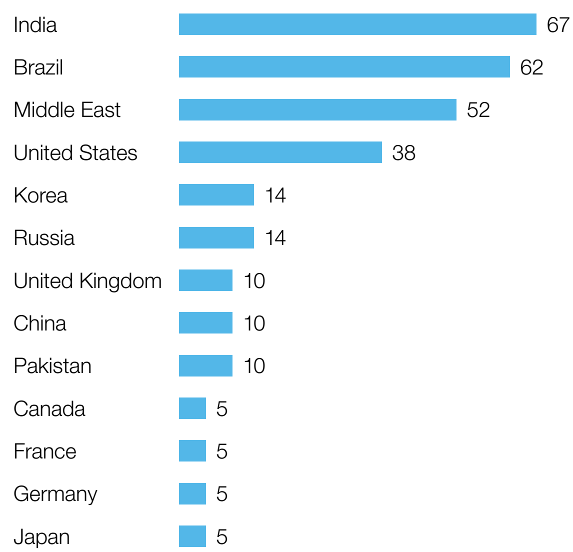
Not surprisingly, to stay competitive, almost three-fourths of respondents expect an increase in the rate at which defense companies will

Defense-industry leaders believe their companies must change the way they do business; the question is how to do it.

Exhibit 2

What are the most attractive markets outside your company's current market focus?

% of respondents



Source: Dec 2012 McKinsey survey of defense-industry executives

manage their portfolio of businesses in the next one to three years, with over three-fourths of respondents expecting their companies to engage in mergers and acquisitions, while almost two-thirds expect their companies to divest some part of their current portfolio.

The search for growth opportunities

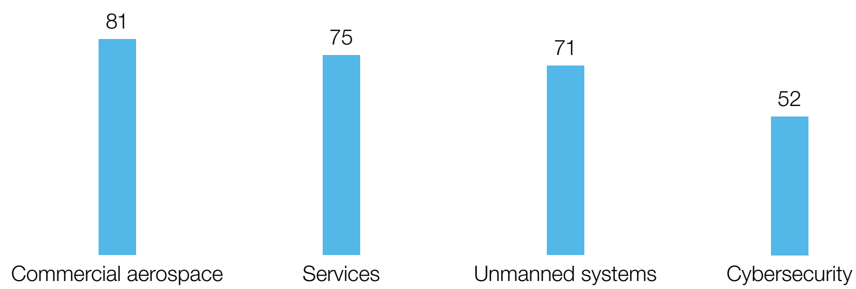
Given the downturn in many major markets, industry executives believe that finding the right growth opportunity is more important than ever. Almost all said that their companies will pursue increased international growth in the next three years. When we asked the executives to name the most attractive markets outside their current focus, a majority noted interest in India, Brazil, and the Middle East, followed by the United States (Exhibit 2).

Industry leaders also shared their apprehensions about the challenges of international growth. Many voiced concerns about export controls and regulations, and about International Traffic in Arms Regulations, suggesting these are a significant barrier to growth. Others noted their struggle with decreasing budgets. Respondents also cited cultural issues, such as "lack of management experience working outside the local country," a similar lack of "understanding of local context or cultures," and the need for a "change of mind-set from top management, including human-resource management," as potential barriers to international growth. One industry executive said that "apart from some huge international programs such as the F-35 Joint Strike Fighter program, much of the defense contracting is kept in country, with

Exhibit 3

What areas show the most potential for increased growth in the next one to three years?

% of respondents



Source: Dec 2012 McKinsey survey of defense-industry executives

a few exceptions such as the United Kingdom or a rapidly growing market with low internal capabilities such as India." Other respondents also noted concerns about obtaining "access in international markets in a robust and ethical way," "local footprint and design/counterfeit security," and "the procurement process in international markets."

Four sectors were cited as showing the most potential for additional growth: commercial aerospace, services, unmanned systems, and cybersecurity (Exhibit 3).

Each of these growth opportunities comes with unique challenges and concerns. With respect to commercial aerospace, one of the largest potential areas of growth for defense companies, executives cited concerns about "cyclicality," "slow GNP growth," "pricing pressure," "displacing incumbents on Boeing/Airbus narrow-body aircraft," "capital constraints," and "production ramp-up." One executive noted "the Asian footprint and consolidated machining in Asia" as a challenge, while another stated having a "decent business case for investment" would be an issue.

When we asked respondents how they expected defense companies to adjust their portfolios between defense and commercial in the next one to three years, about half predicted a bias toward commercial. Only a handful predicted a bias toward defense, with the others expecting portfolios to balance.

Services, the second most anticipated source of growth, was cited by three-fourths of respondents to generate a larger share of their companies' revenues. Executives note challenges for service growth include recruiting, how to create value, the procurement process, competition from government, insourcing by military customers, and customer resistance.

One area of varying opinions was unmanned systems. While about two-thirds of survey respondents say their companies will seek unmanned-systems growth, only a little over half say they will diversify outside of defense. Yet that is where growth will come, according to most of those who plan to diversify. Executives see several challenges for growth in unmanned systems, including "airspace utilization," "a lack of clear requirements from customers," "no common architecture," and "pilots as decision makers." One respondent noted that "the sector is littered with small to medium players and far too many in-country development programs. Our company will focus on the larger platforms (such as the unmanned carrier-launched airborne surveillance and strike system, or UCLASS) where there is more value and more synergies with our scale and capabilities."

In another acknowledgment of the questions around unmanned systems, two-thirds said they believe that the Joint Strike Fighter program will not be the last major manned-aircraft development program.

For cybersecurity, an area in which only half of survey respondents are interested, executives foresee challenges, such as "acknowledgement of the problem and the prospects of dealing with it," "a lack of agreement on what cybersecurity encompasses and on what, exactly, the customer can buy to have more of it," and "the industry's competence to offer effective solutions."

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The consistency in our survey results is striking: while defense-industry executives may differ in opinion on topics such as which growth opportunities to pursue, they all agree that the defense industry is evolving and that they need to prepare for the future. Whether exploring opportunities for growth in a new market or changing their procurement strategies, executives are laying the foundations for future success in a changing defense market.

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Project management in defense: The essential capability

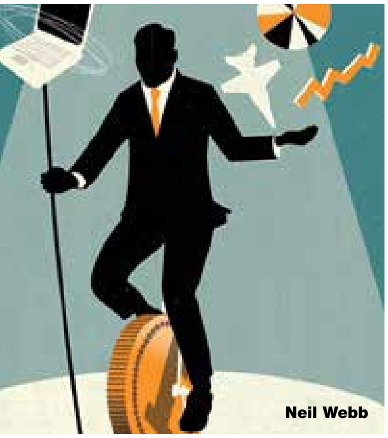
An investment in critical skills can help projects perform as planned.

Jonathan Kolodny, Adi Leviatan, and Dana Maor

In other articles in the 2013 edition of *McKinsey on Government*, our colleagues discuss needed changes in defense procurement, budgeting, and other functions. All are important. But in a very real sense, the success of these changes depends on the skills of the people charged with executing them. Building the skills needed to lead programs and projects among defense-ministry workers—from senior leaders to line commanders, managers, and staff—is essential. Bernard Gray, in his *Review of Acquisition*, a study of Ministry of Defence practices in the United Kingdom, recommended many changes to the ministry's ways of working; importantly, he said that it should "significantly increase programme and project management skills . . . at all levels of the organization."[1]

Programs and projects that can benefit from improved management skills are found throughout defense ministries, including project-oriented functions such as procurement, product development, and maintenance, as well as activities that are more obviously projects, such as big capital investments in IT, construction, and other areas. All of these share a well-documented tendency to run over time and over budget and fall short on quality; all can benefit from tighter management.

A training program for program and project managers that relies on adult-learning principles and emphasizes "learning by doing" can raise standards throughout the organization. When this is coupled with training for senior


Neil Webb

leaders, defense ministries can achieve an organizational capability for project management that results in as much as 20 percent cost savings on the significant portion (about 50 percent) of ministry spending whose management calls for these kinds of skills: procurement of direct and indirect categories; capital-intensive projects in engineering, infrastructure, and IT; maintenance; and, in some cases, manufacturing.

One defense organization used these programs to train several waves of project managers and leaders who together administered a portfolio of more than 1,000 capital projects ranging in size from $100,000 to $500 million. Managers who successfully completed the training were able to cut costs on most projects by between 20 and 35 percent. Over time, the organization expects savings of about 15 percent of its entire baseline spending.

Raising the bar in project management

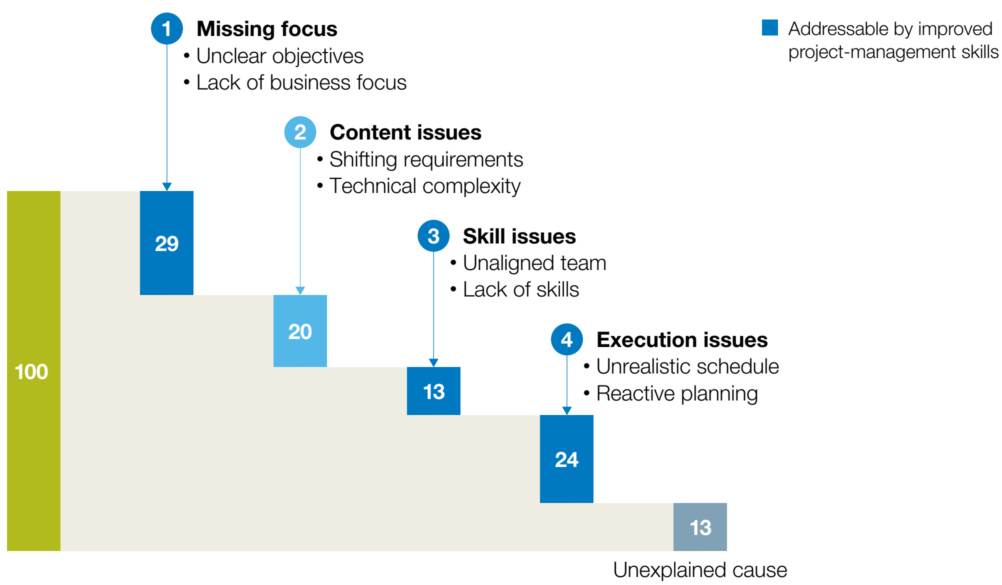
Cost overruns are endemic to big capital projects in both the private sector and government. A recent study examined the root causes of such overruns in large-scale IT projects and found that capability gaps, especially in project management, were to blame (Exhibit 1).

To better understand the skills needed to close these gaps, McKinsey has studied the behaviors of hundreds of top-performing project managers (a term we will use to mean managers of both discrete projects and of programs) in the private

Exhibit 1

Capability gaps cause most project failures.[1]

Causes of cost overruns in IT projects with budgets greater than $15 million, %[2]



[1]With cost overrun, in 2010 dollars.
[2]Figures do not sum to 100%, because of rounding.

Source: McKinsey-Oxford study on reference-class forecasting for IT projects sector, in government, and in defense in particular. In defense ministries, we looked at top performers in procurement, capital-intensive projects such as construction and product development, and maintenance. From that research, we identified four types of capabilities—embracing ten specific skill sets—that are crucial to best-in-class project management.

Management capabilities:

- an ability to optimize and balance costs, time, and quality, primarily by using clearly defined processes and tested project-management tools and methodologies

- a value-optimization mind-set and understanding of value-assurance processes needed to ensure successful project outcomes

- team-management skills including coaching, meeting facilitation, and conflict management

Financial astuteness:

- financial-management capabilities, such as budget planning and other funding processes

- risk-management sophistication—the ability to identify key risks, prioritize them, build plans to minimize and manage them, and develop contingency plans for high-impact, higher-probability risks

- a project-life-cycle view that takes into account the total cost of ownership, from the up-front costs of acquisition through maintenance and ongoing costs (including decommissioning), to inform trade-offs and decision making in design, planning, and contracting

Commercial orientation:

- skills to manage the performance of contractors and ensure that the ministry receives what it needs from them, starting with the inclusion of the right terms in the contract and extending over its lifetime through daily monitoring and management of contractors

- understanding of contract terms with respect to work scope, quality, service level, price, and timing

Organizational capabilities:

- ability to leverage other government agencies effectively (for instance, to obtain contracting or legal services)

- client-management capabilities (for example, minimizing the impact of change orders)

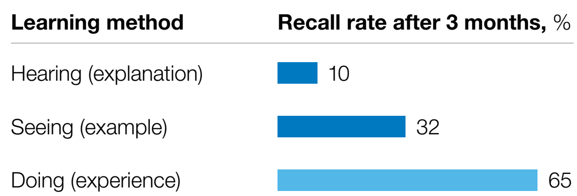
To make a lasting improvement in project-manager performance, companies should take a structured approach that addresses in

Cost overruns are endemic to big capital projects in both the private sector and government.

Exhibit 2

Adult-learning principles increase retention and bolster impact.

Recall rate of simple learning content[1]



[1] Numbers determined in concrete example by teaching small, simple chunks of information to 3 groups.

Source: John Whitmore, *Coaching for Performance*, third edition, Boston: Nicholas Brealey Publishing, 2002; McKinsey interviews

parallel the project managers themselves, to give them needed tools for their work and to coach colleagues, and senior leaders, to help them manage project leaders effectively.

A program for project managers

The hallmark feature of capability building for project managers is that it takes place almost entirely on the job—people are learning in real time as they steer their projects. The effect is to create impact from day one; with their new knowledge and, importantly, the confidence gained from success, project managers are empowered to carry over their new thinking and behaviors to future projects.

This concept, "learning by doing," is one of a few tenets common to many successful adult-learning approaches. Another is the use of proven interactive learning formats—a necessity when 90 percent of lecture-based learning is lost in three months (Exhibit 2). Successful adult learning also stems from repetition and coaching, as well as a link to real work: immediate, on-the-job application of newly learned capabilities makes them stick.

A successful capability-building program should be based on these principles, placing project managers at the center of the program and building their skill sets through fieldwork, classroom training, and peer coaching, while surrounding them with the tools, standards, processes, and systems needed to support growth.

A successful program must also adhere to three other guidelines. First, it must be focused on the right set of capabilities—those that are linked to value generation and impact (and, as mentioned, no capabilities are more closely linked to value generation than project management). Second, the program must be tailored to the specific situation and requirements of the organization. Finally, the program must be scalable and include elements through which the organization can develop itself ("train the trainer" is one such element). By the time the program is over, the organization must have the infrastructure to sustain and expand its new knowledge base. At many defense ministries, this institutional capability is paramount; project managers might leave after two years on the job, taking with them everything they have learned. An institutional capability can help the manager's replacement learn the ropes quickly and is vital to a culture of continual self-improvement.

What follows is an outline of what we believe such a program should look like. It is built around three components: fieldwork with fellow decision makers at critical junctures during the project's path; a small amount of classroom training and forums to introduce and reinforce new skills, encourage the exchange of ideas among colleagues, and facilitate the required cycles of action and reflection; and mentorship to support day-to-day activities on the job.

Fieldwork

Too often, project managers in defense make decisions that appear to save money but turn out to include big unanticipated costs down the road. At times they make calls that bind the project in more costly long-term constraints. A couple of factors often drive these suboptimal decisions. Sometimes managers are rushed; lacking a proper process, the critical decision point seems to arrive on the calendar unannounced and must be resolved quickly, so the cheapest alternative seems self-evidently the best. And sometimes managers don't know how to effectively bring all perspectives into the discussion or do not have the processes or organizational supporting mechanisms needed to do so.

The fieldwork element of our suggested program is designed to carve out breathing room for the project manager; this allows the manager to calmly assess all the variables in play, consider all relevant stakeholder views, and make a decision in view of the various trade-offs, especially cost. At critical junctures, project managers, functional leaders, and other key leaders come together for half-day or all-day workshops designed to promote brainstorming and decision making for that particular phase of the project's life cycle.

In these workshops, managers apply the ideas they have learned in the classroom (discussed below) to a real project. The effect is immediate and as real as it gets—the decision reached in the workshop might be set in motion that same afternoon. The same approach works well for other, more program-based environments. In purchasing, for example, a workshop for category managers can help them bring in all the relevant considerations, including users' needs and optimal contract design.

Consider this example of decision making in the concept-design phase of a big capital project. The project manager has surveyed the building site and can see two possible layouts for the project. It's time to hold a workshop with the project's engineering team, legal team, and other stakeholders to decide how to situate the installation within the site. The project manager works with his team (and his coach, an idea we discuss below) to prepare. At the meeting, he explains his perspective on the layout options. Because the legal team is in the room, they are immediately able to tell the project team that one of the options is not possible, due to regulations. The group then brainstorms and comes up with a new, third option. The engineers test it against the boundary conditions for the project, with the project manager weighing in on the project's strategic objectives. By the end of the workshop, a basic design concept has been agreed upon and syndicated with all key stakeholders and next steps laid out for each person in the room. The project manager, who has experienced firsthand the orchestration of the workshop and the application of the basic management principles learned in the classroom, can now lead others in the application of these concepts in similar situations.

This workshop scenario is one of several that might take place during the course of the project. Others might include sessions on countering contract claims and workshops on contracting strategy. The underlying principles for all workshops are the same: facilitate the exchange of ideas and efficient decision making by gathering key stakeholders, and allow project managers to apply new tools and capabilities in their day-to-day lives.

Classroom training

Although it may sound traditional, the version of classroom training we suggest is fundamentally different from ordinary training. Instead of listening to lectures that don't connect directly to their day-to-day activities—which can leave learners frustrated and unable to effectively apply what they've learned—we advocate a dynamic classroom experience that includes role playing, simulations in small groups, and discussions of real-life problems the participants may have faced.

Project managers are a hard-working group, and they are often cynical about losing a day to training in the middle of a project. Most will show up, but they will be skeptical that time away from the project could possibly improve their efficiency on that project. They likely will trudge into the classroom, prepared to be lectured to for hours.

Instead, they find themselves split into small groups working on simulations of the task they will be performing in the coming week. They learn that others have had the same difficulties with certain aspects of the process before—something they didn't know, since they so rarely have a chance to sit and talk to other project managers—and they begin to compare experiences. After completing an exercise in which the facilitator guides them through new problem-solving techniques and mentions the kinds of analyses that their mentors can perform with them on this particular topic, they leave the classroom feeling optimistic about the coming week.

Peer coaching

In our approach, a coach shadows the project manager day-to-day and provides constant support in analyses, problem solving, and situation

Project managers are a hard-working group, and they are often cynical about losing a day to training in the middle of a project.

management. The coach, a kind of mentor, can be an external expert or a fellow project manager who has already undergone the program and has had some complementary training to build coaching skills. Ultimately, the defense ministry should seek to develop a culture of mentorship in which peers support one another, share the wisdom gained from their varied experiences, and hold one another to a standard of continuous improvement.

The many benefits of strong coaching relationships were demonstrated recently at one defense ministry. The manager in charge of a project to install fire-detection and extinguishing equipment received a supplier's pricing proposal for a particular item, and the price looked reasonable based on his past experience. He was ready to sign the contract when his mentor asked how he knew he was getting the best possible price. The project manager did not have a great answer. The mentor, who had some experience with pricing, guided him through a clean-sheet analysis to understand exactly how much he should be paying. The next time the project manager received a pricing proposal, he reviewed it carefully and asked his mentor to sit with him and repeat the exercise. After doing this several times, the project manager gained confidence; the clean-sheet approach became routine, and he learned to efficiently and effectively control his materials costs.

The clean-sheet analysis is one of many in which an experienced mentor can support the project manager. Additional examples include cost baselining, supplier-market analysis, supplier-performance tracking, and analysis of contractor bids. Most important, a mentor models the new problem-solving mind-set, which favors root-cause analysis over quick fixes and consideration of opportunities over standard solutions, while also putting a premium on leadership.

A program for leaders

In many defense ministries, top leaders are soldiers. They have risen through the ranks on the basis of a substantial body of excellent work that demonstrates mastery of core military skills. Once they are in these leadership roles, however, management problems that are not responsive to military skill may arise. For these leaders, a one-week training program, combined with coaching and consultation with expert trainers, can provide the management skills needed to oversee an extensive slate of projects and help the project leaders who receive the training discussed earlier extract more value from each initiative. (At other ministries of defense, top leaders may include both soldiers and civilians, who sometimes have the skills described here. These teams, however, often face a problem of alignment, which the training program can help correct.)

A leadership-training program ideally serves about 25 senior officers, typically brigadier level or higher, and civil-service leaders at an equivalent level. The program need not be conducted all at once; the sessions can be spread over two or three weeks. The primary goal is to inculcate an economic mind-set among a group of officers with little resource-management experience. The goal is not to teach them the technical skills required to deliver specific initiatives—that is the goal of the training for project managers—but rather to teach senior leaders how to ask the right questions of their project managers.

The training should be done in a "field and forum" style, with hands-on sessions to reinforce the classroom lessons. The curriculum for the classroom sessions (the forum) of such a program should cover five areas:

- basic principles of structured thinking and economic thinking
- end-to-end project planning, the use of key performance indicators, and performance management
- an introduction to typical savings levers, for example, purchasing principles, human-resources basics and principles for "right sizing" teams, principles of lean manufacturing and maintenance, and principles of life-cycle management and the potential trade-offs related to acquisition costs and maintenance costs
- an interactive, whole-day "rolling" exercise that allows participants to apply many of the concepts they have learned by playing out a case study as a team
- how to role model the desired mind-sets and behaviors and help others to adopt them

Participants then take this experience and apply it in the field, with the opportunity to come back to the classroom, think through their field experiences, and build on those.

In our experience with these programs, participants have been uniformly positive; on average, they award the program 4.8 out of 5 points for overall satisfaction. One participant said, "I saved $1 million since our last session, just by asking the questions you taught me to ask." Another told us, "I managed my budgeting process entirely differently this year." A brigadier general said that he had seen the impact of this training when visiting units that had implemented efficiency programs and management techniques shortly after unit leaders had graduated from this program. This is a tough audience to please, but a well-designed training program can reach them and start them on a new path for learning the managerial skills needed to manage multibillion-dollar departments.

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In today's military, project management is more than ever an essential skill. A modest investment in training project managers and program leaders can provide outsize returns.

[1] *Review of Acquisition for the Secretary of State for Defence: An Independent Report by Bernard Gray*, 2009.

Jonathan Kolodny is a director in McKinsey's Tel Aviv office, where **Adi Leviatan** is an associate principal and **Dana Maor** is a principal.

Powering the military:
An interview with Sharon Burke, assistant secretary of defense for operational energy plans and programs

Sharon Burke explains what it's like to create a new office within the world's largest defense organization—and how she plans to help today's leaders start to see energy as an essential military capability rather than simply an unavoidable cost.

Tim Ash and Andrew Erdmann

Last year alone, the US Department of Defense (DOD) spent roughly $20 billion on energy—over three-quarters of which was operational energy to power the US military's fleet of aircraft, ships, and vehicles. At the same time, recent experiences in Iraq and Afghanistan have prompted a fundamental shift in the military's relationship with energy: access and supply can no longer be taken for granted. This means the DOD needs new approaches and technologies for managing its energy requirements.

Appointed and confirmed in 2010, Sharon Burke is the first-ever assistant secretary of defense for operational energy plans and programs. She was previously a vice president and senior fellow at the Center for a New American Security, a defense-policy think tank, where she directed research on energy security. Her job now is to help the Department of Defense and the uniformed services improve capabilities, cut costs, and lower risk through better operational energy accounting, planning, and management. McKinsey's Tim Ash and Andrew Erdmann spoke with Burke about her role in helping to change the Department of Defense's approach to energy—and what it's like to establish a brand-new office within such a large and complex institution.

McKinsey on Government*: *You are the first assistant secretary of defense for operational energy plans and programs. What is your role and why was it established at this particular point in time?

Sharon Burke: My role is to promote the energy security of our military operations. The Department of Defense has a long history of managing energy as an input for its facilities, but this is the first time we've looked at energy as an operational capability. There are three reasons DOD took the step of creating this office. First, because of our presence in Afghanistan and Iraq: our supply lines were physically in the fight itself, and they had become a target. The Army estimates that on any given day, 70 to 80 percent of what's in the supply line in Afghanistan is fuel and water. Second, the total annual energy bill for the Department of Defense is approximately $20 billion, three-quarters of which is petroleum fuels for operational energy. So when oil prices went up to $147 a barrel in 2008, it drew the attention of the bill payers in the Pentagon. Finally, both challenges caught the attention of Congress, it directed us to create an operational energy office, and President Obama agreed that it was important.

McKinsey on Government: *Your office released the Department of Defense's first* Operational Energy Strategy *in June 2011.*[1] *What were you trying to achieve with the strategy, and how has it been received?*

Sharon Burke: The strategy was meant to set direction. Many communities in the DOD use energy, and each has its own energy goals. We wanted to make the departmental goal clear. So this is really a "Go West, young man" message for the DOD. In classic military strategy, we talk about ends, ways, and means. First, we wanted to get unity of effort around an end, which in this case is to make sure our forces have the energy they need to operate. Then we laid out the way, which is: use less. This means reducing demand, increasing diversity and security of supply, and then, finally, incorporating operational energy considerations into future planning. For the means, the goal has been to set a direction for the department and create buy-in across the entire enterprise. It's been well received by our uniformed military—one of the most important consumers of this strategy—including our most senior leadership in Afghanistan.

McKinsey on Government: *Is the strategy helping to raise basic awareness in the military community about the role of energy?*

Sharon Burke: I think everyone is well aware that energy is a cost item. But the idea that energy is a capability—that it can give you more range or more endurance—these are valued military concepts. You can't succeed in your mission if you don't have the right tools—and energy is a tool. We can use it well or we can use it poorly. In the context of military operations, the assumption has always been that we will have what we need, where and when we need it, in the amount that we need it. In the wars of the last ten years, we've certainly had that assumption challenged, and we have to think differently as we look forward. Thinking of energy as an enabler or capability in its own right is a new concept for the DOD.

McKinsey on Government: *How do you define success?*

Sharon Burke: We've been working closely with different military departments to create operationally relevant success metrics based on outcomes, but we are being very careful—success is not easy to define because it's not strictly a question of cost. Success for the Department of Defense is in the context of military capability and mission success. How I personally define success is, "Are we getting capability into the hands of our fielded forces?" We've managed to quickly get hundreds of millions of dollars' worth of improved equipment into Afghanistan and elsewhere in a way that's having a tangible benefit for the force. So that has been our most important success metric to date.

McKinsey on Government: *Could you give a specific example of the successes of which you're most proud?*

Sharon Burke: Sure. The Army Corps of Engineers knew that centralized power and more efficient generators would help tremendously, but they couldn't get them into the field. The challenge was that every tent had a generator, and probably a generator that was supplying more power than the tent could use. That wastes fuel but also damages the generators. The Corps of Engineers fixed that by creating a small grid, so one generator is serving multiple tents or "loads." Sometimes, they might be using better equipment, too, but it is really about using the equipment you have better.

It's a classic problem of split incentives: consumers of fuel are out in combat; they don't consider the limits of the supply line, and they don't see the bill. They have to stay focused on the mission. So to help the Corps, we spent time gathering information and data and making the case to key leaders at Central Command and in Afghanistan, and we continually pressed the issue—it was a question of finding the right allies and pressure points. My leadership also supported me on this, which certainly helped. And now there is a whole suite of changes on the agenda, such as more efficient tents and shelters, centralized power, and hybrid solar systems that reduce the volume of fuel we consume while at the same

Sharon E. Burke

Vital statistics
Married, with 2 sons
Lives in Maryland

Education
Graduated from Williams College and Columbia University's School of International and Public Affairs

Career highlights

US Department of Defense
(2010–present)
Assistant secretary of defense for operational energy plans and programs

Center for a New American Security
(2007–10)
Vice president and senior fellow

Third Way
(2006–07)
Director, National Security Project

US Department of State
(2002–05)
Member of policy-planning staff and lead speechwriter to the deputy secretary of state

US Department of Defense
(1994–2001)
Country director in Office of Near Eastern and South Asia Affairs and speechwriter to the secretary of defense

Fast facts
Received medals for exceptional public service from Department of Defense

Received Superior Honor Award from Department of State

Authored numerous reports, including *A Strategy for American Power: Energy, Climate, and National Security*, Center for a New American Security, 2008 (cnas.org)

In terms of targets, we aimed less at quantitative metrics and more at qualitative goals that would help build institutional capacity.

time enabling our most remote outposts to become less reliant on the supply line.

Let me be more specific: we ran some of the numbers on the energy improvements made at a combat outpost in a tough part of Afghanistan. There were about 300 people there, and they had been going through 500 gallons of fuel every day, all of which had to be delivered by helicopter once a week. About 50 percent of that fuel was going to generators, mostly for heating and cooling. We estimated that just by using better generators, a simple microgrid, and insulation for the shelters, we could cut almost 4,000 gallons per month, saving one helicopter trip and 300 person-hours every month. We've seen similar results with other technologies—one 82nd Airborne location, for example, replaced a diesel generator with a hybrid solar generator to power its mortar pit. For the most part, that meant no noise, no refueling, and less resupply. All of these improvements help our troops do their jobs better with less risk.

McKinsey on Government: *In your second strategy review in August 2012—the first since the publication of* Operational Energy Strategy*—you define seven targets that the armed services must meet. How well are these targets generating change?*

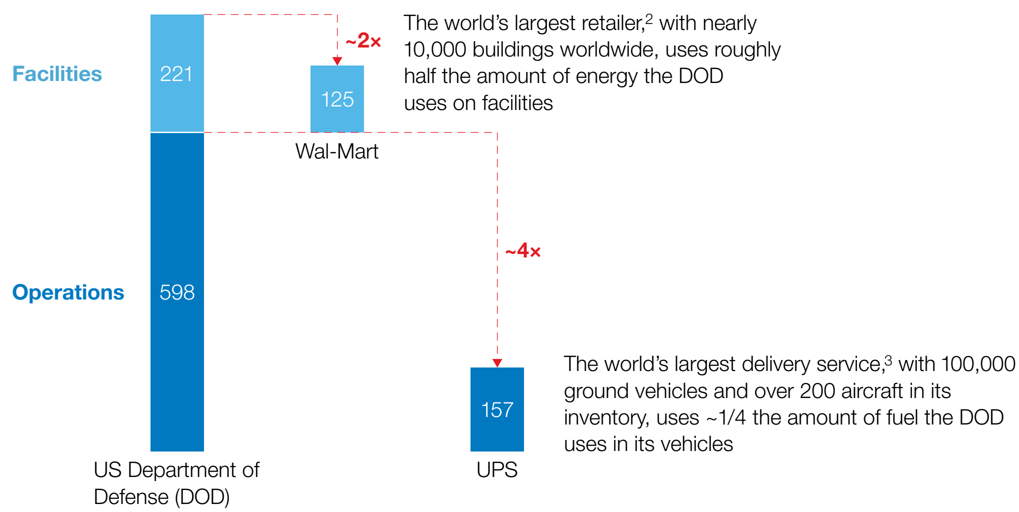
Sharon Burke: This is not just a new office, it's a new business line, and it is the first time the DOD has tried to manage energy security in a deliberate way. So in terms of targets, we aimed less at quantitative metrics and more at qualitative goals that would help build institutional capacity. But with that said, metrics are still important. The classic adage is that "you can't manage what you can't measure." So we started with targets aimed at improving our ability to measure energy. And there are other targets—for example, we asked our research and engineering communities, both in the Office of the Secretary of Defense and across all of the military departments, to assess the way they are currently using operational energy and to look for gaps. That assessment has been completed, and we're going to use it as a tool to guide investment.

There are things that we can do, though, to immediately improve our energy management, and we have set targets to do so. We asked our military departments to show us what they're doing right now to make improvements, but also to show us the investments they're making in improving some of their legacy systems and other platforms. For example, the US Air Force (USAF) has a program called ADVENT, also known as ADaptive Versatile ENgine Technology, which has a goal of 25 percent improvement in engine efficiency. That's been an R&D program—an investment in future engine technologies—but the USAF is also making changes in real time. Air Mobility Command, for example, is

Exhibit

The US Department of Defense uses considerably more energy than the world's largest retailer and largest delivery service.

2010 total annual energy use, trillion BTU[1]



[1] British thermal unit.
[2] Wal-Mart had 8,838 stores (retail units) in operation in 2010.
[3] UPS had 99,975 vehicles and 216 aircraft in its fleet in 2010.

Source: *Beyond 50 Years: Building a Sustainable Future: Wal-Mart 2012 Global Responsibility Report*; company Web site; *Sustainability at UPS*, 2010; *Department of Defense Annual Energy Management Report*, FY 2010

improving how it routes, loads, and flies big-cargo aircraft, which is saving millions of gallons of fuel each year.

McKinsey on Government: *What are your primary concerns at this point—and how do you think they should be addressed?*

Sharon Burke: To create a military force in which energy is a strategic advantage, it's important to build energy performance into both legacy programs and new operations. Many of the planes, vehicles, and ships in our force will be part of our operations for a long time, and energy performance must be incorporated into the processes associated with refurbishing, retrofitting, and operating that equipment. At the same time, we have to make sure we are building energy-performance considerations into our decisions about new equipment, capabilities, and missions. Unless we change the way we address energy in the context of both existing and new equipment and programs, we will see an increase—not a decrease—in the amount of energy our military consumes (exhibit). For both the legacy force and new equipment, we have to understand what it is that energy brings, or conversely, how it limits decisions about where to invest. The DOD's five-year budget plan includes $9 billion of investments in energy improvements.

This is a really good story. But for these investments to be purposeful and systematic, we need to improve our analytical tools so that we know which capabilities and missions we want to target for energy improvements and how we can bring them into the force in a meaningful way.

McKinsey on Government: *What are some of the biggest innovations in operational energy? What do you think could be the next major areas of investment for the Department of Defense?*

Sharon Burke: Over the last five years, the most significant improvements have been in the way that contingency bases—the bases that are forward-deployed in Afghanistan, Iraq, and elsewhere—use energy. Specifically, we've seen meaningful efficiency improvements in what we would call an environmental control unit, which is heating, ventilation, and air-conditioning, and we've also seen improvements in generators, tents, and water use in kitchens. And we already have some meaningful metrics in terms of thousands of gallons "off the road." We are also seeing new kinds of power generation—better batteries and hybrid generation through a combination of microgrids or control systems, solar generation, diesel generators, and batteries. An example I am particularly proud of is Operation Dynamo. The Army's Rapid Equipping Force, working with a number of the Army's acquisition leaders, asked a brigade combat team—while it was in training—to decide which types of energy-improved gear would work best for its mission, and then the Rapid Equipping Force and the acquisition professionals traveled to Afghanistan with the team to help set it up. I initiated the project through a contact with an Army leader, but it was key institutions within the Army that made it work.

In the near term, the lion's share of the investment will be in propulsion and engine improvements. This is where we use a lot of our fuel, so we will prioritize efficiency improvements by investing in things like hydroelectric drive for ships; engine-efficiency improvements for aircraft, vehicles, and ships; and aircraft-body improvements via winglets and microvanes. Further out, we're talking about significant changes in equipment that we actually use, which could mean wholly new systems. For example, some missions that are now performed by manned submarines might soon be performed by unmanned underwater vehicles, which use less fuel and also offer a greater range of fueling options. The same is true for aerial systems—we might soon replace some manned systems with unmanned ones. There is also some experimentation with putting solar on the wings or using hydrogen

fuel cells, which means aircraft can fly longer and farther.

McKinsey on Government: *What is the relationship between the Department of Defense and the private sector when it comes to driving and sustaining innovation in alternative energy and efficiencies?*

Sharon Burke: Our overall mission is national security—to defend the people of this country. Throughout history, that has been a powerful incentive for innovation. There is no guarantee that what we innovate for our purposes will cross over into the private sector, but in some cases there is certainly potential. For example, right now we are engaged in a hybrid energy-storage project in conjunction with the Advanced Research Projects Agency at the Department of Energy. Although it's very much geared toward military purposes, it's an example of a project that has a high likelihood of commercial crossover. Also, we have an excellent innovation backbone within the department, but it doesn't operate alone: we depend on the private sector to help execute our innovation vision. We generally have a problem we have to solve or a need we have to meet, and I think that that can be a very powerful pull for innovation—and it is just as true for energy as it is for any other military capability. We tell the private sector what we need, and they come to us with innovations. But the real target here is to build energy security into our procurement process—our requirements, acquisitions, and contracts. That's how we will generate a sustained demand pull for innovation.

McKinsey on Government: *How did you define your objectives, both as a leader and for what is essentially an entirely new office within a large and complex department? And what lessons have you learned when it comes to managing what is in many ways a start-up?*

Sharon Burke: I think the first lesson I learned is that when you're creating a new business line in a place like the Department of Defense, it's very important to understand the context you're coming into. In this case, it wasn't enough to know what energy security is all about and how important energy security is—it was crucial to understand how energy is relevant to the institution and its mission. It was very important to understand the landscape first. It's also important to understand your boss's priorities. Secretary of Defense Gates and his successors Secretaries of Defense Panetta and Hagel all made it clear that their first priority was existing operations and deployed forces. So that meant that our first priority was deployed forces. Finally, I've learned a lot about building an institution during a very turbulent time, when it wasn't always clear what our budget was going to be or how many people we were going to hire. Ultimately, you can't let that turbulence distract you. You still have to be accountable. I was very fortunate in that I was able to hire very good people to get the office under way. When you can assemble such a great team—and I was very lucky that I was able to do that—it makes a difference. I think that's true for any institution.

[1] *Energy for the Warfighter: Operational Energy Strategy*, US Department of Defense, June 2011 (energy.defense.gov).

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