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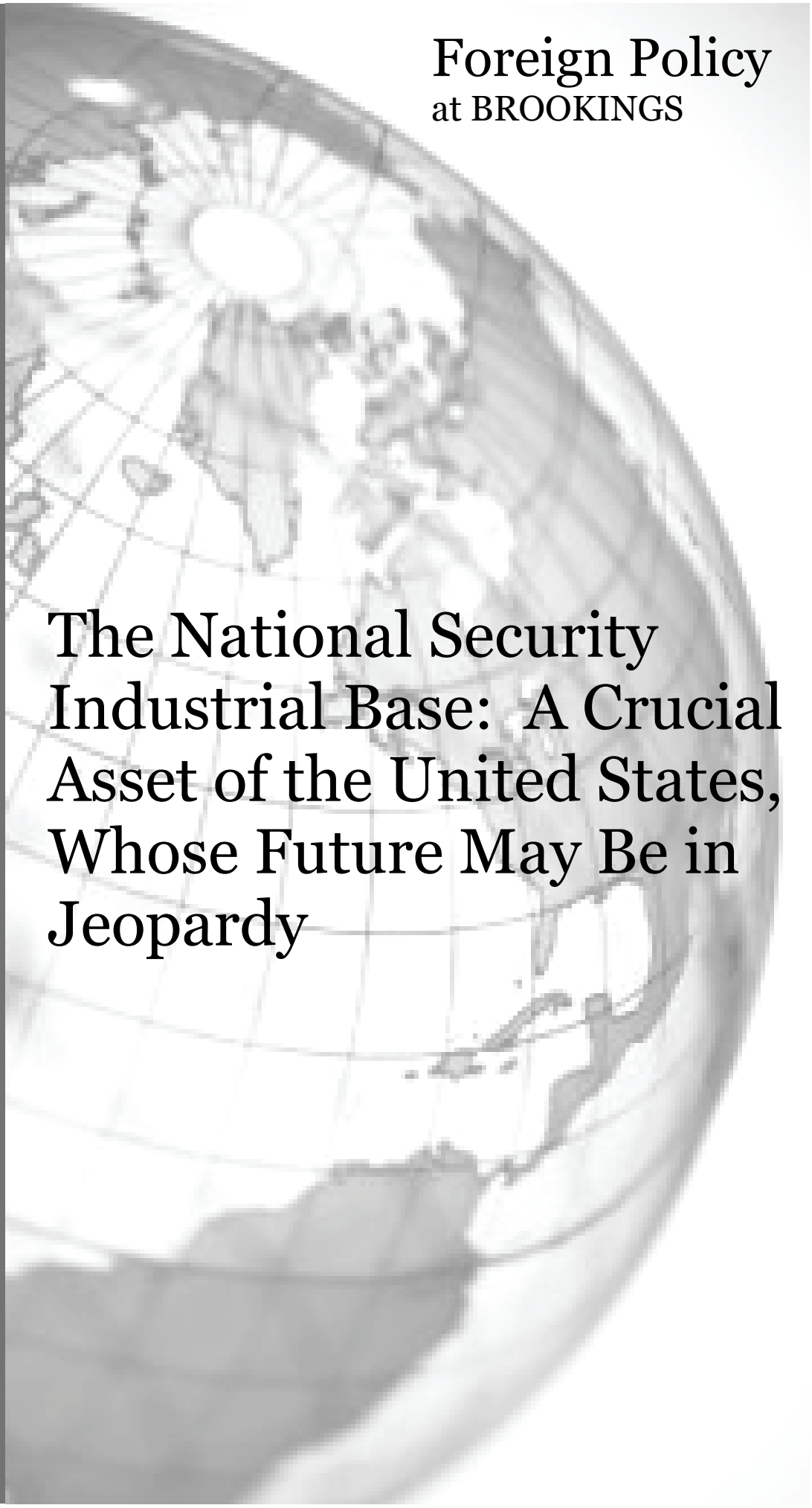

The National Security Industrial Base: A Crucial Asset of the United States, Whose Future May Be in Jeopardy

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"Having the best defense industrial and technology base in the world is not a birthright."

– Ashton Carter, Undersecretary of Defense for Acquisition, Technology and Logistics

It seems hard to believe: at a moment of historic highs in defense spending, there is growing concern about the future of American defense industry as well as the national security industrial and scientific base more generally. How can this be so? Of all the economic sectors in the United States, how could the very sector that has benefitted from a trillion dollars of war spending over the last decade and that is presently enjoying the fruits of a cumulative defense budget 50 percent greater in real-dollar terms than the Cold War average, truly be in trouble?

But the cold, hard reality is that there are serious causes for concern. It was with this in mind that over the course of 2010, Brookings convened a working group of top public and private leaders and thinkers, across the political spectrum, representing a variety of firms, the Pentagon, and think tanks as well as the Congress to explore the key issues facing the defense industrial base in the years and decades ahead. The intent was to move past the "bumper sticker" discussion that usually surrounds the issue, of focusing on the implication of single programs at single firms in single budget cycles, and instead look at overall trends and futures of the industrial base as a whole. The seminars explored everything from likely Pentagon buying plans in the years ahead, and the ability of the American education system to supply the needed human capital, to Wall Street's investment plans relating to this sector.

When one takes a look at the big picture, moving beyond a focus on the implications of a program buy or cut for a single firm or individual congressional district, it becomes clear that the underlying strength, health, flexibility, and dominance of a prized national security asset for the country is facing deep and significant challenges, arguably more so than perhaps ever before in its post-World War II history.

The significance of this runs counter to how issues in security are often framed. We are accustomed in the American public debate to praising men and women in uniform and yet we often ignore or even pillory those who equip and support them—the scientists, engineers, industrialists, investors, and workers who make the equipment that has allowed the United States to dominate most forms of warfare for the last few decades. To be sure, there have been abuses in the defense corporate sector, as well as an absence of adequate regulation for many of the overseas operations of contractors. But the fact remains that American troops have been successful in the field wielding the weapons of war manufactured for them primarily by U.S. firms. And an additional reality looms—many of these firms, and thus many technology areas of excellence for the nation, could soon be in serious trouble.

High defense budgets are good for the defense industry and defense investors at one level. They are dangerous, however, at another level. The stock market does not treat firms well when their sector of the economy is expected to go into significant decline in the coming years, as is the case with defense—even if current spending is reasonably robust. Companies do not enjoy laying off workers and shutting down facilities in communities that have been loyal to them. The workers and communities obviously enjoy the process even less. And in a free-market system, beyond these painful realities of the bust-and-boom cycle of industries that are vulnerable to such roller-coaster dynamics, there is also the concern that cutbacks will be uncoordinated and unpredictable in effect. The national asset represented by research, development, and production capabilities at not just the prime contractors, but also their many subcontractors could be jeopardized. Capabilities could be lost, and once lost, could be difficult, costly, and slow to replace if and when they are needed again. The future taxpayer could suffer. Even more to the point, the nation's future security could be jeopardized, especially in an environment where rising powers and entrepreneurial adversaries will be constantly attentive to any American weaknesses.

We must also remember that the defense industry also is a key engine in the American economy, most specifically as an engine of trade and innovation. To use just one example, if it was not for the defense industry's role in everything from Global Positioning System (GPS) to the Internet to the jet engine, we would not have global trading networks or the "Just In Time" strategy that has raised so many organizations' returns

on investment, quality, and efficiency. Indeed, each of the major firms in this sector spin out literally thousands of copyrights and inventions.

Put more specifically, and numerically, the dilemma might be described in this way: Current American defense spending including war-related expenditures totals more than $700 billion a year. Of that amount, just over $100 billion is normal procurement, about $80 billion is normal research, development, testing and evaluation, and another $80 billion or so sustains acquisition costs related to the war budget. The overwhelming share of these combined amounts, totaling more than a quarter trillion dollars a year, is directed to American firms. In addition, defense companies garner several tens of billions of dollars a year more from accounts in the operations and support budgets—most notably, operations and maintenance—in the war theaters and at home. All told, American defense companies have gross revenues of well over $300 billion a year from Department of Defense (DoD) contracts. And yet, all the analysis and data points to a current industrial base at a crossroads.

Even more, in the coming years, two separate and powerful dynamics are expected to push these numbers significantly downward. First, war costs are likely to decline dramatically—quite likely by 80 percent or more--as American troops are further reduced in Iraq and begin to decline in Afghanistan. Second, as part of the country's efforts to reduce enormous budget deficits, other defense accounts (from the base or "peacetime" budget) might decline by 5 to 10 percent given the most current ideas and plausible projections now available. Taken together, these two effects could reduce funds directed to American defense companies by well over $100 billion a year, or at least one third. These are admittedly rough predictions, but as of this writing they seem well within the realm of the plausible and certainly constitute a realistic scenario that planners in and out of government and industry need to consider.

Transitions of this scale are inherently difficult. That is true even if much of the recent increase in spending was unexpected, and in some ways a boon to parts of the industry—and even if the end of such a period of largesse is to be expected at some point. It is also true even if the likely remaining funds available to industry will be substantial in historical perspective. Many of today's weapons systems are inherently more complex, and thus inevitably more expensive, than those of previous eras, so the same number of real dollars does not guarantee the same health of the industry. To be sure, industry has some hand, and some responsibility, in driving up the unit costs of weaponry. But much of this is desired by the customer, and most of it does in fact provide a war fighting advantage for American GIs even if at times it arguably goes too far. The key point, though, is that whether one welcomes or opposes likely steep cutbacks in defense funding, the health of the nation's research, developmental, and production sectors in the defense industry will not stay healthy automatically through the process.

This paper proceeds as follows. First, it briefly reviews the nation's science, engineering, and industrial state of health, with an eye towards identifying ongoing American strengths as well as weaknesses. The message here is mixed—despite an ongoing process of industrial decline, the United States remains a formidable technological power with key areas of strength including in aerospace and related fields. This suggests that the nation's defense industrial base, while at some risk, is hardly on an inevitable path towards demise or fundamental weakening—meaning that good policy should be able to do a great deal to keep it solid and healthy, if that good policy can be adopted and sustained. The paper then hones in more directly on defense issues, attempting to identify both future requirements for the U.S. defense establishment and also likely future resources available to it. Finally, the paper hazards some preliminary thoughts on steps that might be taken—or at least seriously explored—in the coming years to ensure the future health, strength, excellence, and flexibility of the American national security industrial base.

THE GOOD AND BAD OF TODAY'S AMERICAN ECONOMY AND THE UNDERPINNINGS TO THE NATION'S DEFENSE INDUSTRIAL SECTOR

The defense and broader aerospace and national security industrial base is often thought of as the "arsenal of democracy" going back to the term first coined by FDR during World War II. And in this role, it has certainly played its part in defending America, from the astounding 324,000 aircraft and 88,000 tanks manufactured by the U.S. firms during World War II (amazing numbers to think about given today's D.C. debates over whether to buy 172 F-22s or 500 EFVs or not) to the Mine Resistant Ambush Protected (MRAP) vehicles and Reaper drones that our servicemen and women use today in Afghanistan.

Historically, the vitality of the base has been wrapped up within the state of American military excellence. This may not have been true in Revolutionary War times, when the colonists helped create a form of guerrilla warfare and depended far more on classic insurgent methods than on military might of the classic sort. But it has been largely true ever since, culminating in the victories of the world wars as well as the nonviolent triumph over the Warsaw Pact in the Cold War that was due largely to the nation's strong economy and high technology prowess in defense as well as nondefense realms.

Today those traditional strengths are at risk, and this is all the more concerning given the complex future we face. In a period during which China is rising, extremism and terrorism are thriving, American manufacturing is declining, and technology is evolving at a fast pace, the planning frameworks for American defense policy are much harder to establish.

At the level of grand strategy, the United States retains many impressive strengths. It is still the world's top economic power, with more than 20 percent of global GDP even according to purchasing power parity calculations, and 25 percent according to classic exchange-rate calculations.[1] Those who compare this data to the 50 percent share of global output that the United States accounted for after World War II as evidence of U.S. decline forget that the postwar period was highly unusual because so many other powers had been so (temporarily) weakened by war. In fact, it was largely U.S. grand strategy that led to the rapid recovery of western European democracies as well as Japan, to say nothing of the rise of new economic powerhouses like South Korea and Taiwan, in the ensuing decades. We helped them recover and grow on purpose. Thus, the decline in U.S. GDP as a percentage of the global total should arguably be seen more as a success of American strategy than a weakness or failing. The international institutions that Washington led the way in creating, the foreign aid it provided, and the alliance system it forged made possible economic trends that have generally worked to the U.S. advantage.[2]

As a further benefit of the success of this strategy, most key nations around the world viewed the United States as either friendly or benign. That remains true, even in eras where American popularity declines. As of today, the United States leads a global alliance system of more than 60 partner states that collectively account for almost 80 percent of global GDP and more than 80 percent of total global military spending between them.[3] It should be noted therefore that the defense industrial bases of these other states may also be thought of as part of our overall global security structure. That system includes the NATO alliance, the system of bilateral alliances in East Asia and the Western Pacific, the Rio Pact in Latin America at least at a formal level, and (less formally but quite significantly) American security partnerships with Taiwan, Israel, the Gulf Cooperation Council, and Iraq and Afghanistan. Arguably even Pakistan and India are best seen as part of this system rather than outside of it; at worst they are neutrals. Among the world's major nations, only China and Russia are essentially outside this somewhat informal but still quite significant network. And America's actual open nemeses as well as potential adversaries—Iran, North Korea, perhaps Venezuela, Syria and Burma and one or two other such countries—collectively account for 1 to 2 percent of global economic output or military power.

As Joseph Nye argues, the country's demographics including its immigration policy are more favorable than almost any other country's.[4] There are other signs of health at home, too. For example, even with its melting pot, and economic challenges, America's crime rates have been falling for years. Would-be rivals like China, Russia, and India all have far less favorable demographics—the first due to overpopulation combined with the

[1] World Bank, *World Development Report 2010* (Washington, D.C.: 2009), p. 380, available at http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/Statistical-Annex.pdf [accessed October 6, 2010].
[2] G. John Ikenberry, *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order after Major Wars* (Princeton, N.J.: Princeton University Press, 2001).
[3] Michael E. O'Hanlon, *Budgeting for Hard Power: Defense and Security Spending Under Barack Obama* (Washington, D.C.: Brookings, 2009), p. 24; International Institute for Strategic Studies, *The Military Balance 2010* (Oxfordshire, England: Routledge, 2010), pp. 462-468; and World Bank, *World Development Report 2010* (Washington, D.C.: 2009), pp. 378-380.
[4] Joseph S. Nye, Jr., "The Future of American Power," *Foreign Affairs,* vol. 89, no. 6 (November/December 2010), pp. 2-12.

resulting one-child policy that promises huge economic challenges for the People's Republic of China within a generation,[5] the second due to underpopulation, the last due to overpopulation with few prospects of change on the horizon.[6] Moreover, as noted before, India hardly seems likely to be a threat to American interests. Delhi may harbor some great-power ambitions but there are no irredentist territorial issues auguring future problems in dealings with the United States, and in fact few signs of any overly assertive Indian approach to the broader region or world. More likely it will wind up a global partner.[7]

American universities are still the best in the world, with recent surveys estimating that 58 of the world's top 100 institutions of higher learning are on U.S. soil.[8] Broadly defined and measured, aggregate American research and development (R&D) also leads the world among major economies or economic blocs. In competitiveness surveys, such as those done through the Davos World Economic Forum, the United States generally ranks in the world's top five nations. Despite its weaknesses, discussed more below, it is seen as an open and accessible place for investment. The only countries that occasionally best it in these competitiveness surveys tend to be small European economies, moreover—no large or even mid-sized economy tends to come close.

Yet clearly the United States has serious weaknesses, as a nation and as an international power, and the trend lines in these areas are usually negative as well. These include first and foremost its budget and trade deficits, which have the effects of weakening investment, surrendering more of the nation's wealth to others, and making the country far less resilient in the face of a future crisis. Total debt is headed towards 100 percent of GDP and beyond by decade's end—a figure previously experienced only in the 1940s—with long-term budgetary and demographic trends offering no natural respite from this dilemma. In fact, the U.S. gross savings rate in 2008 was about 11 percent of GDP, half the global average, and the net savings rate had declined from around 8 percent a generation ago to 2 percent before the onset of the recent recession.[9]

It is for such reasons that a growing number of leaders and analysts believe that the nation must consider defense spending reductions in the coming years—as part of a broader plan at reducing the deficit— in order to strengthen the economy's underlying foundations and thereby ensure its longer-term military power and national security. In other words, some calculated and measured short-term military risk may be necessary as a way to minimize the longer-term risk of gradual decline and resulting economic and military weakness. A balanced package of deficit-reduction efforts may be required to avoid economic crisis, and to ensure the types of scientific, educational, and industrial foundations needed for long-term national security. But at the same time, those very reductions must be done in a way that avoids jeopardizing the very same types of scientific, educational, and industrial foundations needed for long-term national security.

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[5] Feng Wang, "China's Population Destiny: The Looming Crisis," Washington, D.C., Brookings, September 2010, available at http://www.brookings.edu/articles/2010/09_china_population_wang.aspx [accessed November 8, 2010]; and Eric S. Edelman, *Understanding America's Contested Primacy* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2010), pp. 52-65.

[6] National Intelligence Council, *Global Trends 2025: A Transformed World* (Washington, D.C.: 2008), pp. 24-27.

[7] On the restraint in Indian military policy, see Stephen P. Cohen and Sunil Dasgupta, *Arming Without Aiming: India's Military Modernization* (Washington, D.C.: Brookings, 2010), pp. 1-28. It is true that some speculate India may soon overtake China as the fastest-growing major new power. But that would be from a much lower base of economic power (roughly one-fourth the GDP), and India's improved short-to-medium term prognosis would come partly at the expense of unfettered population growth that will pose its own major challenges, now and down the road. See "How India's Growth Will Outpace China's," "India's Surprising Economic Miracle," and "A Bumpier but Freer Road," *The Economist,* October 2-8, 2010, pp. 11, 75-77.

[8] Loren Thompson, "Reversing Industrial Decline: A Role for the Defense Budget," Lexington Institute, Arlington, Va., August 2009, p. 5.

[9] International Monetary Fund, *World Economic Outlook* (October 2010), p. 204, available at http://www.imf.org/external/pubs/ft/weo/2010/02/pdf/tables.pdf [accessed October 6, 2010]; and Warren B. Rudman, J. Robert Kerrey, Peter G. Peterson, and Robert Bixby, "Realistic Approaches to Head Off a U.S. Economic Crisis," in Michael E. O'Hanlon, ed., *Opportunity 08: Independent Ideas for America's Next President,* second edition (Washington, D.C.: Brookings, 2008), pp. 262-263.

As things stand, many world-class companies are now appearing in the developing world, with the West often lagging behind.[10] Most major new industrial plants are being built not in the U.S. but abroad. For example, China alone now produces two-thirds of the world's photocopiers, microwave ovens, DVD players, and shoes and also makes more steel and cement than anyone else.[11] Much of this also extends into new areas of more direct military impact like nanotechnology and energetics. China as well as South Korea and Japan dominate global shipbuilding; the United States barely shows up on global production tables.[12] The sovereign wealth funds of some countries evidence a longer-term investment attitude, and more concentrated investment muscle, than American companies or funds often employ.[13]

The United States faces other problems too. Despite the strength of certain cutting-edge technology sectors in this country, most classic manufacturing industries are in relatively weak shape, and overall manufacturing output as a percent of GDP declined from 21.2 percent in 1979 to just 11.5 percent three decades later.[14] Aerospace remains a bright spot in this picture, with total sales exceeding $200 billion a year and an export trade balance exceeding $50 billion annually even in recent economically difficult times.[15] Yet like other aspects of the national security industrial base, it is at some risk.

A core underlying trend is the issue of human capital—the young men and women who will staff the defense industry firms and invent the key military technologies of the future. In many ways, they are more the base than the plants and facilities themselves. Unfortunately a great deal of defense industry work cannot be globalized, and this once rich pipeline is under significant stress, with long-term consequence for the firms that must recruit from this pool (as a great deal of defense industry work cannot be globalized).

Science and technology education levels among the country's public school students are mediocre by global standards—ranking typically in the 20s among 40 nations participating in recent surveys, and 36th among all countries in "health and primary education" according to the World Economic Forum.[16] Although elite universities remain strong, including in the sciences, more and more of the country's science and engineering graduate students are foreigners who often return home after obtaining their degrees. As a percent of U.S. degrees earned, science, technology, engineering, and mathematics (STEM) degrees have fallen from around 25 percent a quarter century ago to only about 16 percent in recent years. This contrasts with levels ranging from 25 to 33 percent in most western nations and 38 percent in Korea.[17] These trends are simply not consistent with the country's long-term need to maintain domestic advantages in cutting-edge technology sectors.

In his new book *Brain Gain,* Darrell West argues that, while education reform to deal with problems in science and engineering capability is certainly necessary, the United States must also rethink its immigration policies. Current immigration policy has not been strategic and the political debate on it has become deeply disappointing. Since 2005, only 6.5 percent of U.S. visas have gone towards highly skilled workers; comparatively, Canada set aside 58 percent, using its visas as part of a drive to fill needed skills gaps and aid long-term economic growth and competitiveness. Reorienting policy towards greater efforts to attract workers with needed skills should be prioritized. In addition to matters such as H-1B visas, the United States presently

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[10] Antoine van Agtmael, *The Emerging Markets Century: How a New Breed of World-Class Companies Is Overtaking the World* (New York: Free Press, 2007), pp. 9-56.
[11] Fareed Zakaria, *The Post-American World* (New York: W. W. Norton and Co., 2008), p. 91.
[12] Shipbuilders' Association of Japan, "Shipbuilding Statistics," Tokyo, Japan, March, 2010, available at www.sajn.or.jp/c/statistics/Shipbuilding_Statistics_Mar2010.pdf {accessed November 12, 2010].
[13] Ian Bremmer, *The End of the Free Market* (New York: Penguin, 2010), pp. 18-24.
[14] Executive Office of the President, *Economic Report of the President 2010* (Washington, D.C.: 2010), Table B-12, available at http://www.gpoaccess.gov/eop/tables10.html [accessed October 8, 2010].
[15] Doug Messier, "AIA: Aerospace Sales Reached Record $214 Billion in 2009," *Parabolic Arc,* January 2, 2010, available at www.parabolicarc.com/2010/01/02/year-space-numbers [accessed January 4, 2011].
[16] Jeffrey J. Kuenzi, Christine M. Matthews, and Bonnie F. Mangan, "Science, Technology, Engineering, and Mathematics (STEM) Education Issues and Legislative Options," Washington, D.C., Congressional Research Service, May 22, 2006, p. 1; and World Economic Forum, *The Global Competitiveness Report 2009-2010* (Geneva, Switzerland: 2009), p. 17.
[17] Darrell M. West, *Brain Gain: Rethinking U.S. Immigration Policy* (Washington, D.C.: Brookings, 2010), p. 130.

makes a massive investment in many foreign PhDs (approximately $300,000 per graduate) that is usually lost when a student must return to their native country after receiving their degree.[18]

The infrastructure that the base also depends on is also weakening, all the more concerning as newer powers outdistance the United States in everything from high-speed rail to major ports to broadband internet capacity. Current annual spending on infrastructure is perhaps $20 billion too low simply to maintain existing services, and about $80 billion too low relative to what would be optimal.[19] This is happening at a time when the finances of cities are in greater peril than at any time over the last quarter century. Even if some of the problem is due to the short-term effects of the great recession, the decline in the property values that provide the base for urban services will probably be longer-lasting. State budgets are similarly strained; for example, Maryland has $33 billion in unfunded future pension and health-care obligations to state employees, and another seven states are in similarly bad straits (with yet another dozen also in some trouble).[20] California, the nation's largest state, is in the most worrisome shape of all. Such localities will not be in a position to provide the type of support or even tax credits they once offered in competitions to entice major new defense industrial facilities to be built in their areas.

The above trends all pose threats, either direct or indirect, to America's future power. They could weaken what the defense industry needs to produce world-class equipment for America's men and women in uniform. They could impede the government from sustaining adequate defense budgets. They could erode the will of the American people to continue to support an enlightened foreign policy focused more on heading off threats, sustaining the global commons and maintaining global order than on waiting for threats to develop and trying to respond only then. They are all of concern.

LIKELY FUTURE REQUIREMENTS FOR THE MILITARY AND THE INDUSTRIAL BASE

Good defense industrial policy is not just about potential assets, but also must include an assessment of the nation's security requirements as well as the threats faced by the United States. It is for this reason that the policy process logically begins with a national security strategy, coordinated at the White House, to guide defense planning and budgeting. The same logic should therefore apply to a consideration of the nation's future national security industrial base requirements.

There are numerous ways to assess potential risks to American security and thus possible requirements for the nation's armed forces that would be supplied by the defense industrial base. As an example, the following are a range of scenarios that the U.S. military could be called upon to deal with in the coming years. The list is suggestive, rather than complete; more important than its wide geographic scope is its functional variability, and coverage of many different types of possible warfare:[21]

- Airstrikes against Iran or perhaps a naval blockade of the country, or at least the potential to threaten the Iranian regime's hold on power in order to deter major aggression
- War between India and Pakistan over Kashmir that then leads to a robust international peace implementation force with strong U.S. participation
- Another Korean war, perhaps involving weapons of mass destruction

[18] Darrell West, *Brain Gain* (Washington, D.C.: Brookings, 2010).
[19] Statement of Peter R. Orszag, Director, Congressional Budget Office, "Investing in Infrastructure," Testimony before the U.S. Senate Committee on Finance, July 10, 2008, p. 8.
[20] Christopher W. Hoene and Michael A. Pagano, "Research Brief on America's Cities," National League of Cities, Washington, D.C., October 2010, available at www.nlc.org [accessed October 7, 2010]; and "Maryland's Silent Tsunami," *Washington Post,* October 13, 2010, p. A18.
[21] Michael E. O'Hanlon, *Defense Strategy for the Post-Saddam Era* (Washington, D.C.: Brookings, 2005), pp. 95-120.

- A Taiwan contingency that could, if things went tragically wrong, pit the United States against China in open conflict, including not only classic kinetic operations but (as with other scenarios here) cyberwarfare and perhaps combat in space
- Perhaps more plausibly, Chinese challenges to other disputed islands and associated sea and seabed resources near its coasts
- A Russian attack on a former Soviet republic like Georgia or, worse yet given their NATO membership, the Baltic states
- A major terrorist attack on U.S. soil, perhaps even involving weapons of mass destruction
- A collapsing Congo or Indonesia…or Mexico or Pakistan

Not all of these would necessitate American military intervention. Even if they did require a role for U.S. armed forces, any U.S. participation might occur only as part of a multinational coalition and in the context of a negotiated ceasefire, UN Security Council resolution, or other international blessing. But such a list underscores the range of possible operations that could prove necessary for a country like the United States that does not have the luxury of defining its national security interests or activities narrowly, given its broad range of interests and alliances.[22]

As one looks into the future, any such list will evolve not only as a function of geopolitics but also of technology. Certainly the trends in computers have already been remarkable, and if "Moore's Law" continues to hold, there could be another billion fold increase in computing power within roughly 25 years. There may be somewhat analogous trends underway in areas such as microbiology and nanotechnology, even if the enthusiasts for a "revolution in military affairs" of the 1990s often overstated their cases and made their arguments about technological progress too sweeping and bold.[23] These trends are providing the basis for the existing growth in systems like robotics to new ones like directed energy or nanotechnology.

The implications of technological trends are that the domains in which conflict could take place, and for which the military will be looking to find solutions, will extend into new areas such as cyber, space, and the changed global environs as well.

This will connect to huge demographic trends to create what might be termed the urban hot zone. That is, just as 15 years ago the U.S. military was not gearing up for a counterinsurgency fight in rural Afghanistan, it may be failing now to face up to a future fight that is much different, and perhaps more urban. A strong majority of the world's future population will lie in major urban areas and some 50 new megacities (with populations of 10 million or more) will be created around the world within a quarter century. Violence and national security threats are likely to be found emanating from such places, where hundreds of millions of individuals, many poorly educated and underemployed yet aware of all that the world offers that they cannot easily access, could represent potential recruits for various militant movements.

All of these developments have major implications for not just the defense budget and weapons decisions, but also for the people that DoD and industry must hire. Operating complex systems effectively, a traditional American strength, will require attracting technology-literate people even more than in the past. Rosie the riveter might not have to become Gussie the group theorist, but the trend is clear nonetheless. The United States armed forces also must think hard about how to attract and retain, and thus the nation's universities and industry must figure out how to supply, individuals with a "Google mindset" who expect access to information as well as modern devices without all the bureaucratic encumbrances and hierarchical structures that traditionally afflict military organizations.

Another key aspect of this change is that the U.S. will have no monopoly on power and some of these sophisticated technologies, meaning not just a diversity of new environments to prepare for, but a deeper lethality within them. The future period holds a greater spread of access-denial technology, cyberthreats and

[22] For a related view, see Thomas G. Mahnken, "Striving for Balance in Defense," *Proceedings* (June 2010), pp. 36-41.

[23] Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, N.J.: Princeton University Press, 2004); and Michael E. O'Hanlon, *The Science of War* (Princeton, N.J.: Princeton University Press, 2009), pp. 172-187.

"GRAM" technologies (guided rockets, artillery, and mortars). Such a "democratization of destruction" will continue with small states and non-state groups having greater access to lethal technologies.[24]

Even more, a "proliferated world" of WMD in the hands of a greater number of states seems a strong possibility. Some argue for pursuit of a nuclear-free world, but even if that goal proves viable as a vision, in the interim it is just as likely that the threat could become more complex and acute. Nuclear campaign planning could become more important, as the likelihood that one or more nuclear weapons will be used somewhere probably grows.[25]

Another key challenge, especially in such realms as cyberwarfare, is integration—not only within individual systems but across systems, and with enough flexibility to allow for modernization, adaptation and innovation. This, though, stands in direct contrast to another key demand, which is to build resilient networks that can resist and recover from attacks. This same growing DoD concern over cyber-assurance will likely grow on the hardware side, as more and more investment and production moves away from traditional U.S. partners and suppliers.[26]

Not all is foreboding. Historically, the United States remains quite secure as a major power. In addition, with China the only plausible rising rival of comparable power, we may not face major challenges anywhere except the Western Pacific—and some would debate the degree to which China, however impressive as a rising power in many ways, is likely to pose a security threat to the United States or its allies. Moreover, for all of China's strengths in manufacturing, the United States still enjoys advantages of leadership in innovation. The ability to integrate across systems and technologies has been and will be a key strength. We can use methods such as data mining to improve intelligence collection and the forecasting and tracking of threats. We have a history in the "black world" of remarkable game-changing inventions.

But the challenges are great. Making this even more difficult from a defense industrial strategy perspective is that we do not have a national security strategy with clear priorities. The main customer, DoD, is often unsure of its clear wants and needs and thus companies are not likely to receive clear demand signals. The 2010 Quadrennial Defense Review document, for example, recognized that industrial base issues are important but failed to lay out any actual strategy or guideposts for protecting and enhancing this economic sector. On the Congressional side, the main tendency loosely seems to be towards major platforms and minimizing the role for U.S. ground forces, but again, it is unclear whether this links to the defined needs in a future environment.

FUTURE RESOURCE REQUIREMENTS AND RESOURCE CONSTRAINTS

What then is the balance of the future resource requirements versus constraints?

While the U.S. has long had deficit issues, the combination of the most recent recession and various recovery mechanisms of the last two years has driven up U.S. debt held by the public from about 40 percent of GDP to 60 percent. The current set of conditions and policies could potentially lead us to figures of 80 to 100 percent over the coming decade absent remedial action. The key is that long-term demographic shifts (especially an aging population with high medical costs) are combining to make the debt grow faster than GDP. While a number of nations have experienced both short- and long-term crises from such a scenario of debt (which often culminates with a fast-moving currency crisis), we have never seen the dominant power go through this

[24] See for example Barry D. Watts, *Six Decades of Guided Munitions and Battle Networks: Progress and Prospects* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2007).
[25] For various views on these subjects, see Michael E. O'Hanlon, *A Skeptic's Case for Nuclear Disarmament* (Washington, D.C.: Brookings, 2010); Andrew F. Krepinevich, *Meeting the Challenge of a Proliferated World* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2010); and Keith B. Payne, *The Great American Gamble: Deterrence Policy and Theory from the Cold War to the Twenty-First Century* (Washington, D.C.: National Institute Press, 2008).
[26] For one useful study, see Richard A. Clarke and Robert K. Knake, *Cyber War* (New York: Harper Collins, 2010).

situation before in the modern era. The experience of other powers is nonetheless worrisome; countries such as Japan and Italy, faced with severe fiscal problems, have tended to turn inward even more than before, and cut defense spending further. (For example, Japan's has now dropped well below one percent of GDP and Italy's is trending towards that same ballpark.)

For the United States, which retreated dangerously to isolationism once before in its modern history in the 1930s, the temptation could be to revert to a defense policy of offshore balancing. Overseas military capabilities might not be entirely neutered, but the country could for example narrow its ambitions to the protection of key sea lanes and Persian Gulf oil sources—with less concern for the security and well-being of other key allies and key regions of the world. This would be a dangerous outcome.

Various policy goals for the effort at fiscal discipline have been floated. One is to cap debt at roughly 60 percent of GDP and ensure that it does not exceed that figure thereafter (barring another major crisis such as a war). The exact figure and how one would achieve it is debatable; the need for significant action, however, is not.

In looking for answers, it is clear that demographic change combined with federal entitlements—especially in the retirement and healthcare systems— and an inefficient tax system are the main drivers of this long-term fiscal challenge. But defense and domestic discretionary accounts are all sizeable parts of the budget, too, and as such would likely all have to be part of any realistic solution to the current predicament. In addition, efforts to protect the defense sector from the pain of deficit reduction efforts could lead to even greater cutbacks in some areas of the federal budget—like education and infrastructure development and science R&D—that are also important to future national security and the industrial base. As such, it will be difficult to imagine a serious effort at fiscal reform that does not include some effort to reduce defense spending commensurately with reductions in other major federal programs.

U.S. debt is no longer primarily debt held by Americans; half is now held by foreigners.[27] Because of low savings rates by Americans, foreigners also are increasingly important in owning American property and stock equity and other assets. This dynamic has kept up investment levels in the United States, and the country also retains reasonably solid levels of research and development—greater than the EU in aggregate, indeed. But this dynamic depends on Americans accepting such a growing foreign role in the economy. It also depends on foreigners continuing to perceive the United States as a favorable investment haven even in the face of various worrisome indicators—notably, the country recently ranking only 93rd globally for macroeconomic policy according to the World Economic Forum.[28]

Beyond such concerns, high debt levels are debilitating. They can crowd out investment. They can make the nation extremely vulnerable to another serious crisis of some type—be it war, or another major recession, or a flight of investors from American assets that results from a sudden and contagious crisis of confidence in the U.S. economy. Indeed, former Congressional Budget Office (CBO) and Office of Management and Budget (OMB) director as well as Vice Chairman of the Federal Reserve Alice Rivlin warns of a possible economic "catastrophe" from such high debt.[29] High and continued deficits also risk driving debt service levels to very high numbers especially if and when interest rates again rise. CBO projects net interest payments rising from $200 billion in 2010 to nearly $800 billion in 2020 even under relatively favorable assumptions about growth in the debt.[30]

So how much does the deficit need to decline to mitigate risks and protect our future in a more competitive world, and how much of that reduction should come from defense spending? The first step in answering this

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[27] David M. Walker, *Comeback America: Turning the Country Around and Restoring Fiscal Responsibility* (New York: Random House, 2009), p. 22.
[28] David M. Smick, *The World Is Curved: Hidden Dangers to the Global Economy* (New York: Portfolio, 2009), pp. 20-60; Klaus Schwab, ed., "The Global Competitiveness Report 2009-2010," World Economic Forum, Geneva, Switzerland, 2009, p. 22; and Zakaria, *The Post-American World,* pp. 190-201.
[29] Alice Rivlin, "The Defense Budget and American Power," Brookings Event, December 22, 2010, available at www.brookings.edu.
[30] Congressional Budget Office, *The Budget and Economic Outlook,* pp. 11, 20-22.

question is to set a general target for deficit reduction. There is no absolutely correct answer, of course. As noted, debt level of 60 percent of GDP is considered a high but tolerable level according to most economists who have examined the challenges of countries around the world.[31] So deficits could be brought down to a level that would keep debt to 60 percent of GDP. A somewhat less ambitious approach to the problem would simply try to get deficits as a percent of GDP down well below the expected GDP growth rate as soon as possible. In that event, the size of the nation's debt relative to its GDP could begin to decline. Specifically, if debt owed the public were two-thirds of GDP, and deficits were held to less than two-thirds of GDP growth in a given year; debt relative to the size of the economy would gradually decline.[32]

Were the "peacetime" defense budget to contribute its proportionate share to the deficit-reduction effort, annual military costs might realistically be expected to decline by say $50 billion to $70 billion. (After that point, the defense budget could be allowed to grow again without undue economic risk—perhaps at two percent a year above the rate of inflation, which tends to be a "treading water" level of defense budget growth and would keep defense from growing as a percent of the GDP.) To be clear, these would be actual dollar cuts in the overall military budget, not the movement of savings across programs as currently planned. Such figures are of course not inevitable; they derive from a specific estimate of the future deficit, based on assumptions about economic recovery and growth, tax policy, and other matters. They also derive from specific assumptions about how much deficit reduction is enough to make the nation's future economic course relatively promising, and of what the military budget's proper role should be in the broader deficit reduction effort. It is a judgment call. But it is a reasonable number; it is also similar to the savings recommended by the recent bipartisan Domenici-Rivlin task force, even if the way of explaining the savings is different.[33]

In a dangerous world, there is no reason to think that defense spending need be cut exactly proportionately with the rest of the federal budget—arguably, indeed, defense spending might need to be protected. On top of that, in 2009 Secretary Gates cut some $10 billion in annual spending out of the defense program that President Obama inherited, and in 2011 he then cut the budget itself (especially in the "out years" of 2014 and 2015) relative to what had been planned by an average of about $15 billion a year. This means that the Pentagon has already begun to make its contributions to deficit reduction at a time when the rest of government has not. He deserves considerable credit for doing so at a time of war, and at a time when the rest of government was hardly being held to tough fiscal discipline. Moreover, his desire to avoid wasteful spending on bureaucracy and organization, favoring muscle over fat, was of course wise.

That said, there is also an argument that, after a decade of wars, Americans may decide to gamble and hope that a more restrictive policy on defense spending is compatible with a stable international environment, in which case defense spending might be cut more than its "share." On balance, a $60 billion figure (plus or minus) is a reasonable upper bound (but not the highest imaginable figure) for cuts in the real-dollar, base defense budget—meaning that, with Gates's changes now already reflected in official planning documents, another $40 billion reduction in annual spending might still be at issue.

The $60 billion target for reductions in yearly defense spending is not measured against the classic CBO baseline. That baseline is unrealistic as a way to think about anticipated spending assuming current defense policy. Most defense costs—for personnel, health care, environmental restoration, equipment maintenance, equipment modernization, and the like—go up faster than inflation in most eras. This is a general trend that does not factor into projections specific matters like the defense budget cuts already suggested in the last two years by Secretary Gates; it is a rough starting point for calculations. In fact, CBO itself estimates that the average annual defense budget requirement for the next two decades will be about 12 percent greater than current real-dollar levels (factoring wars out of the equation). The goal of $60 billion in savings in the 2017

[31] Galston and MacGuineas, "The Future Is Now," p. 4.
[32] Peter Orszag, "One Nation, Two Deficits," *The New York Times,* September 6, 2010, available at www.nytimes.com [accessed October 7, 2010]. Orszag actually cites three percent of GDP as a sustainable level, slightly higher than what the above would imply.
[33] See Senator Pete Domenici and Dr. Alice Rivlin, co-chairs, "Restoring America's Future," Bipartisan Policy Center, Washington, D.C., November 2010, pp. 96-107, available at www.bipartisanpolicy.org/sites/default/files/FINAL%20Report%202011.16.10.pdf [accessed November 17, 2010].

budget (again, now more like $40 billion given Gates's recent decisions) is measured relative to what that budget would likely be under current policy—and *not* relative to a simple straightlining of today's budget adjusted for inflation.[34]

An additional reason to consider the plausibility of real budget cuts of up to ten percent in the base defense budget is that, while hardly pain-free, they may be manageable—as a calculated short-term risk, part of a broader deficit reduction effort featuring shared sacrifice across the federal budget (and the country) and designed to shore up the foundations of long-term national power. My own initial analysis suggests, illustratively, that such a reduction might be accomplished by a combination of some additional management reforms (yielding relatively modest but nontrivial savings), changes to modernization policy developed further in the section below, and a reversion to Clinton-era ground force levels once the war in Afghanistan declines in its demands.

That latter policy would mean roughly 15 percent troop cuts, relative to current combat force structure. That would restore the Army and Marine Corps to Clinton-era levels. There was in fact a reasonable amount of bipartisan consensus on those earlier levels, with defense secretaries Aspin, Perry, Cohen, and Rumsfeld all supporting them over a ten-year period.[35] To give a sense of the respective facts and figures, today's U.S. Army has about 550,000 active-duty soldiers, plus another 110,000 reservists who have been temporarily activated (of those, nearly 80,000 are from the National Guard and just over 30,000 from the Army Reserve). The U.S. Marine Corps is about 200,000 strong, with another 5,000 Marine reservists temporarily activated.[36] By contrast, the active Army of 2000 was 472,000 strong and the Marine Corps numbered 170,000.[37] Excluding activated reservists, therefore, making 15 percent personnel cuts would reduce current levels approximately to those of a decade ago. Such cuts would presumably be kinder to industry than retaining current force structure (or trying to do so) while cutting overall defense spending ten percent—and in my judgment, it is not plausible to imagine such ten percent reductions without a considerable fraction of the savings coming from reductions in manpower and operations budgets as opposed to just acquisition. It is important to note here that such personnel cuts would not have a massive impact on the industrial base. That said, acquisition can hardly expect to be spared, as discussed further below.

THE CURRENT NATIONAL SECURITY INDUSTRIAL BASE AND CORE CONCERNS

The above considerations lead to the subject of the defense industrial base and its future prospects. Any such analysis should begin with a clear understanding of the state of the national security industrial base today. Several considerations are important to bear in mind; many came out of a series of discussions at Brookings in 2010 under the auspices of a national security working group that included members of industry, the Department of Defense, the Congress, the financial and consulting sectors, and the think tank world.

For one thing, the U.S. national security industrial base has greatly downsized, with the aerospace and defense sector now employing somewhat more than 600,000 workers in contrast to numbers twice as large in the fairly recent past.[38] That said, employment over most of the last decade has been reasonably stable.[39] This sector is a high-wage and high-export sector for the U.S. economy.

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[34] Congressional Budet Office, *Long-Term Implications of the Fiscal Year 2010 Defense Budget* (Washington, D.C., January 2010), pp. 1-33, available at www.cbo.gov [accessed September 20, 2010].
[35] See for example, Frederick W. Kagan, *Finding the Target: The Transformation of American Military Policy* (New York: Encounter Books, 2006), pp. 180-197, 222-236, 281-286.
[36] International Institute for Strategic Studies, *The Military Balance 2010* (Oxfordshire, England: Routledge, 2010), pp. 32-38.
[37] International Institute for Strategic Studies, *The Military Balance 2000* (Oxford, England: Oxford University Press, 2000), pp. 26-30.
[38] Robert H. Trice, "The Business of Aerospace and Defense," Briefing Slides, Lockheed Martin Corporation, Arlington, Va., September 2010.

Yet the profit margins of the defense and aerospace sectors of the economy, while hardly bad, are often only about half of what is commonly believed due to certain costs that cannot be billed to the government and related matters. In fact, the sector averages profit margins of five to nine percent, less than many industries that tend to achieve margins in the teens.[40] It is perhaps partly for this reason (and partly out of expectations of coming defense budget cuts) that defense stocks are underpriced in the eyes of many. Whether this is a reasonable and fair state of affairs or not is debatable. Some suggest that companies with a sure customer and dependable market (the U.S. government) should not be entitled to as much profit as those operating in a more unpredictable marketplace, whereas others counter that the U.S. government is hardly a consistent customer or an easy customer to work with.

The stakes here are high. Restoring lost assets or capabilities within the defense industrial base, while generally feasible, can be a slow and uncertain process. It can also be much harder than enlarging the size of a given military service by a certain percentage. In other words, the loss of key industrial capabilities may be a greater worry than having a force structure that proves temporarily too small. (This is not to argue for *either* a weak industrial base *or* an inadequate force structure, only to frame the issue in terms of possible tradeoffs.) The above concern is reinforced by the fact that, today, many companies are showing greater interest in the most lucrative and least capital-intensive parts of the DoD acquisition agenda—service contracting, information technology, cybersecurity, and so on. To the extent they can make money in these areas, they may have less incentive than before to sustain inherently expensive production facilities and related hardware.[41]

Some are concerned about the current DoD interest in moving back to fixed-price contracts, rather than "cost-plus" contracts which reimburse contractors for their documented expenses and then add a profit margin. The fixed-price contracts are designed to discourage gold-plating. The cost-plus approach, by contrast, is designed to ensure that firms stay financially healthy, and also to reflect the reality that inventing new technology is an inherently unpredictable process that can entail unexpected costs. As such, moving back towards the former approach will worry some. It was attempted two decades ago with unfortunate results for the industry. That said, there are mitigating factors. For example, most of today's top defense executives cut their teeth in the industry during that previous downturn, so they are experienced at dealing with tough periods. Also, the industry has numerous survival skills. For example, greater use of fixed-price contracts by the department may lead to higher bids for a given system (as contractors try to ensure that any unexpected cost growth will not preclude achieving a profit).

The most likely outcome is that the big five U.S. defense primes, plus BAE Systems and other larger firms, will find ways to survive the coming expected downturn. But the country could lose key capabilities in the process, and affordability issues could grow. In addition, as noted earlier, the subcontractor industrial base could be jeopardized.

There are other challenges for the industry too. They include: increasing burdens from regulation and oversight, ongoing hurdles from export controls (even if they are gradually lessening), the difficulty of turning profits based on R&D and prototyping work, demographic trends in the defense workforce (with many experienced workers retiring en masse), and the uncertainty of attracting young talent into a business that may not be as likely to produce new systems in the future as in the past.[42]

Finally, the next few years will be important, as we are in a transition period. A case in point: for the first time in the history of aviation, the United States does not have a manned aircraft program in the R&D phase. Only the long-range bomber (which is likely to include a manned-unmanned option) fits that category, illustrating a

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[39] Carole Rickard Hedden, "Hire Education," *Aviation Week and Space Technology,* August 16, 2010, pp. 48-49.

[40] Aerospace Industries Association, "U.S. Defense Acquisition: An Agenda for Positive Reform," Arlington, Va., November 2008, p. 8 (graph based on CSIS data).

[41] For related information, see for example Defense-Industrial Initiatives Group, "Structure and Dynamics of the U.S. Federal Professional Services Industrial Base, 1995-2009," Center for Strategic and International Studies, Washington, D.C., November 2010, pp. ix-xiii.

[42] On export controls, see for example, Clara Marina O'Donnell, "A Transatlantic Defence Market, Forever Elusive?" Centre for European Reform, London, England, July 2010, available at www.cer.org.uk.

significant shift underway in the very nature of the products aviation firms provide. Of note, the bomber development program will ultimately keep one company's design and development team alive in coming years but not those of other firms (in aircraft, there are three main American actors, out of the primes—Northrop Grumman, Lockheed Martin, and Boeing). In addition, the C-17, C-130, F/A-18E/F, F-22, F-15, and F-16 production lines are all now slated to close by 2015.

But above all, a core immediate concern of the industry is the bottom-line: the possible impact of any coming defense budget reductions on funds available for acquisition. The broader subject of defense budget reductions was addressed above, but the following section explores what might be seen by some in the industry as a plausible "worst case" should deficit reduction be pursued in a serious way in the coming years. In fact, there is a serious case for such deficit reduction, as it could strengthen the nation's long-term economic foundations and thus the pillars of long-term national security. But it would also understandably cause some angst in industry circles. The below is my best estimate of what the implications of such plausible reductions (amounting to about ten percent in the real "peacetime" defense budget) might be for procurement as well as research, development, testing, and evaluation (RDT&E).[43]

EFFECTS ON ACQUISITION OF A DEFICIT REDUCTION PLAN

As noted above, any effort to reduce the base defense budget by ten percent in real terms would presumably include numerous efficiencies and management reforms, perhaps some additional base closures, as well as at least modest reductions in force structure. These would probably be concentrated in the ground forces, which were built up over the last decade even as the rest of the nation's force posture continued to be streamlined. Another, complementary way to find savings is to propose reductions in modernization plans for the U.S. military's acquisition of equipment—in both procurement and advanced development/prototyping efforts. Other types of savings might be explored too, beyond those emphasized below. For example, intelligence spending has grown greatly in the last decade and in largely unregulated, unscrutinized ways given classification issues. Those same issues complicate my efforts to analyze intelligence thoroughly here, but that does not rule out the possibility of savings in such accounts.

My view is that all these types of efficiencies will need to be pursued if there is to be any realistic hope of reducing defense spending while posing minimum risk to the country's security. My purpose here is not to advocate such cuts but to outline them as a way of framing the likely parameters for the future acquisition budget and its potential impact on the industry. The long and short of the analysis presented below is that acquisition budgets might be expected to undergo up to ten percent real cuts—at a maximum—in the coming years, above and beyond those reductions that result directly from reduced war expenditures pursuant to force redeployments from Iraq and Afghanistan back to the United States.

Reducing funding for acquisition was already pursued once in recent times, in the 1990s, when annual procurement budgets were reduced by two-thirds relative to earlier Reagan-era highs. But that was an unusual historical moment. The United States could take a "procurement holiday" of sorts since it had recently bought so much new equipment during that Reagan buildup, and since the concomitant reduction of the combat force structure allowed older equipment to be selectively retired first.

These cutbacks were not easy on industry or the economy. Softening the pain to an extent, however, was the fact that the 1980s had been a fairly good decade for defense business. In addition, even though the economy was tough in the early part of the 1990s in the United States—and even though defense cutbacks exacerbated

[43] Michael O'Hanlon, "Defense Budgets and American Power," *Foreign Policy Paper 24* (Washington, D.C.: Brookings, 2010).

the difficulty in some cases[44]—the situation rapidly improved. As the 1990s progressed, the general health of the U.S. economy strengthened, creating new jobs in other sectors.

The situation is different today. In addition, even though current acquisition budgets are sizeable by historical standards in real-dollar terms, the growing cost of weaponry means that these budgets can fund fewer major programs than was the case before. That reality is reinforced by the fact that more of today's acquisition budget is devoted to research and development rather than production—understandable to a degree at a time of rapid technology change, but still a tendency that deprives procurement accounts of the share of funds they used to receive. Historically RDT&E budgets have usually been less than half as large as procurement accounts; today they are nearly as large, and this trend may thus have gone too far. The number of workers in aerospace and defense is down from more than 1,000,000 in 1991 to just over 600,000 two decades later, exemplifying the tendency of the U.S. manufacturing base writ large to lose lots of jobs over that period.[45] In addition, there are now just five major U.S. contractors in the defense business—Boeing, Raytheon, Northrop Grumman, Lockheed Martin, and General Dynamics, plus BAE and EADS from Europe—and often the number capable of creating a given type of weapon system is just one or two. As such, the competitive health of the industrial base needs to be kept in mind to an even greater extent than during the last comparable period, since budgets are not so large as to guarantee a diverse and strong national security industrial base absent considerable care and attentiveness.[46] Certain capabilities could simply be lost, and take years to recreate.[47] The ability to keep costs in check through competition can also be lost.[48]

If however ways can be found to keep the military strong and the industrial base on solid ground while reducing certain programs, substantial sums might be saved. Not counting war costs, the Pentagon's procurement budget has again exceeded $100 billion a year. Its RDT&E budget adds another $80 billion, the latter figure in particular being quite robust by historical standards.[49] Big-ticket programs are together worth almost $800 billion at present, over the lifetime of the programs, with almost $550 billion of that scheduled to be spent in 2012 and beyond. So there is clearly a lot of money to consider.[50]

A few caveats and constraints about the possibility of reaping easy savings from weapons cutbacks should be kept in mind, however. First, despite the claims of some defense budget cutters, few if any of the new systems can still be described as "Cold War legacy weapons." That common refrain makes it sound as if the Pentagon (and its industrial partners) has simply retained weapons it should have eliminated 20 years ago out of inertia. While inertia, and bureaucratic as well as parochial politics, definitely can play a role in the defense budgeting process, there is no weapon today being justified on the grounds that it might be needed against a Soviet-like threat. Rather, worries about advanced surface-to-air and air-to air and surface-to-sea missiles, quiet diesel submarines, sophisticated mines, and other such assets that could appear in the hands of future U.S. adversaries drive the desires for stealth, speed, maneuverability, and related characteristics in future weaponry.

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[44] R. William Thomas, *The Economic Effects of Reduced Defense Spending* (Washington, D.C.: Congressional Budget Office, 1992), pp. 5-42.
[45] Briefing by Robert H. Trice, Senior Vice President, Lockheed Martin, "The Business of Aerospace and Defense," Washington, D.C., September 2010, p. 8.
[46] Barry D. Watts, *The U.S. Defense Industrial Base: Past, Present and Future* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2008), pp. 32, 81-90.
[47] Aerospace Industries Association, "The Unseen Cost: Industrial Base Consequences of Defense Strategy Choices," Arlington, Va., July 2009, p. 1.
[48] Hadley and Perry, "The QDR in Perspective," pp. 84-91.
[49] Over the last half century, expressed in constant 2010 dollars, acquisition budgets have averaged about $150 billion a year, with the RDT&E budget about $50 billion of that total on average. Watts, *The U.S. Defense Industrial Base,* pp. 21-28.
[50] See Department of Defense, "Selected Acquisition Report Summary Tables," December 31, 2009, available at www.acq.osd.mil/ara/2009%20DEC%20SAR.pdf [accessed September 30, 2010], pp. 21-23.

Second, while it may be tempting to cut weapons experiencing cost overruns—and these run well into the tens of billions of dollars if not more[51]—it is also natural to expect some state-of-the art weapons to cost more than originally foreseen since the process of invention is inherently full of surprises.

Third, cost overruns are often the result of the requirements process—that is, of the armed forces demanding too much, rather than of industry proposing too much or gold-plating weaponry after the fact. To paraphrase a former four star, the services need to remember to take appetite suppressant pills as often as industry needs to be chastised for deliberately driving up costs whether out of technophilia or profit maximization efforts.

Fourth, if a weapons system is canceled somewhere in the development or production process, the costs already incurred with that program cannot of course be recouped.

Fifth, unless the combat units that were to receive the new weaponry are simply eliminated, the cancellation of the weaponry would not in fact change the need to buy *something* serviceable and safe and reliable to equip those units. As a rule, weapons costing at least half as much as the canceled systems will be needed.[52] And with today's Air Force tactical aircraft averaging more than 20 years in age, as well as Navy and Marine Corps aircraft averaging more than 15, purchasing some types of new planes—not to mention other types of systems in similar straits—cannot be deferred.[53]

Savings are nonetheless quite possible, and therefore any defense industrial planning should assume they will be sought. Today's military may not buy Cold War legacy systems as critics allege, but it does arguably over-insure. A case in point is air combat. Even as unmanned systems have become much more effective, precision-guided ordnance has become devastatingly accurate (even when dropped from older planes or drones), and real-time surveillance and information grids have evolved rapidly (at great expense), plans for modernizing manned combat systems have remained essentially at previous levels. Between them, for example, the Air Force and Navy and Marine Corps still plan to buy 2,500 F-35 combat jets at a total price of more than $250 billion (and growing). Despite all the capability they offer, the current and next generation of unmanned systems have been seen to date largely as add-ons to existing procurement requirements (largely bought out of the war budget supplementals), rather than means of perhaps carrying out a mission more effectively so that other systems might be scaled back.[54]

It is clearly possible to push thinking about economizing too far. A number of thoughtful analysts have already lamented the declining size of the U.S. Navy, for example, at a time when China is being more assertive in seas around its borders and when Iran continues to pose a major threat to the broader Persian Gulf. Analysts have also expressed concern about too much emphasis on America's current wars at the budgetary expense of other possible missions and scenarios. They worry for example about the nation's relatively low investments in long-range strike platforms at a time when China is becoming more powerful *and* when technologies that can attack ports and airfields in forward theaters are becoming more prevalent.[55] But a general emphasis on those areas of technology that are evolving fastest—munitions, sensors, communications grids, robotics—and a somewhat

[51] See Gene L. Dodaro, Acting Comptroller General of the United States, "Maximizing DoD's Potential to Face New Fiscal Challenges and Strengthen Interagency Partnerships," Washington, D.C., Government Accountability Office, January 6, 2010, available at www.gao.gov.
[52] Michael E. O'Hanlon, *The Science of War* (Princeton, N.J.: Princeton University Press, 2009), pp. 8-31; and Amy Belasco, *Paying for Military Readiness and Upkeep: Trends in Operation and Maintenance Spending* (Washington, D.C.: Congressional Budget Office, 1997), pp. 5-15
[53] Stephen J. Hadley and William J. Perry, Co-Chairmen, "The QDR in Perspective: Meeting America's National Security Needs in the 21st Century," Washington, D.C., Quadrennial Defense Review Independent Panel, 2010, p. 53, available at www.usip.org/files/qdr/qdrreport.pdf [accessed October 20, 2010].
[54] "The Man Behind 'Unmanned,'" *Aviation Week and Space Technology,* August 23/30, 2010, p. 63.
[55] See for example Thomas G. Mahnken, "Striving for Balance in Defense," *Proceedings* (June 2010), pp. 36-41, available at www.usni.org [accessed September 5, 2010]; Stephen J. Hadley and William J. Perry, co-chairmen, "The QDR in Perspective: Meeting America's National Security Needs in the 21st Century," Washington, D.C., 2010, available at www.usip.org/files/qdr/qdrreport.pdf [accessed October 10, 2010]; and Jan Van Tol, *AirSea Battle: A Point-of-Departure Operational Concept* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 2010).

reduced emphasis on expensive new platforms except when there is a particularly strong case for the latter would make sense as a guiding philosophy. [56]

Following the logic of the discussion on aircraft, I would propose evaluating existing weapons modernization plans with an eye towards streamlining or canceling several of them. Top candidates for reassessment include systems that are redundant, performing poorly on cost or technical grounds, or designed for potential types of warfare that are increasingly unlikely or obsolescent.

In this light, changes to several weapons systems might be considered. I will avoid a list here, in the interest of focusing discussion at the conceptual and strategic levels rather than risking a finger-pointing exercise; my more specific ideas can be found elsewhere.[57] My main purpose here is less to prove the case for specific changes in the modernization agenda than to sketch out a philosophy by which cuts might be made and to indicate the kinds of changes that would be required to achieve up to $20 billion in annual savings in the normal (non-war) acquisition accounts.

TOWARDS AN INDUSTRIAL BASE POLICY

The above considerations leave us, then, with the enduring question of what new or modified roles government should play to preserve and strengthen the U.S. national security industrial base? The ideas presented below are preliminary, but they do reflect an overall path forward that the nation needs to adopt at least in general terms rather soon.

The discussion must begin with the premise that in fact this industrial base is itself a national security asset of the United States. That observation, seemingly so common-sensical, and offered of late by scholars like Barry Watts, is nonetheless ahistorical in the American experience. More typically in this country, a combination of laissez-fair attitudes towards economics together with the robust defense funding levels associated with most periods of the modern era have led to the implicit assumption in the policy community that no explicit national strategy was needed. That is no longer true.

A corollary to this observation is the need for adequate structures to bear the responsibility associated with this task. More capacity is needed within the government to monitor trends in the U.S. defense industrial base. Separate capabilities at DoD, Commerce, the National Security Council, and perhaps Department of Energy and the National Academy of Science should be buttressed to improve the nation's tracking and analytical capacities in this regard.[58] In turn, the issue must be more forthrightly addressed in major strategy documents such as the next Quadrennial Defense Review.

One key task for such capabilities is to watch global industrial and resource development trends, as well as scientific innovation. Some key elements of the defense industrial base may, if we are careless, become concentrated in a small number of overseas hands, with China the most likely such location. Key components of military systems may wind up being produced primarily in countries with which the United States has

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[56] See P.W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin Press, 2009); and Michael E. O'Hanlon, *Technological Change and the Future of Warfare* (Washington, D.C.: Brookings, 2000), p. 65.

[57] For specific suggestions, see Michael O'Hanlon, "Defense Budgets and American Power," *Foreign Policy Paper 24* (December 2010). On cost savings estimates, see Congressional Budget Office, *Budget Options* (Washington, D.C., 2009), pp. 5-21, available at www.cbo.gov/ftpdocs/102xx/doc10294/08-06-BudgetOptions.pdf [accessed October 20, 2010]; Department of Defense, "Selected Acquisition Report (SAR) Summary Tables, December 31, 2009, pp. 21-23, available at www.acq.osd.mil/ara/2009%20DEC%20SAR.pdf [accessed October 20, 2010]; and Michael E. O'Hanlon, *A Skeptic's Case for Nuclear Disarmament* (Washington, D.C.: Brookings, 2010), pp. 110-131.

[58] Loren Thompson, "Reversing Industrial Decline," Lexington Institute, Arlington, Va., August 2009, p. 16.

military rivalries or tensions—and even the possibility of conflict.[59] A related challenge is the fraction of rare Earth elements being mined at present in China. If the United States cannot find alternative sources, it may need to consider stockpiling as a matter of prudent national security planning, given rare Earth elements' key role in many modern materials.[60]

Among their other missions, these new governmental units should assess the health of the defense subcontractor base. The top six defense companies have combined revenue equal to that of the following next several dozen, and the latter are often primarily focused on other, nondefense businesses. The logical consequence is that the financial health of these smaller companies as well as their proclivity, and need, to engage in defense business is often less than that of the primes. For that reason, the depth of the subcontractor base is often less (despite the many players within it), with only one or two bids often being made on work being outsourced by the prime. Exacerbating the problem sometimes is the fact that the new mega-companies may sometimes collaborate in ways that do not serve the nation's best interests given their other working relationships; for example, one large firm might subcontract to another not because the second offers the best quality for the money but because of their collaboration on some other project. This can lead to some firms being forced out of the marketplace due to a form of collusion, intentional or not, by some dominant firms.[61]

Another core aspect of the development of this policy must be to reassess the barriers to public-private discussions and partnerships. Current "revolving door" restrictions make it hard for industry and government to stay in adequate contact about plans and future needs. There is a case for relaxing them so that customers and industry can talk to each other more easily. There may also be excessive separation between the "requirements" process and the "acquisition" process within some services.[62]

But just as important, the underpinnings to the industry's future health must also be evaluated. As defense-specific policies are adopted, greater attention is also due to basic science and technology capabilities in the United States—for the good of not only the defense and aerospace industries and the armed forces, but the country's economic future in general. Sean Maloney and Christopher Thomas of INTEL have laid out an agenda to double the nation's numbers of engineering graduates, H-1B visa recipients, and basic science R&D budgets while also recruiting 10,000 more math and science teachers per year and incentivizing at least 1,000 of the nation's top engineering students to pursue PhD's. Some considerable fraction of this proposed agenda merits adoption.[63]

In addition, it would be useful to begin a campaign led by the president to the nation's youth as well as its business leaders to emphasize the importance of new cutting-edge technologies in areas such as cyber, space, biologics, energy-related matters including alternative sources and high-efficiency batteries, and classic aerospace areas as well.[64] These areas of technology should be seen as cool and trendy and patriotic in nature—like the space program was in the 1960s. Since then, alas, the scientific worlds have too often been caricatured as the realms of geeks and nerds by much of modern American culture, to the nation's detriment.

Another key aspect related to this is the expansion of "crowd-sourcing" competitions (the DARPA Grand Challenge as an example of a success story) and the refocusing of agencies like DARPA on core technical and

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[59] Sheila R. Ronis, "A Defense Industrial Base Scenario," in Sheila R. Ronis, ed., *Project of National Security Reform Vision Working Group Report and Scenarios* (Carlisle, Pa.: Strategic Studies Institute, 2010), pp. 134-135.
[60] Cindy A. Hurst, "China's Ace in the Hole: Rare Earth Elements," *Joint Forces Quarterly,* issue 59 (2010), pp. 121-126.
[61] Watts, *The U.S. Defense Industrial Base,* p. 41.
[62] Charles Nemfakos, Irv Blickstein, Aine Seitz McCarthy, and Jerry M. Sollinger, *The Perfect Storm: The Goldwater-Nichols Act and Its Effect on Navy Acquisition* (Santa Monica, Calif.: RAND, 2010), p. xi.
[63] Michael E. O'Hanlon, ed., *Opportunity 08: Independent Ideas for America's Next President* (Washington, D.C.: Brookings, 2008), p. 372.
[64] For provocative ideas on the military's potential role in energy policy, and roles for industry as well, see for example Amory B. Lovins, "DoD's Energy Challenge as Strategic Opportunity," *Joint Forces Quarterly,* issue 57 (2010), pp. 33-42.

research challenges for the future, rather than its current tendency of focusing on the needs of today. This approach will help foster spin-offs from defense to civilian sectors, "spin-ons" going in the other direction, or mutual advantage to greater government efforts to spur and encourage innovation in key technology sectors. Whatever the direction of causality, the notion of letting the hidden hand of the market do all the work here on its own is not only unrealistic but ahistoric.[65]

A warning is in order though for anyone who hopes for a top-down and comprehensive defense industrial strategy (such as how certain nations like Japan once ordered their industry) to be implemented anytime soon. Whether in regard to production, industrial research, or DARPA efforts, many hope for clearer guidance from DoD about its future acquisition requirements. My impression, however, is that it will be difficult to achieve this to any of the level of detail they often cry out for. The United States has an array of military needs; different administrations (and different services) see things slightly differently from era to era; and finally, the process of invention is unpredictable enough by definition as to make it hard to foresee what will be needed in 10 or 20 or 30 years. There may be more specific, limited decisions that can be made—about the optimal number of industry producers and design teams for major equipment, for example—but beyond that, industry should probably expect most of DoD's planning guidance to be vague.

But again, while an absolutely comprehensive strategy may not be in the cards politically or bureaucratically, there is much that can be done in smart ideas that would provide elements of what such a strategy would offer. The Obama administration's idea to create a unified export control agency, for example, makes eminent sense as a means of streamlining, simplifying, and speeding decisions on export applications.[66] It should not however weaken controls on nuclear-sensitive technologies or on the nation's most precious defense-industrial assets such as stealth technology. Of special note given its growth in the aerospace sector, the current challenges of exporting unmanned aerial systems—which are essentially aircraft, not missiles—also require attention. They are presently impeded by the Missile Technology Control Regime (MTCR). Instead, it might make sense to control Unmanned Aircraft Systems (UASs) through a different mechanism that allows transfer of complete systems among members, or to modify the MTCR guidelines in such a way as to allow such trade in UASs more freely.

Various ideas on streamlining acquisition rules and regulations should be considered. For example, the dollar threshold above which full reports need to be carried out on subcontractors by prime contractors could be raised substantially yet preserve a good deal of ability for federal oversight. In addition, contractors' past performance on previous contracts could be emphasized more in competitive contracting decisions.

Recognizing the need to keep design teams and associated basic engineering and prototyping capability robust, even as the numbers of production lines continue to diminish in all likelihood, contracts for RDT&E might also be rethought. It is important that companies begin to view these activities as profit-making activities so that adequate capacity can be retained within the industry. This may also argue against fixed-price contracts in the RDT&E stage, particularly for cutting-edge technologies.[67]

For fiscal reasons, additional tough decisions are going to be needed about acquisition programs in the coming years. The need will grow further if serious deficit reduction efforts are attempted. Among the weapons that should be least protected in this process are those that are redundant with other weapons. Sometimes, bureaucratic inertia combined with America's great resource base allows its military to avoid tough choices. For example, the unmanned aerial vehicle budget has approached $5 billion a year of late, and great progress has been seen as well in the efficiency of all platforms due to improved munitions and information systems.[68] But few effects have been seen on manned aircraft programs. A certain degree of redundancy and of

[65] Guy Anderson, "Inventive Application," *Jane's Defence Weekly,* December 8, 2010, pp. 28-31.
[66] "White House Calls for Export Control Agency," *Space News,* July 5, 2010, p. 3.
[67] Aerospace Industries Association, "U.S. Defense Acquisition: An Agenda for Positive Reform," Arlington, Va., November 2008, p. 11.
[68] Michael W. Isherwood, "Unmanned Systems and the Joint Team," *Joint Forces Quarterly,* issue 58 (2010), available at www.ndu.edu/press/unmanned-systems.html [accessed January 4, 2011]; and David A. Deptula and James R. Marrs, "Global Distributed ISR Operations: The Changing Face of Warfare," *Joint Forces Quarterly,* issue 54 (2009), pp. 110-115.

competitive modernization are useful in areas of warfare that are changing fast and particularly crucial to the nation's security, but only up to a point.[69] Weapons that perform poorly—technically or financially—should also be reassessed.[70] And weapons designed for less important missions, if these can be convincingly identified, should also receive lower priority. One needs to be careful; sweeping conclusions about which types of warfare or scenarios are supposedly obsolete and which are the wave of the future prove wrong at least as often as they prove correct.[71] Yet strategists must do their best to determine the most plausible future missions for the military; doing everything is unaffordable.

Such a broader look might examine not just what new systems need to be bought to ensure the health of a future defense industrial base, but also what production lines might be kept open. As an illustration, the fixed wing manned aircraft field is in the process of not only becoming a relative monopoly with the F-35 buy, but also spiraling in costs. Thus, it may make sense to keep the existing F-16, F-15, or F-18 lines open as part of a budget savings and defense industrial base policy.[72]

And of course, some level of stability in defense budgets would be desirable as well. At one level, this is an apple-pie recommendation that few would contest in the abstract. At another level, it is somewhat fanciful, as it implies that the world does not itself represent an exogenous variable in setting U.S. defense spending levels. But in the coming fiscal responsibility discussions, if defense is to be cut, a thoughtful and predictable trajectory would be advantageous to those concerned with planning and sustaining the national security industrial base.

CONCLUSIONS AND KEY QUESTIONS

As we explore the needs and future of the defense industrial base it is important to recognize that there is no one silver bullet solution to the challenges that range from how to manage an austere defense budget environment to how to solve long-term trends in fields that may not seem directly linked, but are foundational, like STEM education.

Even more, it is important to recognize that there are many questions that remain open in a sense, requiring greater study and analysis. These include:

- What is the range of probable levels of future American defense spending in the coming years, as well as the likely resources available for weapons acquisition?

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[69] For a good historical example of such a case, see Montgomery C. Meigs, *Slide Rules and Submarines: American Scientists and Subsurface Warfare in World War II* (Honolulu, Hawaii: University Press of the Pacific, 2002); on the more general challenge of promoting innovation within military bureaucracies, see for example Stephen Peter Rosen, *Winning the Next War* (Cornell University Press, 1991).

[70] The Nunn-McCurdy Amendment to the 1982 Defense Authorization Act triggers reviews of weapons when their estimated program cost exceeds by 50 percent original estimates. See Department of Defense, "Selected Acquisition Report (SAR) Summary Tables," Washington, D.C., April 2, 2010, p. 3, available at www.acq.osd.mil/ara/2009%20DEC%20SAR.pdf [accessed November 12, 2010].

[71] For a provocative and insightful, yet to my mind ultimately unconvincing, argument along these lines (making the case that great-power war planning is no longer nearly as important as it once was), see Thomas P. M. Barnett, *The Pentagon's New Map: War and Peace in the Twenty-First Century* (New York: G.P. Putnam's, 2004). I agree with Barnett that great-power wars are unlikely to be waged—but their likelihood can increase to the extent we fail to prepare for them and thereby fail to deter them.

[72] I would favor a mix of F-35 and F-16 as a cost-saving measure, buying fewer of the former than now planned. Others would advocate the F-15, or perhaps the F-18E/F, more capable planes, especially in certain scenarios against new Chinese threats. But their unit cost is at least 50 percent greater than the F-16s according to CBO ($75 million to $90 million for the Super Hornet, and about $50 million for the F-16). So the Super Hornet does not provide the economies available through the F-16. Budget Office, *Alternatives for Modernizing U.S. Fighter Forces* (Washington, D.C. May 2009), available at http://www.cbo.gov/ftpdocs/101xx/doc10113/05-13-FighterForces.pdf [accessed January 11, 2011].

- What apportionment of acquisition resources between procurement, on the one hand, and research, development, testing and evaluation on the other makes sense—and should the structure of contracts be changed to strengthen one process or the other?
- How can key innovation and design-team capabilities be retained even in an era of fewer new key program starts?
- How can industry-Pentagon dialogue, now probably too constrained, be best promoted in a manner consistent with tight ethics restrictions?
- Which specific areas of technological capability might require protection so that at least one to two key American suppliers remain? Relatedly, how can the defense industry subcontractor base be kept viable, including at the small-business level?
- Which export control reforms are needed?
- How can defense workforce excellence be retained—in terms of STEM competence, military experience, and financial and organizational acumen—as a key generation of workers and leaders retires in the coming years?

Throughout the process, American planners should remember that winning wars takes first and foremost great troopers, as well as excellent strategists to guide their operations and employment. But it also takes outstanding equipment and technology. We should neither lose sight of this fact nor consider the high quality of U.S. weaponry a God-given birthright of the American people and their men and women in arms.

ABOUT THE AUTHOR

Michael O'Hanlon is a senior fellow in Foreign Policy at the Brookings Institution, where he specializes in U.S. defense strategy, the use of military force, homeland security and American foreign policy. He is a visiting lecturer at Princeton University and adjunct professor at Johns Hopkins University. O'Hanlon's latest books are, *A Skeptics Case for Nuclear Disarmament* (Brookings, 2010), *Toughing it out in Afghanistan*, with Hassina Sherjan (Brookings, 2009), *The Science of War* (Princeton University Press, 2009) as well as *Budgeting for Hard Power* (Brookings, 2009). He is presently working on books on the defense budget and U.S. foreign policy, while contributing to Brookings' Iraq, Pakistan, and Afghanistan indices.

O'Hanlon's other recent books include *Hard Power: The New Politics of National Security* (with Kurt Campbell) and *A War Like No Other*, about the U.S.-China relationship and the Taiwan issue, with Richard Bush. His previous books include a multi-author volume, *Protecting the Homeland 2006/2007* (Brookings, 2006); *Defense Strategy for the Post-Saddam Era* (Brookings, 2005); *The Future of Arms Control* (Brookings, 2005), co-authored with Michael Levi; and a related book, *Neither Star Wars nor Sanctuary: Constraining the Military Uses of Space* (Brookings, 2004). Together with Mike Mochizuki, he wrote *Crisis on the Korean Peninsula* (McGraw-Hill) in 2003; he also wrote *Expanding Global Military Capacity for Humanitarian Intervention* (Brookings) that same year. O'Hanlon has written several hundred opeds in newspapers including The Washington Post, The New York Times, The Los Angeles Times, The Washington Times, and The Japan Times. He has also contributed to The Financial Times, The Wall Street Journal, and many other papers. O'Hanlon has appeared on television or spoken on the radio about 2,000 times since September 11, 2001. He is also a commentator for Alhurra television.

O'Hanlon was an analyst at the Congressional Budget Office from 1989-1994. He also worked previously at the Institute for Defense Analyses. His Ph.D. from Princeton is in public and international affairs; his bachelor's and master's degrees, also from Princeton, are in the physical sciences. He served as a Peace Corps volunteer in Congo/Kinshasa (the former Zaire) from 1982-1984, where he taught college and high school physics in French.