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The State of Defense Innovation in the United States: How to Cope in an Age of Austerity

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Innovation is perhaps the most important determinant of a nation's economic growth, international competitiveness, and security posture in the twenty-first century. Specifically, the U.S. national security posture (for at least the last six decades) has been based on "technological superiority." In this regard, it is important to recognize that innovation encompasses not only research and the creation of new ideas, but the demonstration, development, and effective implementation of these ideas into mission-enhancing new ("disruptive") products and services. Today, the relevant (security) innovations must not only be "mission enhancing," but also "affordable."

Due to recent problems in the U.S. economy and the actions of the Congress (e.g. "sequestration" legislation), the defense budget is experiencing severe reductions (along with future uncertainties); and the U.S. Department of Defense (DoD) is also seeing significant cuts in the "supplemental" dollars it had been receiving for the ongoing operations in Iraq and Afghanistan. (And, even with the declining force structure in these operations, current equipment is worn out and must be replaced.)

In addition, this squeeze on defense resources is being felt by many other nations (particularly in Europe). So the United States is being required to carry an even bigger share of the NATO load than in the past. Shifting the responsibility to our allies in this resource-constrained period is not an option for the United States

Unfortunately, economic problems in the United States are likely to grow worse, as every day ten thousand U.S. citizens age into social security, and the payment on the national debt continues to grow (by 2017, this payment alone is projected to equal the defense budget).

To compound the problem of a declining defense budget, costs continue to rise—for equipment, services (which now make up more than 50 percent of the DoD's acquisition dollars), government labor (military and civilian), energy, and healthcare.

So the first challenge becomes "what to cut," and the answer in prior defense budget reduction periods has been big cuts in travel, training, and research—that is, giving up the future to maintain what exists. This is clearly a disastrous choice. We must maintain the funding for research in order to assure DoD's future technological superiority.

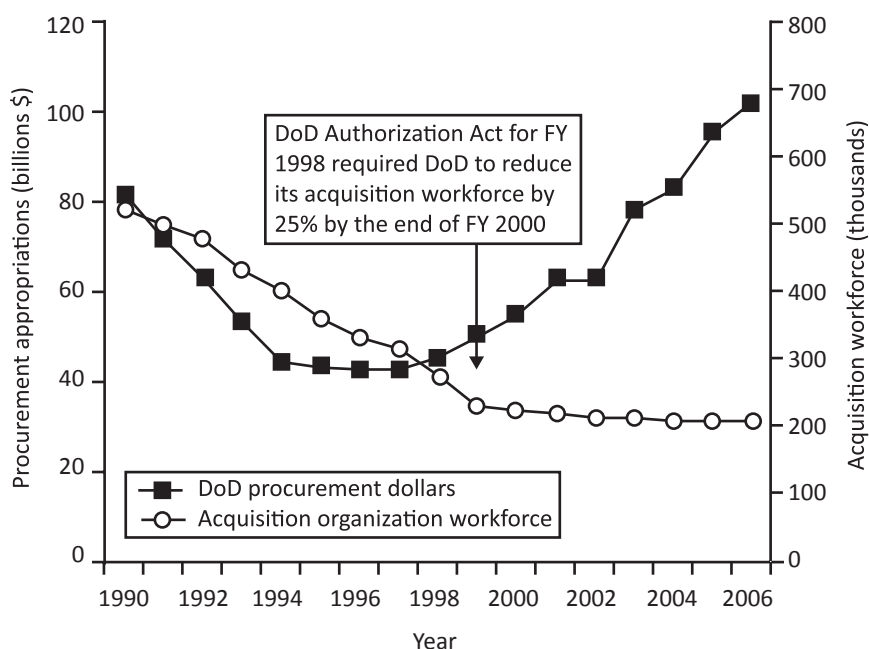
We are facing a rapidly-changing world—technologically, economically, geopolitically, and particularly in security—with a broad spectrum of security concerns—pirates, terrorists, cyber attacks, chemical, biological, and/or nuclear threats; IEDs (“roadside bombs”); regional instabilities; widespread proliferation; “loose nukes;” pandemics; struggles for scarce resources (energy, water, raw materials); violent religious extremism; and so on up to the threat of nuclear Armageddon—with much uncertainty as to what’s next.

To be able to effectively and efficiently respond to this new environment, and to encourage the needed changes that come from a renewed emphasis on innovation, we need a highly-skilled, trained, and experienced government acquisition workforce.

However, as Figure 1 clearly shows, in the last two decades this need has been greatly undervalued (by both Congress and the DoD)—and it is most obvious in the post-9/11 era, where the defense budget rose dramatically but the acquisition workforce remained below workable levels.

The problem is particularly critical at the senior levels, where retiring workers were replaced (for inherently governmental positions) with “interns.” Today, more than fifty percent of DoD’s acquisition workforce has less than five years of experience—and little, if any, understanding of industry. To compound the problem, there are few high-level senior officers (SESs), to “mentor” them. For example, the 2008 Commission on Army Acquisition and Program Management in Expeditionary Operations” found that:

- In 1990, the Army had five general officers with contracts background; in 2007 it had none.
- In 1995, the Air Force had 40 general officers in acquisition; in 2007 it had 21. The number of SESs dropped from 87 to 49.
- The Defense Contracts Management Agency went from four general officers to none; the staff went from 25,000 down to 10,000.



Source: Adapted from OSD, “Creating an Effective National Security Industrial Base for the 21st Century. Report of the Defense Science Board Task Force on Defense Industrial Structure for Transformation,” chair Jacques S. Gansler, July 2008, 43.

Figure 1. The DoD acquisition workforce has been greatly undervalued, and has declined (even as procurement appropriations increased).

In addition to the acquisition personnel issue, four critical considerations stand out among the many twenty-first century changes to the U.S. defense innovation landscape:

Globalization: The reality is that today technology, industry, and labor are truly globalized. Some examples: Much of the breakthrough technology is coming from multinational collaborative research (even as measured by patents filed); the sixth largest domestically-located U.S. defense firm, BAE, is headquartered in London; most major international defense firms have a presence in the United States (still the largest defense market); and most major U.S. defense firms are now global. Even labor is globalized: for example, many of the founders of Silicon Valley were not U.S. citizens and many of the outstanding graduate students and professors in the leading U.S. science and technology schools are not U.S. citizens. Likewise, many major U.S. universities are establishing overseas campuses, while many U.S. firms are establishing overseas research centers.

Coalition Security Operations: All conceivable future military scenarios will undoubtedly require coalition operations—for geopolitical, as well as practical, reasons. This means that the U.S. State Department will play a significant role (for example, in gaining international agreements regarding control of cyber security); and the DoD will have to agree to the multinational interoperability of systems and to multinational military commands and exercises in order to gain the large potential benefits of coalition operations.

Technological Leadership: In the past, the DoD often led the world in new innovations (for example, airplanes, the Internet, jet engines, computers, application of semiconductors, global positioning systems, and mass production). Today it is the commercial world (for example, in software, materials, electronics, among other sectors) where, in the United States alone, industrial R&D now is more than twice the total annual federal R&D expenditure.¹ In other words, the shift is from “spin-offs” to “spin-ons.” In many areas, the leadership is coming from other countries since today, total U.S. R&D (industry and federal) is less than a third of global R&D.² For example, where the United States used to “own the night,” today the French lead in night-vision devices—and there are many other examples of foreign leadership. In fact, today, every U.S. weapon system contains foreign parts—because they are better, not because they are cheaper.

Growing Dependence on Cyber: The commercial world’s rapid progress in performance and response time through smart, mobile devices, cloud services, broadband wireless networks, Big Data analytics, integrated, distributed sensors, and other new technologies all have great applicability for enhanced security operations (such as integrated systems-of-systems and superior intelligence). However, this raises growing concerns about cybersecurity both in the commercial world (power grids; air-traffic control, privacy issues) and in the security world, thus introducing the concept of “cyber warfare”—disruptions, deception, counter-intelligence, and other mainly covert operations.

Unfortunately, today (in the United States) there are laws, regulations, policies, and practices that create barriers to the DoD being able to change and to take full advantage of these trends: globalization of technology, industry, and labor; the need for future operations to involve coalitions; technological leadership often being in the commercial world and/or outside of the United States; and the need to capitalize on the potential of cyber, while assuring security and privacy.

Needless to say, change will not be easy. As Niccolo Machiavelli warned in the “The Prince” (in 1513):

It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage, than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old institutions and merely lukewarm defenders in those who would gain by the new ones.

¹ David Mowery, *Military R&D and Innovation* (Berkeley: University of California Press, 2007).

² National Science Foundation, S&E Indicators 2006; OECD, Main S&T Indicators database, November 2004.

So, we should expect—and are seeing—significant resistance to the needed changes from many sources:

- From Congress, which is stopping DoD-requested base closures, even though the force size is being cut back significantly, and stopping public/private competitions for non-inherently-governmental work, even though thousands of prior competitions yielded an average of more than 30 percent savings with improved performance, no matter who won.
- From government unions, which push the administration to reduce “outsourcing” and to push “insourcing.” For example, public sector workers push to continue maintaining DoD equipment even though the Congressional Research Service reports that it is 90 percent less expensive to have competitive, private sector firms do the maintenance.
- From the military. For example, for two years the Air Force refused to fund the Global Hawk, the first unmanned aircraft, even though unmanned systems are far less expensive.
- From incumbent defense firms, to maintain their current (twentieth-century) products—with the enthusiastic support of their Congressional representatives.

Clearly, this resistance must be overcome. To do so will require proactive leadership and management at multiple levels and perspectives, in the Office of the Secretary of Defense, OSD, contracting, the defense industry—and Congress.

Declining budgets and growing security concerns mean “doing more for less” while meeting the diversity of twenty-first-century global security needs. The keys to doing so are innovation and incentives. Innovation is a driver of significant change; for gains in effectiveness and/or efficiency—which could be in technology, or in process, or, most important, in thinking—to happen, incentives (for both government and industry) are required.

To successfully achieve such a “culture change,” two things are required:

1. Widespread recognition of the need for change.
2. Leadership, with a vision, a strategy, and a set of actions.

For DoD, the recognition of the need for change is spurred both by the declining defense budget and the realization that superior performance at lower cost is being demonstrated, every day, in the competitive, commercial world.

This growing awareness of the need for change is increasingly being acknowledged at all levels—beginning in the White House with “presidential initiatives” in such areas as: manufacturing (National Manufacturing and Manufacturing Institute Initiatives); materials (Materials Genome Initiative); changes in export controls; and provisions for foreign students/scholars to do government-sponsored fundamental research (National Security Decision Directive 189). At the same time, Congress has increased funding for Small Business Innovation Research (SBIR) and has been trying to help with provisions for “buying commercial.”

Similarly, in the Pentagon’s civilian leadership (beginning at the Secretary of Defense), there are initiatives such as “cost as a military requirement” and enhancing the acquisition workforce, and DARPA initiatives in bio-inspired computing, energy harvesting, advanced materials for computing, big-data analytics and visualization, and cyber security. Military initiatives in areas such as unmanned systems, modern logistics (as practiced in the commercial world), and recommending needed base closures are also underway.

In addition to the national security imperative, the need to stimulate innovation—for economic growth and global competitiveness benefits—is also being widely recognized in the United States at the state and regional levels, with initiatives such as “cluster developments,” “science parks,” economic development organizations and resources, and stimulation of university/industry/government-laboratory partnerships.

Unfortunately, but understandably, most of these initiatives are focused on the near term (“shovel ready”) versus the need for “vision, strategy, and actions” that are oriented toward the longer term, toward innovation and significant change.

On the positive side, Secretary of Defense Chuck Hagel has taken the lead in emphasizing the need for change, acknowledging in his Budget Request of April 11, 2013 that: “Today the Department of Defense faces the significant challenge of conducting long-term planning and budgeting at a time of considerable uncertainty... third year of flat or declining budgets... frenetic pace of technological change... opportunity to re-shape the military and reform defense institutions to better reflect 21st-century realities...”

What must be recognized is that this is a critical period, similar to the period following the launch of Sputnik or the fall of the Berlin Wall. Today, the security world is changing dramatically, especially post 9/11—geopolitically, technologically, commercially, in terms of threats, missions, and war-fighting—and a holistic perspective is required. Moreover, a decade of solid budget growth (see Figure 1)—which will certainly continue to be reversed in the new economic climate—had deferred difficult choices (between more twentieth-century equipment versus new, twenty-first-century equipment), thus continued, severe resistance to the necessary changes can be expected. Additionally, the controlling acquisition policies, practices, and laws as well as the Armed Forces’ budgets and “requirements” priorities have not been transformed sufficiently to match the needs of this new world. In fact, there is still an emphasis on “resetting” versus “modernization,” of “preserving” the industrial base versus “transforming” it, and of inadequate support for innovation.

Summary

For a strong national security posture in the twenty-first century, the United States must refocus on and adequately support its historic pillars of innovation strength:

- Protection of intellectual property
- Federal funding of research
- Research universities
- National laboratories, including the 100 DoD labs
- The private sector (large and small; defense and commercial)
- Venture capital, especially early stage, including government-sponsored (e.g. In-Q-Tel)
- Public-private partnerships (often including universities and/or national laboratories)
- Education and training of a skilled S&T workforce

The United States must overcome, and remove, the barriers to change (cultural, legislative, regulatory, and policy) through leadership (in both the Executive and Legislative branches) with a vision, a strategy, and a set of actions that emphasize, support, and incentivize innovation, and recognizing the realities of our globalized, twenty-first-century world and benefitting from them.

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