SSQ
STRATEGIC STUDIES QUARTERLY
SUMMER 2016 VOLUME 10, NO. 2

Commentaries

AIR UNIVERSITY

Strategic Studies Quarterly (*SSQ*) (ISSN 1936-1815) is published quarterly by Air University Press, Maxwell AFB, AL.

Strategic Studies Quarterly

An Air Force-Sponsored Strategic Forum on National and International Security

SUMMER 2016 VOLUME 10, NO. 2

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Sustaining and Enhancing the US Military's Technology Edge

The United States has long enjoyed a powerful military with a significant technological advantage, if not superiority, over its competitors and adversaries. The Department of Defense's (DOD) ability to develop and integrate new, cutting-edge capabilities like stealth, precision-guided munitions, and networked command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) has been a vital source of strength, agility, and confidence in our nation's armed forces. Along with the extraordinary quality of the men and women who serve in our all-volunteer force, our technological prowess has long been a distinct advantage that makes the US military the best in the world.

But, the United States can no longer take for granted its decisive technological superiority. Several factors conspire to challenge this traditional source of strength and advantage. Powers like China and Russia are investing heavily in new technologies and military capabilities specifically designed to blunt US strengths and exploit US vulnerabilities. Examples such as precision-guided cruise missiles designed to sink US aircraft carriers and theater ballistic missiles meant to deny the United States use of regional air bases will challenge US power projection in multiple theaters. Advanced networked radars threaten to uncloak our stealthiest aircraft. Electronic warfare, cyber, and space systems promise to degrade or even cripple our C4ISR. Some of these capabilities are coming on line now, while others will appear in the next 5–15 years. Many technologies and capabilities that have given the United States a comparative advantage over potential adversaries in the past are now proliferating to an increasing number of states and nonstate actors, including terrorist groups. These include military-grade unmanned systems, access to Global Positioning System (GPS) data, commercial communications, space capabilities, and networked intelligence, surveillance, and reconnaissance (ISR). The rapid pace of this proliferation is creating a potentially dire situation.

What's more, many technologies that will define the next cutting-edge advancements of the twenty-first century are not being developed within the DOD or even within the US defense industry but in the commercial sector by companies ranging from giants like Google, Amazon, SpaceX, and Apple to start-ups no one has heard of yet. This is

particularly true in the dynamically changing area of information technologies. The problem is, the DOD has yet to determine how to fully leverage the dominance and innovation of the US tech sector in support of sustaining and enhancing the US military's edge.

The battle to sustain and enhance the US military's technological superiority has begun. What happens in the remainder of this administration and the next one will profoundly affect the outcome. The next commander in chief, regardless of political affiliation, should come into office with a proactive agenda to work with Congress and industry to protect and advance the US military's technological superiority. The decisive factor in this quest will be the extent to which the existing system can exploit rapid technology cycles and be made agile enough to field military capabilities faster and more affordably than ever before. Part of this strategy should include the following 10 actions:[1]

1. **Create a sense of urgency and focus across the DOD leadership and workforce**. The department needs a clear vision for sustaining US technological superiority and should approach this objective with an intensity akin to that of the Manhattan Project or the Apollo Program. Building upon recent actions by Congress and DOD leadership, the next secretary of defense should partner with the chairman of the Joint Chiefs of Staff and military services to develop and implement a shared roadmap to this end. Particular priority should be given to recruiting senior political appointees and military leaders with the requisite technology, procurement, and management expertise to drive transformational change. Priority should be given to leaders with proven track records of innovative thinking, risk tolerance, and results. To enhance the agility and responsiveness of acquisition, defense leaders should consider implementing a "team of teams" approach, similar to the successful Joint Special Operations Task Force model. This approach relies upon inculcating a shared consciousness or mind-set for innovation, empowering decentralized decision making, and then being willing to take and reward risk.[2] The DOD should also take stock of the various organizational approaches that different components, such as the Air Force Rapid Capabilities Office, which runs the Long-Range Strike Bomber program, have established for rapid acquisition to identify lessons learned and best practices.[3]

2. **Build upon the momentum of current DOD efforts rather than starting with a clean sheet of paper**. The Obama administration and the Pentagon leadership in particular have made important strides toward implementing a third "offset strategy" that is focused on sustaining the US military's superiority, especially global power projection, in the face of adversaries' antiaccess/area-denial strategies.[4] For example, Secretary of Defense Ash Carter created the Strategic Capabilities Office (SCO) to rapidly field new capabilities by primarily leveraging existing weapon systems and is recommending $902 million in the DOD's FY17 budget request for the SCO.[5] The department has begun to scale best practices of the Air Force Rapid Capabilities Office into the US Army and US Navy to accelerate other high-priority acquisitions that are necessary for the strategy.[6] The DOD's FY17 budget request ($12.5B), respresents a 25-percent increase over FY2000, and also proposes $64.9 billion for science and technology (S&T) in the Future Years Defense Program.[7] These research and development initiatives will build upon those started by the FY16 National Defense Authorization Act (NDAA) to develop directed-energy, high-speed munitions, autonomous systems, undersea capabilities, and other technologies to counter adversary advantages.[8] The next leadership team should maintain momentum on the third offset strategy, protect critical rapid acquisition organizations and their programs, and look for ways to accelerate these as a matter of highest priority.

3. **Create a healthy competition of ideas focused on solving the toughest challenges the US military will face in the coming decades**. Too often, the DOD lets "the tyranny of consensus"—the overriding bureaucratic tendency to drive toward lowest-common-denominator answers that everyone can agree on—constrain its efforts to identify promising capabilities and concepts of operations for solving difficult military problems.[9] Fear of unhealthy interservice rivalry can prevent the healthy competition of ideas that drives innovation. At times, the large, complex Pentagon bureaucracy complicates decision making to the point that decisions are delayed or watered down to reach consensus without sufficient opportunity for senior leaders to hear and consider dissenting opinions and alternatives. Instead, DOD leadership should encourage a norm of critical appraisal within the DOD culture and include realistic options and

share dissenting views when seeking a senior leader decision. A good model today is the secretary of defense's deployment orders process, which fully and fairly represents nonconcurrence or the dissent of affected combatant commands and services.[10] Historically, the process George Kennan used to create the Marshall Plan serves as a great example of how to compete ideas and prepare alternatives for a senior decision maker.[11] To further explore competing ideas, the next administration should expand on recent efforts by the Office of the Secretary of Defense (OSD) and the services to incentivize and elevate the use of war gaming, red teaming, and genuine experimentation to generate new options for addressing priority challenges.

4. **Eliminate the barriers between those who define requirements, those who acquire systems, and those who will ultimately use them**. Today, different communities representing force providers, combatant commands, acquisition professionals, and technologists are often isolated from one another in stovepiped organizations and follow sequential decision-making processes. Too often, the artificial separation of these personnel complicates, if not cripples, the department's ability to make smart capability-cost-schedule tradeoffs. This is particularly true for less than fully mature technologies that are still in development as early stage acquisition begins. In these cases, it may make sense to form integrated teams drawn from the requirements, technology, acquisition, and end-user communities to consider trade-offs during program creation and execution. US Special Operations Command (USSOCOM) provides a superb example of how requirements, acquisition personnel, and experienced operators work together to rapidly deliver new capabilities.[12]

   Another key step toward integrating requirements and acquisition processes is the recent move by Congress to strengthen the role of the service chiefs in acquisition. As a result, the service chiefs who are responsible for organizing, training, and equipping and who are the customers of the acquisition process, now have greater responsibilities to balance cost, schedule, and performance along with deciding requirements.[13] Five major independent studies of acquisition oversight and management, including one by the Defense Business Board, recommended greater responsibilities by service chiefs in acquisition.[14] Furthermore, the Government Accountability Office reports a strong correlation between acquisition performance and

strong leadership, especially by top leaders who control requirements growth, stabilize funding, and streamline decision making.[15] Over the next few years, the DOD should assess whether increasing the service chiefs' involvement in the acquisition process translates into better execution of more high-priority programs.

5. **Create "safe space" for deeper dialogue and engagement with industry, both traditional defense industry and commercial companies**. The current litigious environment, in which nearly every major procurement decision begets a protest, has effectively silenced much of the brainstorming and shared problem solving that used to occur between DOD leaders and their counterparts in industry. Ironically, the deep collaboration between the DOD and industry that made the first and second offset strategies possible—with innovations in nuclear, stealth, and precision-guided munitions programs—would not be allowed today.[16] In recent years, it has become increasingly difficult for senior DOD officials to have candid conversations with industry leaders about the problems the US military is grappling with and what the art of the possible might be in terms of the future capabilities industry may be able to offer. When the customer cannot have reasonable conversations about requirements with potential suppliers, both the government and suppliers risk wasted effort at the expense of the US military's technological superiority. The DOD and industry require better mechanisms to enable this absolutely critical conversation to occur without being seen as biasing future procurement decisions. Therefore, the next DOD leadership team should work with the DOD general counsel and key overseers in Congress to carve out more space for communication and collaboration with industry while ensuring fairness in the market place.

6. **Increase investment in basic activities that tend to drive innovation within the DOD.** Priority should be placed on pilot programs, expanded use of prototyping, and funding to transition promising efforts in high-priority areas into either rapid acquisition pipelines or service programs of record. The DOD's primary focus in this regard should be on operational prototyping that cycles more capability into the field for operators to learn what does and does not work.[17] Through large force exercises such as Red Flag and Green Flag, war fighters can drive innovation by trying out prototypes and sharing results with the acquisition community.[18] To make this possible, war

fighters must adopt higher risk tolerance for trying new equipment and concepts in exercises and the field. They must also expedite their fielding processes and, perhaps, create their own rapid fielding organizations to accelerate training and deployment readiness to match the expected pace of innovation. Prototyping and subsequent field upgrades will only get faster once the defense enterprise expands the open systems architecture (OSA) approach proposed in the Acquisition Agility Act of 2016.[19] With higher priority on OSA, a greater number of suppliers are likely to generate more materiel solutions on shorter timelines.[20] Clearly, iterative and operational prototyping will be vital to the DOD's ability to exploit rapid technology cycles for addressing a complex, dynamic operational environment.

7. **Enhance the DOD's ability to work with the most innovative companies in the commercial tech sector.** Secretary Carter deserves high praise for the spotlight he has placed on this issue, as it is absolutely critical to extending and expanding our technological advantage. His successor should aim to build on his efforts, both by enhancing external outreach and tackling obstacles to innovation internal to the department. For example, the vision of the Defense Innovation Unit Experimental's roles as a technology scout and a facilitator of relationships between Silicon Valley firms and potential customers across the DOD should be clarified. The organization should be given the leadership, authorities, resources, and staffing it needs to be successful. Next, the DOD should expand its use of nontraditional mechanisms like prizes, challenge grants, and hack-a-thons to create concrete opportunities for tech companies to use their own problem-solving approaches to help the department solve its toughest problems. The DOD should also make available its significant and often unique resources to the commercial tech sector in the same way it did for Silicon Valley from the 1940s through the 1970s. This means access to the DOD's advanced testing and lab facilities throughout the United States as well as access to government intellectual property for potential commercial and military applications.[21] The defense arena offers the opportunity to solve some of the hardest problems in human history such as in information security, military operations at computer speeds rather than human speeds, and many others. Solutions to these challenges

have the potential to create new product lines beneficial to both the commercial tech sector and to US military superiority.

8. **Increase the use of rapid, more-flexible acquisition authorities to accelerate acquisition.** In the FY16 NDAA, Congress provided the department with several approaches to accelerate DOD acquisition, such as other transaction authorities, rapid acquisition authority, rapid prototyping and fielding authority, use of alternate acquisition paths to acquire national security capabilities, acquisition authority for US Cyber Command, experimental authority, and secretary of defense waiver authority.[22] All of these provisions reflect historical congressional actions, including the 1926 Air Corps Act to energize the nascent aviation industry, the creation of the National Aeronautics and Space Administration to accelerate space capabilities, and granting mechanisms to the Defense Research Projects Agency for addressing strategic surprise.[23] Given this Congress's intent to ensure the United States maintains military-technological dominance, this secretary and the next should identify every opportunity for the DOD to use these authorities. Doing so will almost certainly require more training and clear incentives for government program offices to more fully leverage these authorities. However, too often in the DOD these authorities are not well known or understood, seen as risky to use, or both. Visibly rewarding those who depart from the path of least resistance to take some risk to get better results for the war fighter can be a powerful way to incentivize greater use of these authorities. The FY16 NDAA represents bold action toward a more-innovative defense department. For the next NDAA, the DOD and Congress should consider greater budget flexibility, as needed, for establishing programs faster than the two-year lead time driven by the program of record process.[24]

9. **Empower professionals in all stages of the process and strengthen accountability for performance in acquisition**. Nearly every acquisition-reform study written in the last several decades has emphasized the importance of increasing performance measures and accountability in the system. Indeed, this is critical to improving the DOD's ability to deliver needed war-fighting capabilities on schedule and within budget. But despite myriad reforms aimed at this very issue, too little progress has been made. The next secretary should consider a number of steps to enhance empowerment

and accountability in the acquisition system, including but not limited to clarifying roles and responsibilities, streamlining decision-making processes, delayering the acquisition oversight staffs within each service and the OSD, decreasing the number of management reviews and reports levied on those who execute programs, eliminating incentives that drive risk-averse behaviors that often add cost and time to programs, and creating clear performance measures and data-driven dashboards to evaluate performance. Measures should also include doubling down on the professionalization of the acquisition corps by more fully leveraging outside business education and exchange tours in industry, increasing deployments to better understand how weapons systems contribute to operations and strategy, lengthening the tours and modifying the career paths of acquisition professionals to enable more stable and accountable program management, aligning incentives to desired behaviors, and basing promotions on clear performance metrics rather than time in grade. For the highest-priority acquisitions, the next secretary should consider significantly streamlining the chain of command.

10. **Support and accelerate Congressional efforts to reform the acquisition system**. The DOD has a rare opportunity to seize a moment of bipartisan and bicameral consensus that the acquisition system can and must be improved. The House and Senate armed services committees, Secretary Carter, and Under Secretary of Defense for Acquisition, Technology, and Logistics Frank Kendall all deserve credit for having taken meaningful steps in acquisition reform to address US military technological superiority. With engaged leaders in both the Senate and the House, the next team of DOD leaders should work intensively with key members to 1) remove remaining obstacles to more rapid and efficient acquisition of the most critical capabilities, 2) give acquisition officials the training and incentives they need to fully leverage a more diverse and appropriate set of authorities and tools adapted to twenty-first-century realities, and 3) eliminate layers of past requirements and reforms that have not worked but create a real drag on the system.

The next president and Congress will inherit a stark and sobering responsibility: their actions (or inaction) will likely determine whether or not the US military keeps its technological superiority in the face of a more-challenging future. In addition to the specific actions recom-

mended above, perhaps the most important step they could take up front would be to conclude a comprehensive budget deal. The basic elements of such a deal are well known: tax reform, entitlement reform, and increased investment in the drivers of American economic growth and competitiveness. The missing piece in this highly polarized political environment is political courage and leadership on both sides of the aisle and at both ends of Pennsylvania Avenue to reach a sensible compromise that will move us forward as a nation. After several years of living under a Budget Control Act that tries to solve the country's debt problem on the back of discretionary spending (half of which is in the DOD) and has brought us government shutdowns, sequestration, and governance by continuing resolutions and two-year mini-budget deals, the damage to our national security enterprise is becoming real. To be clear, we cannot succeed in maintaining our technological edge and our military superiority unless we have a more stable and healthy defense budget along with a more innovative and responsive acquisition system that allow the DOD to invest in the future capabilities needed to protect our interests and sustain our leadership globally. Now is the time for pragmatic compromise to protect our national security, but time is running short. SSQ

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Notes

1. Our Center for a New American Security colleagues Shawn Brimley and Ben FitzGerald reviewed our draft and helped guide our writing—especially with the context of the third offset—and hone our arguments throughout the recommendations.

2. Stanley A. McChrystal et al., *Team of Teams: New Rules of Engagement for a Complex World* (New York, New York: Portfolio/Penguin, 2015), 164.

3. Randy Walden, "Rapid Prototyping: Leapfrogging into Military Utility" (presentation, 9th Annual NDIA Science & Engineering Technology Conference, 16 April 2008), http://www.dtic.mil/ndia/2008science/Day2/03Walden.pdf. Established in 2003, the Air Force Rapid Capabilities Office (AFRCO) utilizes a number of best commercial practices and novel organizational paradigms for rapid acquisition. The AFRCO employs iterative prototyping, empowers small teams with decision-making authority, and responds directly to high priority combatant command and Air Force requirements. The Air Force provides the AFRCO with streamlined reporting to a board of directors comprised of the secretary of the Air Force, the chief of staff, and the under secretary of defense.

4. The first offset refers to President Dwight Eisenhower's New Look Strategy in the 1950s, which relied on investments in and fielding of nuclear capabilities to deter the Soviet Union.

The second offset refers to Secretary of Defense Harold Brown's strategy in the 1980s, which proposed technology, such as stealth and precision weapons, as the answer for the Soviet Union's numerical superiority in conventional forces. The third offset refers to US investments in technology to preserve its conventional military superiority in the face of proliferating antiaccess/area-denial capabilities. See Robert Work, "Deputy Secretary of Defense Speech: The Third U.S. Offset Strategy and Its Implications for Partners and Allies" (speech, Willard Hotel, Washington, DC, 28 January 2015), http://www.defense.gov/News/Speeches/Speech-View/Article/606641/the-third-us-offset-strategy-and-its-implications-for-partners-and-allies.

5. Comptroller, *Defense Budget Overview: Department of Defense Fiscal Year 2017 Budget Request* (Washington, DC: Department of Defense, 2016), 5–6.The DOD budget request proposes seven Red Flag and 18 Green Flag exercises. Red Flag enables USAF to train for major air combat by integrating large numbers of aircraft and joint force capabilities. Similarly, Green Flag provides training for air-to-ground integration. Both can provide significant data and lessons learned for requirements and acquisition recommendations.

6. Robert Work, "Deputy Secretary of Defense Speech: China Aerospace Studies Institute" (speech, RAND Corporation, Arlington, VA, 22 June 2015), http://www.defense.gov/News/Speeches/Speech-View/Article/606683/china-aerospace-studies-institute.

7. Stephen Welby, Assistant Secretary of Defense for Research and Engineering, *Accelerating the Development of Military Capability through Innovative Defense Research and Development, Testimony before the Subcommittee on Emerging Threats and Capabilities, Armed Services Committee, House of Representatives*, 114th Cong., 2nd sess., 24 February 2016, http://docs.house.gov/meetings/AS/AS26/20160224/104518/HHRG-114-AS26-Wstate-WelbyS-20160224.pdf.

8. OSD Comptroller, *Defense Budget Overview*, 49.

9. Michèle A. Flournoy, CEO and Cofounder, Center for a New American Security, *The Urgent Need for Defense Reform, Testimony before the Senate Armed Services Committee*, 114th Cong., 1st sess., 8 December 2015, http://www.cnas.org/sites/default/files/publications-pdf/Flournoy_SASC-Written-Statement-Dec-2015.pdf.

10. Ibid.

11. Irving L. Janis, *Groupthink: Psychological Studies of Policy Decisions and Fiascoes*, 2nd ed. (Boston: Houghton Mifflin, 1982), 166–67.

12. The USSOCOM acquisition organization demonstrates agility through a number of best practices. Acquisition personnel routinely and significantly interact with requirements and operational personnel while establishing and executing acquisition programs. The organization also uses information technology to provide transparency about program status, shattering the typical information barriers that exist between stakeholders. Leadership sets high expectations for and fosters a mind set throughout the special operations acquisition force. James Geurts's briefing asserts acquisition performance at less cost, less time, and at a fraction of the personnel as compared to conventional acquisition programs. See James "Hondo" Geurts, "Special Operations Research, Development, & Acquisition Center" (presentation, Armed Forces Communications and Electronics Association, 2014), http://www.afceaboston.com/documents/documents-briefings/SOCOM%20AFCEA%20Brief%202014.pdf.

13. National Defense Authorization Act for Fiscal Year 2016, 158, https://www.congress.gov/bill/114th-congress/house-bill/1735/text.

14. Michael J. Sullivan, *Defense Acquisitions: Observations on Whether or Not the Service Chief's Role in Managing and Overseeing Major Weapons Programs Should Be Expanded* (Washington, DC: Government Accountability Office, May 2014), http://www.gao.gov/products/GAO-14-520.

15. Michael J. Sullivan, *Report to the Committee on Armed Services, U.S. Senate: Strong Leadership Is Key to Planning and Executing Stable Weapon Programs* (Washington, DC: Government Accountability Office, May 2010), http://www.gao.gov/new.items/d10522.pdf.

16. The first offset refers to the threat of massive, offensive striking power from nuclear weapons to deter the numerically superior, in military terms, Soviet Union. See James S. Lay Jr., *National Security Council Document 162/2* (Washington, DC: National Security Council, 1953), 6–8. The second offset refers to use of technology, particularly stealth and precision weapons, to offset numerically superior military forces. See pages ix–x in Harold Brown, *Department of Defense Annual Report Fiscal Year 1982* (Washington, DC: Defense Technical Information Center, 19 January 1981), http://www.dtic.mil/dtic/tr/fulltext/u2/a096066.pdf.

17. Bill Greenwalt, interview by Robert P. Lyons III, 19 February 2016. Mr. Greenwalt and Lt Col Lyons exchanged electronic correspondence about the importance of operational prototyping in this latest round of acquisition initiatives. Greenwalt suggested getting more prototypes to the war fighters for learning and product refinement. The validity of this approach is supported by historical examples such as the US Air Force's experience with fielding the first air force gunships during the Vietnam War and Lt Gen George Kenney's experience with innovation during the Pacific Campaign in World War II.

18. OSD Comptroller, *Defense Budget Overview*, 3–11.

19. Cong. Mac Thornberry (R-TX) introduced a bill, titled the Acquisition Agility Act of 2017, to the House Armed Services Committee. The bill includes language mandating open systems architecture (OSA) in acquisition strategies and during program execution. OSA is a set of published interface standards or open standards for building systems or components. OSA should allow more rapid replacement of obsolete hardware and software as a weapons system ages. See pages 1-9 in Acquisition Agility Act, 2nd.

20. Katherine Blakeley, "Thornberry's 'Bold' Bill May Speed, Improve Buying Weapons," *Breaking Defense*, 15 March 2016, http://breakingdefense.com/2016/03/thornberrys-bold-bill-may-speed-improve-buying-weapons/.

21. Greenwalt interview. Greenwalt is a professional staff member of the Senate Armed Services Committee. He brought over 34 years of experience to help the Senate prepare the FY16 National Defense Authorization Act.

22. National Defense Authorization Act for Fiscal Year 2016, 159–76.

23. Richard Dunn, interview by Robert P. Lyons III, 19 February 2016. Mr. Dunn served as the first general counsel of the Defense Advanced Research Projects Agency and previously as a general counsel at NASA and as an USAF judge advocate. He explained the history of acquisition provisions since the Air Corps Act of 1926 through the FY16 NDAA.

24. Bill Greenwalt, personal communications with Robert P. Lyons III, 25 February 2016. Greenwalt's correspondence with Lt Col Lyons described the benefits of budget flexibility to transitioning capabilities. Without the flexibility, the defense program of record process requires a two-year lead time to get any new effort into the defense budget. Colonel Lyons's experience as a program manager also reveals the importance of budget flexibility. The DOD budget process does have annual OSD-level reprogramming actions, below-threshold reprogramming, above-threshold reprogramming, and New Start processes when necessary. However, sometimes urgent requirements emerge due to changes in the operational environment. Important changes also occur in the commercial market with advancements in technology or unexpected obsolescence. Sometimes the traditional budget authorities are not fast enough to reduce the two-year lead time.

Why US Nuclear Force Numbers Matter

The US debate about nuclear forces and policy often descends into arcane details. These details can be important, but it also is important to address a basic question: For effective deterrence, does the United States need greater numbers and different types of nuclear capabilities than the very limited numbers and types of nuclear weapons deemed necessary to threaten an opponent's society? While it appears incongruous, a minimum US nuclear deterrent typically is defined as a second-strike, or retaliatory, capability sufficient to threaten the destruction of an opponent's societal or urban/industrial assets, such as "a nation's modern economy, for example, electrical, oil, and energy nodes, [or] transportation hubs."[1]

That adequacy standard for deterrence—the nuclear capabilities necessary to threaten the destruction of an opponent's societal assets—is "easy" to meet in quantitative and qualitative terms given the high vulnerability of unprotected, fixed societal targets to nuclear strikes.[2] Indeed, the number of US second-strike weapons typically considered adequate to meet a minimalist standard for deterrence ranges from "several" weapons to hundreds of weapons.[3] Such numbers are modest compared to the approximately 2,000 US nuclear weapons reportedly now deployed.[4]

Minimalists typically criticize as unnecessary and destabilizing US nuclear capabilities beyond those necessary for threatening opponents' societies and populations. Indeed, these are the criticisms now leveled against the Obama administration's fledgling US nuclear modernization programs.[5] The connection between the advocacy of minimal US nuclear capabilities and a deterrence policy of targeting opponents' societies has been explicit for decades. For example, in 1961 a prominent academic commentator observed, "Would the Soviets be deterred by the prospect of losing ten cities? Or fifty cities? No one knows, although one might intuitively guess that the threshold is closer to ten than to either two or fifty."[6]

More recently, two prominent commentators recommended a US "responsive force" of 400–500 nuclear warheads because this number of weapons would be adequate to target Russian sites, "affecting industrial recovery—the major nodes in the electric power grid and air, ground,

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This article is a revised version of the original published by the National Institute for Public Policy, Information Series (http://www.nipp.org/wp-content/uploads/2016/03/IS-404.pdf).

and rail transportation systems, as well as major industrial sites."[7] In 2010 a minimum deterrence-oriented assessment by US Air Force personnel concluded that a US nuclear force of "311 weapons" would be more than adequate because, "there is not a state on the planet that could withstand that sort or punishment or a leader who would run that sort of risk."[8]

The critical question here is, how much is enough for effective deterrence? As illustrated above, precise answers derived from the minimum deterrence approach range from several weapons to hundreds. However, every Republican and Democratic administration for five decades has rejected this minimalist standard for and approach to nuclear deterrence.[9] There are six basic reasons for rejecting the minimalist standard of adequacy for US nuclear capabilities that everyone who cares about this subject should understand.

First, as illustrated above, there are many confident claims regarding the number of nuclear weapons adequate for deterrence. The problem with all such claims is that no one knows with precision the minimal US nuclear capability necessary to deter attack—now or in the future. Omniscience would be required to predict how many and what types of weapons will deter across a spectrum of circumstances and opposing leaderships. And, if that number somehow could be known, it would likely change rapidly with shifting circumstances. That is, the US requirement for effective deterrence is not some known, set number of weapons or capability; it will change depending on the opponent, the time, and the context.[10]

Developments in circumstances that can shift deterrence requirements may be technical, political, operational, or even personal to a given leadership. For example, the possibility that a US nuclear system could experience an unexpected reliability problem that would disable or degrade US weapons may best be mitigated by having a level of diversity and overlapping capabilities in the deterrent arsenal. This factor alone could lead US force requirements beyond the typical minimal definitions of adequacy. The goal of preventing nuclear war is so crucial that it is better to hedge with flexible, diverse, and overlapping capabilities rather than risk the failure of deterrence due to unknown or unpredictable developments or otherwise having too few or the wrong types of nuclear forces needed to deter. We should not plan only for a minimal US deterrent because no one knows what that capability is or how deterrence requirements may shift. Correspondingly, every US administration during the

last five decades has concluded that US nuclear deterrence forces should be diverse, flexible, and overlapping to help ensure the US always possesses the capabilities necessary to deter attack across a wide spectrum of threats and shifting circumstances.[11]

Second, to pose a retaliatory deterrent threat, US nuclear forces must be able to withstand an opponent's "first-strike" attack. US forces manifestly vulnerable to a first strike would be useless as a retaliatory deterrent threat. Hence, the US deterrent must be sufficiently large and diverse to survive—under all conditions—a nuclear first strike by a determined foe. This requirement has led to a long-term consensus in favor of ensuring the United States possesses a sufficient number of nuclear weapons to survive an attack and a diverse nuclear triad of platforms for those weapons—nuclear bombers, sea-based ballistic missiles and land-based, intercontinental ballistic missiles. The diversity of this overlapping triad of nuclear systems, with their different operations and locations, helps to ensure that under all conditions an opponent could not reasonably anticipate destroying the US retaliatory nuclear deterrent in a first strike. This is one of the rationales for and great values of the US nuclear triad that again takes US nuclear requirements beyond the numbers typically associated with a minimum deterrent.

Third, as noted above, intentionally planning to destroy societal or urban-industrial centers establishes a minimal, easy-to-meet set of deterrence requirements for US nuclear capabilities. But, it also involves intentional threats to kill innocents and noncombatants on a massive scale. Thus, it is widely considered immoral, a potential violation of international law, and inconsistent with the Just War tradition. Instead, the United States should strive for deterrence capabilities that are not limited to or dependent upon threatening opponents with societal destruction. The US nuclear deterrent should instead have the diverse and flexible nuclear capabilities necessary to pose a threat to a variety of other types of targets and, indeed, to avoid to the extent possible an opponent's societal centers—thereby potentially minimizing the destruction of an opponent's innocent noncombatants. This deterrence standard again imposes US force requirements that are likely more diverse qualitatively and larger quantitatively than typically is deemed adequate to meet the minimal deterrence standard of threatening the destruction of an opponent's population and societal assets.

It should be noted that this particular point stings advocates of minimal US nuclear capabilities. They clearly want to avoid being charged with advocacy of an approach to deterrence that so offends all humanitarian concepts. Consequently, they often claim in response that the types and scale of US nuclear capabilities and the targeting plans underlying US deterrent threats essentially make no real difference in the prospective level of societal destruction in a nuclear war. If so, then a minimal deterrent is no guiltier of violating humanitarian norms than other approaches to nuclear deterrence.[12] There is, however, no doubt whatsoever that the types of nuclear weapons and targeting plans can dramatically affect the levels of destruction and casualties—with the weapons and targeting plans advocated by minimalists unsurprisingly causing the greatest levels of societal destruction. Many careful studies over decades have reached this conclusion.[13] The United States should not help ensure that any use of nuclear weapons leads to unmitigated levels of societal destruction by adopting an approach to deterrence that is *"easy"* simply because societal targets are so vulnerable to nuclear weapons that few are needed to threaten such targets.

Fourth, and related to the above, for US deterrence strategies to function most reliably, the US deterrent must be able to threaten retaliation against those potentially different types of assets that opponents value most highly. In some cases, the minimalist deterrence threat to destroy an opponent's societal infrastructure as the basis of US deterrence strategy will not threaten what an opponent values most. There are many historical examples wherein leaders have willingly and knowingly accepted a high risk of societal destruction in pursuit of a goal judged to be more important than avoiding that risk.[14] In short, threats against an opponent's society embraced by minimalists may deter in some cases; however, in other cases, the opposing leader's goals and values may suggest an alternative approach to deterrence is necessary and require more and different types of US nuclear forces.

During the Cold War, for example, US deterrence policy reportedly was based in part on the expectation that Soviet leaders placed highest value not on urban-industrial centers but on their political and military assets, including the Soviet control structure itself and Soviet military/nuclear capabilities. As the Carter administration's secretary of defense, Harold Brown, said in 1980, the US deterrent should be capable of posing a threat to "what the Soviets consider most important to them,"[15]

which could include Soviet conventional and nuclear military forces, the Soviet political and military control structure, and military industry.[16] Thus, US forces had to be large enough and possess the diverse qualities necessary to threaten, for deterrence purposes, the military and political assets apparently valued most highly by the Soviet leadership—which were numerous and often protected. This was a standard for US deterrent forces well beyond the relatively small number of weapons typically deemed adequate to meet the minimal deterrence standard of threatening society.

In today's international threat context, there is no reason to assume that current and future opponents, potentially including Russia and China, will not similarly place greatest value on numerous assets that are realistically vulnerable only to US nuclear threats and impose higher standards of adequacy on US deterrence capabilities than a minimal deterrent can.[17] Again, because the US goal of deterring war is so critical, the size and diversity of the US nuclear arsenal for effective deterrence must be maintained accordingly.

Fifth, the minimum deterrence approach to sizing US nuclear forces provides little, if any provision for the failure of deterrence. For example, in most plausible contingencies, it would provide a president only the most miserable options possible if the United States or allies were to suffer a nuclear attack. In the event of a nuclear attack, a president certainly would want the scope and size of any US response to help discourage any further nuclear escalation by the opponent. Yet, retaliating against, say, many Russian or Chinese societal targets—per minimum deterrence notions—would be likely to undo whatever targeting restraint Moscow or Beijing might have practiced in the initial attack and would do little or nothing to protect the United States from further attack. In 1962 Secretary of Defense Robert McNamara emphasized precisely this point: "In the event of war, the use of such a force against the cities of a major nuclear power would be tantamount to suicide."[18] Similarly, in 1967, then-Secretary of the Air Force (and later Secretary of Defense), Harold Brown said, "the execution of the option to destroy Soviet population and industry would be our poorest choice."[19] There remains almost no conceivable circumstance in which US retaliation against numerous societal targets in the event of an initial Russian or Chinese attack could help to restore deterrence and limit the carnage. The president, instead, would want flexible and diverse US nuclear retaliatory options to have available

a response best suited to the crisis and to limiting further escalation and levels of destruction.

The hope that escalation can be limited in the event of war may be a faint hope, but the United States should not be limited, by the narrowness of its capabilities and rigidity of its planning, to a response that would likely ensure that nuclear escalation proceeds unabated. Again, the US deterrence goal should be, and has been, to have flexible and diverse response options for the purpose of deterring further escalation and limiting damage,[20] not the very narrow types of responses imposed by a minimum deterrence approach to sizing US forces. This point is not a rejection of deterrence or a call for a US "nuclear war-fighting" policy as some continually and mistakenly charge;[21] it is a call for diverse US capabilities that make available to the president a variety of options best suited for deterrence and reestablishing deterrence and limiting nuclear escalation in the event deterrence fails. Once again, this goal can require a US arsenal well beyond the number and types of weapons deemed adequate for minimum deterrence.

Finally, the United States has formal extended deterrence responsibilities to provide a "nuclear umbrella" for more than 30 allies. Many of these allies (particularly those in close proximity to Russia and China) consider the US nuclear umbrella essential to their security. However, a minimalist US nuclear deterrent capability limited to threatening an opponent's society may be judged incredible—as in, not believed by the opponent—as an extended deterrent, because of the well-recognized US desire to limit civilian destruction in its military operations and, again, because of the likelihood that a US nuclear response against an opponent's society could lead that opponent simply to launch strikes in return against US urban-industrial centers. In this case, a US extended deterrent threat focusing on an opponent's society essentially would be, as Secretary McNamara warned, a US threat to commit national suicide on behalf of an ally. Opponents may understandably doubt that any US president would ever choose to proceed along such a course. Indeed, former Secretary of State Henry Kissinger long ago publicly explained to allies that they should *never* expect the United States to follow such a course.[22] Even if the United States clearly possesses a minimal deterrent capability, an opponent's doubts about its credibility would render a US minimal nuclear deterrent threat of little deterrent value. This potential credibility problem is not a vestige of the Cold War. Given Russia's new

expansionism and numerous, explicit nuclear threats to US allies, it is again a serious contemporary concern.

Consequently, for decades US policy has been to have a diversity of flexible and limited nuclear response options, including dual capable aircraft (DCA) deployed in North Atlantic Treaty Organization countries that are intended to be more credible for extended deterrence purposes than a minimal deterrent. Department of Defense officials in the Obama administration fully recognize the continuing need for diverse nuclear options and the corresponding continuing need for the US triad and DCA. Why? Because "sustaining a diverse set of U.S. nuclear capabilities is essential for the role they play in regional deterrence and assurance."[23]

Conclusion

For all of the reasons noted above, US officials have long recognized a minimalist US nuclear arsenal as inadequate to support US deterrence requirements. Minimal US nuclear force numbers may sound appealing to some, but in general, the smaller and less diverse the US force is, the less survivable it is, the less flexible it is, the more narrow the available US deterrent threat options are, and the less credible it is likely to be in some potentially critical contingencies.

It must be acknowledged that there is considerable speculation regarding "how much is enough?" in both the minimum-deterrence approach to sizing the US nuclear force and the decades-long US approach that instead seeks flexible, diverse, and overlapping capabilities. But, while both approaches involve speculation, the now-traditional US approach to deterrence is by far the more prudent in a subject area that begs for prudence.

Why so? Because deterrence is an art that includes numerous moving parts with some inherent and irreducible uncertainties. How much is enough for effective deterrence is not fully predictable because we have an inherently limited capacity to predict reliably and precisely how foreign leaders will think and act in crises. Given the great variety of international threats and the equally great variation in the perceptions, values, and decision-making modes of foreign leaders, no one knows with any level of confidence that a small, minimum deterrence-oriented US arsenal will deter on any given occasion—much less universally for all plausible occasions now and in the future. As a result, the most imprudent approach

to deterrence is to have an *"easy,"* small, and narrow set of US deterrence threat options based on the presumptions that opponents will be deterred by nuclear threats to their societies and that the United States can make such threats credibly. The effective functioning of deterrence is too important to depend on the assumption that the United States will face only opponents who are susceptible to minimum deterrent threats.

US planning must recognize the possibilities that other approaches to deterrence may be necessary and that deterrence may fail. Yet as noted above, minimum deterrence will lack credibility in plausible cases and makes no useful provision for the failure of deterrence. Indeed, it likely maximizes the prospects for uncontrolled societal destruction if deterrence fails. The functioning of deterrence is not foolproof, and thus, making no provision for its failure is grossly imprudent.

In summary, while all approaches to determining how much is enough for deterrence involve speculation about how opponents will think and act, for the United States, the possession of flexible, diverse, and overlapping capabilities is the most prudent approach. This is particularly so in the contemporary threat environment, which is characterized by an expansionist, revanchist, and hostile Russia that is adding to its nuclear arsenal and making explicit nuclear first-use threats and also by an increasingly aggressive, expansionist China that also is adding to its nuclear capabilities.[24]

Advocates of a minimal US nuclear deterrent continue to call for revising US nuclear deterrence policies and targeting plans per the minimum deterrence adequacy standard to facilitate lower US nuclear force requirements.[25] They actually argue against diverse and flexible US forces, because those attributes suggest the requirement for retaining larger US force numbers than they prefer.[26] But, given the stark reality of increasing nuclear threats to the United States and its allies, US deterrence policies should not be determined by how well they facilitate easy standards and provide a rationale for eliminating US nuclear capabilities; US deterrence policies serve purposes other than rationalizing the elimination of US nuclear forces. The adequacy of US nuclear forces and policies should be determined primarily by the requirements for deterring enemies and assuring US allies in the most effective and prudent manner possible. The US goal must be for deterrence to work in all cases, which again suggests the value of capabilities that are adaptable for deterrence purposes across a wide variety of potential circumstances.

Consequently, the reasons described here for rejecting a minimalist US nuclear deterrent force continue to be sound. SSQ

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Notes

1. See for example, Hans M. Kristensen, Robert S. Norris, Ivan Oelrich, *From Counterforce to Minimal Deterrence*, Occasional Paper no. 7 (Washington, DC: Federation of American Scientists and the Natural Resources Defense Council, April 2009), 31–32, see also 2 and 43–44, http://docs.nrdc.org/nuclear/files/nuc_10042901a.pdf.

2. Robert Jervis, "Why Nuclear Superiority Doesn't Matter," Political Science Quarterly 94, no. 4 (Winter 1979–80), 617–18. See also, Steven Pifer and Michael E. O'Hanlon, *The Opportunity: Next Steps in Reducing Nuclear Arms* (Washington, DC: Brookings Institution Press, 12 October 2012), 20–21.

3. *Several* is the level identified as adequate in James Wood Forsyth Jr., B. Chance Saltzman, and Gary Schaub Jr., "Minimum Deterrence and Its Critics," *Strategic Studies Quarterly* 4, no. 4 (Winter 2010), 7, http://www.au.af.mil/au/ssq/2010/winter/forsythsaltzmanschaub.pdf.

4. Hans M. Kristensen and Robert S. Norris, "Nuclear Notebook: United States Nuclear Forces, 2016," *Bulletin of the Atomic Scientists* 72, no. 2 (2016), 63–64.

5. See for example, Center for Arms Control and Nonproliferation, "Is a New Nuclear Cruise Missile Necessary?," (fact sheet, Center for Arms Control and Nonproliferation, 2 February 2016), http://armscontrolcenter.org/is-a-new-nuclear-cruise-missile-necessary/.

6. Glenn H. Snyder, *Deterrence and Defense: Toward a Theory of National Security* (Princeton, NJ: Princeton University Press, 1961), 57.

7. Sidney Drell and James Goodby, *What are Nuclear Weapons for? Recommendations for Restructuring U.S. Strategic Nuclear Forces* (Washington, DC: Arms Control Association, October 2007), 15.

8. Forsyth, Saltzman, and Schaub, "Minimum Deterrence and Its Critics," 6.

9. The Obama administration too has explicitly rejected minimum deterrence. See, Department of Defense (DOD), *Report on Nuclear Employment of the United States*, *US Code*, vol.10, sec. 491 of (Washington, DC: DOD, 12 June 2013), 4, http://www.globalsecurity.org/wmd/library/policy/dod/us-nuclear-employment-strategy.pdf.

10. See Keith B. Payne, *The Fallacies of Cold War Deterrence and a New Direction* (Lexington: University Press of Kentucky, 2001), chapters 1–4.

11. See for example, National Security Council, National Security Decision Memorandum 242, Policy for Planning the Employment of Nuclear Weapons, 17 January 1974 (declassified 29 June 2007); The White House, Presidential Directive NSC-59, Nuclear Weapons Employment Policy, 25 July 1980 (declassified 24 July 2012); and DOD, *Report on Nuclear Employment of the United States*.

12. See, Bruce G. Blair et al., *Toward True Security: Ten Steps the Next President Should Take to Transform U.S. Nuclear Weapons Policy* (Cambridge, MA: Federation of American Scientists, Natural Resources Defense Council, and Union of Concerned Scientists, February 2008), 17–18, http://www.ucsusa.org/assets/documents/nwgs/toward-true-security.pdf; Daryl Kimball and Matthew McKinzie, "Nuclear Dangers: Myth, Reality, Response," *Defense News*, 23 February 2015, http://www.defensenews.com/story/defense/commentary/2015/02/23/commentary-nuclear-dangers-myth-reality-responses/23885837/; and Walter Pincus, "Nuclear Weapons Modernization: Not Fast Enough for Kyl," *Washington Post*, 27 February 2014, https://www.washingtonpost.com/world/national-security/nuclear-weapons-modernization-not-fast-enough-for-kyl/2012/02/25/gIQANAJoeR_story.html.

13. A study by the Natural Resources Defense Council showed that a small "countervalue" strike with up to 192 weapons would inflict 54–56 million casualties in an exchange with Russia, while a very large "counterforce" strike—employing many times that number of weapons (approximately 1,300)—would inflict 11–17 million casualties. See Matthew McKinzie et al., *The U.S. Nuclear War Plan: A Time for a Change* (New York: National Resources Defense Council, June 2001), x and 125. Other studies find far fewer casualty levels from counterforce targeting scenarios and much higher possible casualty levels from intentional countervalue targeting. The distinction here involves literally scores of millions of potential casualties. See for example, Senate, *Briefing on Counterforce Attacks, Hearing before the Subcommittee on Arms Control, International Law, and Organization of the Committee on Foreign Relations,* 93rd Cong., 2nd sess., 11 September 1974, 12–22*;* Keir A. Lieber and Daryl G. Press, "The Nukes We Need: Preserving the American Deterrent," *Foreign Affairs* 88, no. 6 (November/December 2009): 47; and Office of Technology Assessment, *The Effects of Nuclear War* (Washington, DC: Congress of the United States, May 1979), 10.

14. See Payne, *Fallacies of Cold War Deterrence*; 1–77 and Keith B. Payne, *Deterrence and the Second Nuclear Age* (Lexington, University Press of Kentucky, 1996), especially chapters 2–4.

15. See, the testimony by Secretary of Defense Harold Brown in Senate, Nuclear War Strategy, Hearings before the Committee on Foreign Relations, 96th Cong., 2nd sess. (Top Secret hearing held on 16 September 1980; sanitized and printed on 18 February 1981), (Washington, DC: US Government Printing Office [GPO], 1981), 10. See also, Harold Brown in, *MX Missile Basing System and Related Issues, Hearing before the Committee on Armed Services*, 98th Cong., 1st sess., (Washington, DC: US GPO, 1983), 6–7.

16. See, the testimony by Secretary of Defense Harold Brown and the "Administration's Responses to Questions Submitted Before the Hearing," in ibid., 10, 16, 25, 29–30. See also, Office of Secretary of Defense, "Remarks Prepared for Delivery by the Honorable Harold Brown, Secretary of Defense, at the Convocation Ceremonies for the 97th Naval War College Class, Naval War College, Newport, Rhode Island, 20 August 1980;" and the discussion in Walter Slocombe, "The Countervailing Strategy," *International Security* 5, no. 4 (Spring 1981): 18–27.

17. For reasons explained in Keith B. Payne et al., *Minimum Deterrence: Examining the Evidence* (Fairfax, VA: National Institute Press, July 2013), 22–25, http://www.nipp.org/wp-content/uploads/2014/12/Final-Distro.pdf.

18. Remarks by Secretary McNamara at North Atlantic Treaty Organization (NATO) Ministerial Meeting, 5 May 1962, Restricted Session (Top Secret; declassified in part, 17 August 1979), 11–12, quoted in, Kurt Guthe, *Ten Continuities in U.S. Nuclear Weapons Policy, Strategy, Plans, and Forces* (Fairfax, VA: National Institute for Public Policy, September 2008), 50, http://www.nipp.org/wp-content/uploads/2014/11/N-Continuities-Draft_Rev-2.11.pdf.

19. *Memorandum from the Secretary of the Air Force (Brown) to Secretary of Defense McNamara*, 14 September 1967, in Office of the Historian, US Department of State, *Foreign Relations of the United States 1964–1968*, vol. 10, *National Security Policy*, Document 191, (Washington, DC: Department of State, n.d.) https://history.state.gov/historicaldocuments/frus1964-68v10/d191.

20. See for example, Senate, *The Honorable Harold Brown, before the US Senate Committee on Foreign Relations, The Department of Defense Statement on Strategic Military Balance: Military Assessment*, 96th Cong., 1st sess. (11 July 1979), 3.

21. For example, Hans M. Kristensen, "Questions about the Nuclear Cruise Missile Mission," *FAS Security Blog*, 25 March 2016, http://fas.org/blogs/security/2016/03/lrso-mission-questions/.

22. Henry Kissinger, "The Future of NATO," in, *NATO, The Next Thirty Years*, edited by Kenneth A. Myers (Boulder, CO: Westview Press, 1981), 8.

23. Robert Scher, Statement of Robert Scher, Assistant Secretary of Defense for Strategy, Plans, and Capabilities before the Senate Armed Services Subcommittee on Strategic Forces, 9 February 2016, 4, http://www.armed-services.senate.gov/imo/media/doc/Scher_02-09-16.pdf.

24. See Keith B. Payne et al., *Russian Strategy: Expansion, Crisis and Conflict* (Fairfax, VA: National Institute Press, 2016); and US–China Economic and Security Review Committee, *2015 Report to Congress* (Washington, DC: US GPO, November 2015), http://origin.www.uscc.gov/sites/default/files/annual_reports/2015%20Annual%20Report%20to%20Congress.PDF. See also, Bill Gertz, "China Adds Warheads to Older DF-5s," *Washington Times*, 10 February 2006, http://www.washingtontimes.com/news/2016/feb/10/inside-the-ring-china-adds-warhead-to-older-df-5s/.

25. See for example, Hans M. Kristensen and Robert S. Norris, "Reviewing Nuclear Guidance," *Arms Control Today*, 2 November 2011, http://www.armscontrol.org/act/2011_11/Reviewing_Nuclear_Guidance_Putting_Obama_Words_Into_Action; and Adam Mount, "The Fiscal Threat to Nuclear Strategy," *The Bulletin of the Atomic Scientists*, 15 March 2015, http://thebulletin.org/fiscal-threat-nuclear-strategy8080.

26. Kristensen and Norris, "Reviewing Nuclear Guidance;" and Tom Nichols, "Time to Change America's Atomic Arsenal," *The Diplomat* (Japan), 14 March 2013, http://thediplomat.com/2013/03/time-to-change-americas-atomic-arsenal/.

China's Nuclear Threat Perceptions

Susan Turner Haynes

Abstract

Since the end of the Cold War, China is believed to have doubled the size of its nuclear arsenal, while the other nuclear powers under the Nuclear Nonproliferation Treaty (NPT) have cut their forces in half. Many analysts explain China's buildup as a direct response to US missile defense. This article takes a broader view, looking at the threat China perceives from the United States as well as from other nuclear players under the penumbra of US hegemony. A state-by-state analysis provides a multidimensional look at China's nuclear security environment, allowing deeper insight into the motivations behind China's modernization.

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In a recent issue of *Strategic Studies Quarterly*, Stephen Cimbala analyzed the impact of China's military modernization, including its nuclear buildup, on the balance of power in Asia.[1] His article concludes with an assessment of implications for US policy and the recommendation that the United States include China in triangular dialogues going forward. Engaging China in such a conversation is a legitimate and feasible policy goal—especially since China has shown an increased willingness in recent years to participate in the nuclear nonproliferation regime and it was the first nuclear weapon state to propose a world summit to discuss the global elimination of nuclear weapons. At the same time, consideration must be given to the fact that China is now the only nuclear weapon state under the NPT that continues to increase the size and sophistication of its nuclear arsenal. Consequently, a constructive conversation necessitates a clear understanding of China's present motivations for force modernization.

Despite the fanfare surrounding China's nuclear buildup, relatively few Western scholars have studied the Chinese perspectives behind it. The

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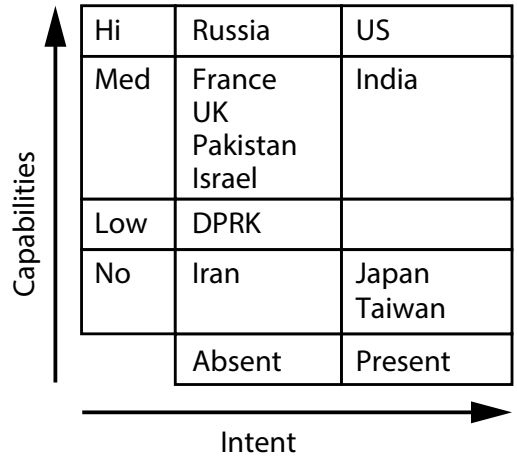
most common analysis distills China's force development to a response to US ballistic missile defense (BMD).[2] Other studies have analyzed the deterrence dynamics of South Asia specifically, discussing China's role in countering India.[3] In reality, China's nuclear threat perception, and thus its nuclear modernization, stems from both bilateral relationships, where the United States is rightfully characterized as the "heavyweight" in China's security calculations, and India is the peripheral aggravator. Though bilateral analyses are beneficial to our overall understanding of China's nuclear strategy, the compartmentalization of China's deterrence relationships does not reflect all aspects of Chinese perceptions. We can no longer afford to analyze the bilateral relations between two nuclear weapon states without embedding the narrative within the modern multidimensional framework of nuclear deterrence, or what Gregory Koblentz refers to as the "new geometry of deterrence."[4] In regard to China, this means presenting a complete picture of China's present threat environment, as China perceives it, and explaining how these perceptions interact to form the basis of China's nuclear deterrence strategy.[5]

China is currently the only nuclear weapon state situated within striking range of all eight nuclear powers.[6] Four of these states share borders with China, and three of the four are actively increasing their nuclear arsenals.[7] In addition, China's long-time adversary and neighbor, Japan, has long had the capacity to join the club. In terms of nuclear deterrence, China's leaders face a multiplayer game. This article analyzes the threat China perceives from each player, including those not presently prominent in China's strategic calculus—those with minimal nuclear capabilities and/or no perceived intent. It analyzes how the shape of security has shifted for China and provides a more complex picture of China's perceived nuclear threats. Such a comprehensive snapshot enables us to take inventory of China's present security calculations while also having the information necessary to see how China's strategy might shift if the conditions of other states change.

The matrix in table 1 shows these threats according to perceived capability as well as perceived intent. In the following analysis, those states absent intent will be discussed first, followed by states China considers as having intent. Even though the United States is not on China's border, it nonetheless features prominently in China's nuclear strategy calculations. While the US–China security dilemma is the primary driver of China's strategic nuclear decisions, this situation involves more than just US BMD.

China perceives US BMD, in conjunction with the US development of prompt long-range conventional missiles to be a part of a larger shift in US nuclear strategy. This shift, according to China, is further demonstrated by US interactions with other nuclear and near-nuclear states on China's periphery. This relationship is discussed at length and contextualized amid the larger nuclear landscape.[8]

Table 1. A complex reality: China's nuclear threat perceptions



Hi	Russia	US
Med	France UK Pakistan Israel	India
Low	DPRK	
No	Iran	Japan Taiwan
	Absent	Present

Iran—No Intent, Potential Means

Despite only having latent nuclear capabilities, Iran is often cast as the most recent transgressor of the norm against nuclear proliferation. The primary narrative, shaped largely by the United States, is that Iran is a defiant nation whose nuclear ambitions, if actualized, would present a prominent threat to world peace. Pres. Barack Obama elaborated upon this point at an address before American University in August 2015. According to the president, Iran's nuclear acquisition "would spark an arms race in the world's most unstable region, and turn every crisis into a potential nuclear showdown . . . embolden terrorist groups . . . and unravel the global commitment to non-proliferation that the world has done so much to defend."[9] Not every nation agrees. In fact, the level of concern over Iran's dereliction depends mostly on the envisioned aim of its nuclear development. China believes it has little to fear. It is also quick to emphasize that Tehran's capabilities are embryonic at best and that Iran is years away from being an official nuclear state. The immediacy of the

situation, some argue, wanes when put into historical perspective and contextualized among larger geopolitical factors.

The origins of Iran's nuclear program began in the 1960s when the United States provided Iran with basic nuclear facilities. After signing the NPT in 1969, Iran further expanded its civilian nuclear program to meet increased demand and offset a spike in oil prices. At this point, the United States and China diverged in their understanding of the Iranian situation. US intelligence indicated that Iran had ambitions of starting a nuclear weapons program. China, by contrast, viewed Iranian intent as benign and supported Tehran's right under the NPT to grow its civilian nuclear capabilities.[10] Iran capitalized on China's benevolence in 1985 when the two countries signed a ten-year nuclear cooperation agreement. This agreement permitted the sale of Chinese nuclear materials and equipment to Iran and allowed for specialized training. It also laid the foundation for future assistance. Shortly following the agreement, for instance, China supplied Iran with several research reactors and related research laboratories. It also sold Iran an electromagnetic device for separating isotopes and exported a metric ton of uranium hexafluoride.

The most controversial of these exchanges occurred in the early 1990s when China agreed to provide Iran with a uranium conversion facility as well as a 20-megawatt research reactor and two 300-megawatt power reactors. Though ostensibly compliant with the International Atomic Energy Agency (IAEA) obligations, the United States argued that the uranium conversion facility, in particular, would allow Iran to produce a gas suitable for uranium enrichment. The United States also found the Iranian demand for nuclear energy suspect in light of the country's abundance in natural gas and oil. With mounting pressure from the United States, China ultimately suspended the Iranian agreement. Its acquiescence, however, was less an affirmation of the indictment of Iranian action than it was a calculated shift based upon self-interest. It chose to trade the Iranian deal for a better deal with the United States where it would be on the receiving end of US nuclear technology.

China's shift in partners was strategic and did not indicate a fundamental shift in its beliefs. In fact, while it discontinued most of its cooperation, China still maintained that Iran had a right to nuclear technology, as did every state that met its obligations under the NPT. According to China, Iran's pursuit of peaceful uses of nuclear energy should not be au-

tomatically (and unilaterally) equated with the pursuit of nuclear weapons, a statement it shared in a 2000 Sino–Iranian joint communiqué.

China's empathy for the Iranian position was strengthened in 2002 when Pres. George W. Bush named Iran, alongside North Korea and Iraq, as a part of the "axis of evil" intent on creating weapons of mass destruction. Chinese Foreign Ministry spokesman Kong Quan immediately spoke out against the "arbitrary" label, and Liu Jianfei, a party school expert, called the statement "irrational." A *Xinhua* article published the following month even went so far as to (falsely) claim there was no evidence confirming that any of the three states were developing weapons of mass destruction.[11] "Even if they *did* have these kinds of weapons," the article explained, "who would dare to use them against the United States, the world's number one nuclear nation . . . while risking the danger of being completely annihilated?" The article continued, "These three countries do have one common denominator. . . . Their values and polices do not agree with those of the United States and none of them are on good terms with the United States."[12]

As time passed, it became more difficult for China to deny that Iran might be pursuing nuclear weapons. At the same time, however, China did not agree with the United States, Germany, France, and Great Britain that economic sanctions or force were appropriate responses. Instead, it continued to advocate for constructive multilateral dialogue. China's divergence from the West on the Iranian nuclear issue stems from several factors. First, Iran and China have a history of "friendly cooperation" in a variety of areas including energy, trade, and military technology, and thus, it is against China's economic interest to speak out or act on unsubstantiated evidence of nuclear weapons production. This is especially true when it comes to oil. China is second only to the United States in oil imports, and China's domestic demand for oil continues to grow. This makes Iran, a country rich in oil and natural gas, a preferable partner. Iran's appeal increases when one considers the competitive pricing brought about by Iran's shrinking customer base. Sanctions against Iran enacted by individual states under United Nations Security Council (UNSC) Resolution 1929 allow China to purchase Iranian crude oil at a heavy discount. This encourages the $20–$30 billion China spends on Iranian oil each year. If China were to fall in line with other countries and foist sanctions against Iran, this would have a significant economic impact. It would also disrupt the two nations' long-standing

bilateral relationship, and while China has expressed its disapproval of Iran's nuclear ambitions, in the end, Beijing has little to fear. After all, even if Iran were developing nuclear weapons and this aspiration came to fruition, the rapport shared by Iran and China leads Chinese leaders to believe that China would not be a target of these forces.

The same cannot be said for the United States. Interestingly, in many Chinese accounts of the Iranian nuclear narrative, the story told is not one of the peril of Iranian nuclearization but the cautionary tale of US hegemony. This began as early as the late 1990s, when US suspicions of Iranian nuclear weapons first emerged and continued after Iran pursued uranium enrichment. In an article entitled "Iran Nuclear Crisis Tests China's Diplomacy," for example, the author announced Iran's debut of a new nuclear facility and the collective request of Britain, France, Germany, and the United States to put the issue to the UNSC for discussion. The author argued that China did not agree with this decision: "The most important thing," he explained, "is that China, as the largest developing country, always upholds multilateralism and non-intervention in the internal affairs of other countries. . . . Whether or not China can, together with the peace-loving countries, prevent a repeat of the tragedy of the US attack on Iraq is not only in line with China's interests but is also in line with the general direction of the harmonious development of the world."[13] Here the blame shifts away from the potential proliferator back to the United States. This trend continues with the case of the Democratic People's Republic of Korea (hereafter North Korea).

North Korea—No Intent, Minimal Means

North Korea is an interesting case as it relates to China, because it has minimal demonstrated nuclear capabilities and China believes that it has no intent of actually using this capability. North Korea has long had the ability to produce highly enriched uranium and plutonium from its civilian nuclear facilities, but it waited until 2003 to withdraw from the NPT and did not test its first nuclear weapon until 2006. It conducted subsequent tests in 2009, 2013, and 2016. At present, North Korea is presumed to possess between four and eight nuclear warheads that can theoretically be affixed to any of its short-, medium-, or intermediate-range ballistic missiles. This means it can conceivably deliver a nuclear warhead up to 3,000 kilometers (km)—well within reach of China. It is

also developing a newer missile with a range of 6,700 km, enabling it to target all of China.

These facts have not caused alarm in China for multiple reasons. First, there are several technological steps that still need to occur for North Korea's nuclear weapons to present a viable threat to its neighboring states. The foremost of these is miniaturization. Right now, North Korea has nuclear bombs and it has missiles, but it is not believed to have the ability to put these two components together and deliver them to a selected target. A South Korean estimate quoted in a Chinese publication indicates that North Korea's latest test—the one deemed "perfect" by the North Korean government—was only two-thirds of "effective saturation" (the equivalent of 6–7 kilotons of dynamite rather than the ideal 10), indicating that the technology is not yet "mature." Lastly, outside of actual weapon design, North Korea does not have a sophisticated command and control system. This would be critical if it wished to go up against a more mature nuclear power, such as the United States or even China.

Another factor mitigating Chinese concern, in addition to the perceived inchoate development of North Korean nuclear capabilities, is the perception that North Korea does not intend to use its nuclear weapons for military purposes. This presumption is widespread in China and has manifested into a subtle empathy for the North Korean plight vis-à-vis the United States. One article, for instance, published immediately after North Korea's first nuclear test in 2006, claims that while the North Korean government may exhibit irrationality and "not follow the rules of the game," its nuclear tests and provocations are only pomp concealing the state's desire to engage in meaningful dialogue with the United States. "For this reason," it argues, "although the peninsula's situation looks tense, the possibility of a military conflict is almost next to nothing." Ultimately, China perceives little direct threat from the Korean peninsula, and it believes the larger threat is still "under control by big powers."[14]

In recent years, China has secured a position as one of these *big powers* managing the situation through the Six-Party Talks. This role has led to the gradual dissolution of empathetic undertones toward North Korea in the Chinese press but not to a fundamental change in China's position. If North Korean nuclearization is meant to serve as diplomatic leverage in US–North Korean relations, as some in China claim, then China has limited influence in the situation. A 2009 article appearing in the Chinese newspaper *Ta Kung Pao* reiterates the crux of the issue:

> North Korea's ultimate goal is not to have nuclear weapons. What North Korea is doing as it strives to obtain nuclear weapons is to use the nuclear issue to create tension on the Korean Peninsula and to use these conditions to force the United States, which is the dominant hegemon in the contemporary international system, to accept its legitimate status and provide it with sufficient existential and developmental space so that it can preserve the stability of its political power.[15]

The article continues to explain that China's hands are tied in providing an adequate solution, since North Korea's ultimate objective can only be achieved through dialogue with the United States. Ultimately, China operates on the assumption that North Korea does not pose a security threat to China. At the same time, however, China must consider the implications of North Korea's nuclearization on the regional security dynamics, specifically as it relates to Japan and South Korea.

If North Korea were to continue down the road of nuclearization and build deliverable nuclear weapons, then other states in East Asia might feel compelled to do the same, producing a so-called "domino effect" in the region. This kind of cascade would be directly opposed to China's security interests, since it might provide Japan and South Korea with the excuse each needs to acquire its own nuclear deterrent and/or nuclear defense. It could also bolster both states' claims that they need theater missile defense. Another concern is the increased potential for a nuclear accident. Considering China's proximity, any such event would likely lead to radiation contaminating China's atmosphere, underground water, and soil.

Pakistan—No Intent, Limited Means

Another state of close proximity to China is Pakistan, yet despite being within range of over 100 Pakistani nuclear missiles, China does not perceive Pakistan as a threat to its security. The relatively few academic articles and news articles in China exclusively discussing Pakistan's nuclear weapons development and/or its nuclear weapons strategy support this assessment. As far as China is concerned, Pakistan's place in the conversation has to do with its position vis-à-vis India. It is commonly believed that the long-standing strategic rivalry between India and Pakistan took a dangerous turn when both countries acquired nuclear weapons. This fear, which pervaded the global media, fueled speculation that an arms race or escalation of conflict was inevitable in South Asia. Both of these situa-

tions would have serious international ramifications (such as the delegitimization of the NPT) as well as an immediate effect on regional stability.

Though China has a vested interest on both counts, its assessment of the situation seemed more muted than most. Rather than anxiety over nuclear escalation in South Asia, the primary sentiment expressed by Chinese officials and adopted by most others, was a sense of disappointment. For instance, Chinese Foreign Minister Zhu Bangzao publicly expressed "deep regret" over Pakistan's nuclear tests, and he implored both India and Pakistan "to exercise the utmost restraint" and to immediately cease nuclear weapons production.[16] Another Chinese official repeated this request nearly verbatim a few days later when Pakistan continued with its sixth nuclear test.

These statements and others coupled India's and Pakistan's tests together and described them as a direct affront to the international nonproliferation regime. Chinese assessments also noted that the decision to test belied both states' economic interests. At the sixth meeting of the Preparatory Committee for the Comprehensive Test Ban Treaty shortly following the test, for instance, China's permanent representative Zhang Yishan remarked that India and Pakistan should fall in line with the global trend of peace and "strive to develop their national economies and raise the living standards of their own peoples. . . . They should not act willfully and arbitrarily, and use their national resources that are inadequate in the first place to facilitate an obsolete nuclear arms race."[17]

Even in the tensest of circumstances, such as when India and Pakistan were both threatening nuclear use over conflict in the Kashmir region, many in China publicly doubted that a nuclear event would occur. It was like "loud thunder, but little raindrops" said one article.[18] Another article admitted that "contrary to the malicious insinuations of many news media . . . nuclear weapons have had a stabilizing effect on both India and Pakistan."[19] Another article echoed, "Amid the tense situation between India and Pakistan, public opinion holds that this is a matter for rejoicing that both India and Pakistan have possessed nuclear weapons and have formed a deterrence to each other."[20] In other words, from the Chinese perspective, the seemingly synchronous weapons development of India and Pakistan following the 1998 tests and the subsequent nuclear parity achieved brought stability to a precarious bilateral situation on its periphery.

The contradiction in these messages and China's earlier messages are apparent. On one hand, China's official statements following Pakistan's nuclearization mimicked the rhetoric of other nations, casting Pakistan's actions as a blow to the NPT and as a potential catalyst for a South Asian nuclear arms race. At the same time, however, the later literature implies that China has accepted Pakistan's nuclear force as a counterweight to India. This acceptance is related to the long-standing cooperation between China and Pakistan.

Pakistani officials often characterize the Sino–Pakistan relationship as "higher than the mountains, deeper than the oceans, and sweeter than honey."[21] This description stems from the long-standing mutual understanding undergirding the two countries' bilateral relations. After all, Pakistan was among the first states to end official diplomatic relations with Taiwan and recognize the legitimacy of the People's Republic of China (PRC) in 1950. China later provided Pakistan with much-needed military assistance, and the two nations formed a strategic alliance in 1972.

Two years later, India tested its first nuclear device, and Pakistan's desire to keep pace tipped its partnership with China into new territory. China's military assistance was no longer limited to conventional arms, but included weapons-grade uranium, instructions for uranium enrichment, and design information for a uranium bomb. Under the 1986 Comprehensive Nuclear Cooperation Agreement, China also helped Pakistan establish two nuclear power reactors. When China signed the NPT in 1992, these types of actions were ostensibly constrained, but reports of Chinese assistance continued. In 1995, for instance, China sold Pakistan 5,000 ring magnets for its high-speed gas centrifuges. It also sold Pakistan several M-11 short-range ballistic missiles and provided significant assistance in the development of Pakistan's *Shaheen* missile series.[22] In most recent years, the two states' cooperation has also extended to civilian nuclear energy.

Speculation of a bilateral arms race between India and Pakistan exists in China, but such speculation is not generally coupled with recommendations or even discussions of Chinese action. This is partially because Pakistan serves as a convenient counterweight to a nuclear state that could challenge China. The same can be said for Russia.

Russia—No Intent, Extensive Means

Continuing to examine China's nuclear periphery, one cannot fail to mention the neighbor with the largest inventory of nuclear weapons: the Russian Federation. Presently, Russia has eight strategic nuclear weapons for every one of China's nuclear weapons and has a solid diversification of nuclear platforms (land, air, and sea). It also leads the world in tactical nuclear weapons and maintains a limited ballistic missile defense system. Looking solely at capabilities and proximity, Russia appears to present the greatest threat to China's security. When one considers other factors, however, the calculation of China's risk shifts substantially. These mitigating factors include an extended period of Sino–Russian cooperation and the perception in China of a steady decline in Russia's overall national power.

Following the end of the Cold War, both China and Russia felt marginalized by the United States, and it did not take long for the two countries to attempt to counter this situation by strengthening bilateral relations. This resulted in a relationship that advanced from a "constructive partnership" in 1994 to a "strategic partnership" in 1996 to, finally, a "friendship" in 2001. Though a formal Sino–Russian alliance was never established, the 2001 friendship brought mutual benefits, including ongoing military cooperation. One of the regional mechanisms through which this cooperation takes place is the Shanghai Cooperation Organization (SCO), an organization established to enhance security in Central Asia at the same time as the Sino–Russian friendship was formed. The SCO enables Russia and China to join forces with Kyrgyzstan, Kazakhstan, Tajikistan, and Uzbekistan to have an established platform for regional military exercises. Examples of multilateral military cooperation carried out through the SCO include the five-state exercises in August 2003, the Uzbekistan-led "East Anti-Terror" exercise in 2006, and the "Peace Missions" of 2007, 2010, 2012, and 2014.

While the SCO exercises have increased in frequency and magnitude, they have not altogether displaced traditional bilateral military cooperation. In the "gap years" of 2005, 2009, and 2013 for instance, China and Russia carried out their own Peace Missions, where other SCO members could observe but not participate. In 2012 the two countries also began cooperating in the naval sphere, conducting joint naval exercises. This continued in the subsequent three years.

From a Russian perspective, one of the peripheral benefits provided by the exercises is the opportunity for Russia to showcase its latest military technology to its most valued buyer. Since 1992 Russia has been the primary arms dealer to China, providing China with everything from warships and combat aircraft to missiles and missile launchers. In addition, experts speculate that Russia also provided China with design information and/or the technological expertise to advance China's nuclear weapons production, particularly, the *Julang*-2 submarine-launched ballistic missile and the *Dongfeng*-31 intercontinental ballistic missile (ICBM).[23] These exchanges occurred alongside a series of large-scale joint military exercises, at least one of which was reported to mimic a potential joint response to a US nuclear strike.

The idea of China actively preparing for and training to defend against a nuclear strike is supported in its military manuals and People's Liberation Army (PLA) publications. While these sources do not explicitly acknowledge joint exercises to this end, they do make it apparent that China perceives Russia to also be at risk for US preemption. Moreover, Chinese news and journal articles often list China and Russia alongside one another as potential targets of US nuclear aggression, and, as one article states, this justifies "an appropriate expansion of the scope and degree of military and security cooperation between the two countries."[24]

This feeling of shared risk and vulnerability has led not only to military cooperation but also to a history of diplomatic cooperation. Through established venues of bilateral communication and conferral, Beijing and Moscow have been able to show their shared support for issues like state sovereignty (particularly in the cases of Syria, North Korea, and Iran), multipolarity, and strategic stability. Of particular note is China and Russia's shared acrimony regarding US missile defense. This is exemplified by a range of statements from 1999 protesting US missile defense to the more frequent expressions of shared opinions in press releases provided by Chinese and Russian officials. Most recently, for instance, at the eighth round of Russian–Chinese consultations on strategic security, Russian Security Council Secretary Nikolai Patrushev stated that China and Russia were mutually concerned about American missile defense and that both countries agreed to coordinate countermeasures.[25]

The history of Sino–Russian cooperation and mutual interest in counterbalancing US hegemony and missile defense strongly reduces China's fear of Russian nuclear forces. Another substantial consideration influenc-

ing this conclusion is the perception in China of the overall decline in Russian power. After all, the volatility of the international environment dictates that state-to-state relationships are subject to change, and the present Sino–Russian rapport is no exception. Not long ago the Soviet Union considered launching a nuclear strike against China. As such, it is prudent to assess the situation absent the condition of mutual cooperation.[26]

According to the Chinese literature, the pattern of the past two decades reveals that "Russia's composite national strength has declined greatly and its international status has fallen." [27] It cannot credibly challenge the United States, and it is not likely to have the strength to challenge China in the future. In the nuclear realm, in particular, China cites Russia's failure at forestalling US missile defense as an example of its waning influence. America has the upper hand according to one *Renmin Ribao* article: "Russia's all-round national strength is not what it was, . . . and [Russia] requires a great deal of US technical and fund support in order to develop its economy and achieve the goal of 'a rich country and a strong people.'"[28] This was followed in 2002 by a speech by Pang Zhongying, professor of international relations, to an audience at Qinghua University, where he stated matter-of-factly that "Russia is now a second rate country. It is a declined country."[29]

The portended consequences of this perceived weakness is a reduction in Russia's military strength. More specifically, many believe Russia will soon be incapable of maintaining its oversized nuclear stockpile. One article claims that this condition enables the United States to pursue a shift in nuclear strategy. Wang Guosheng and Li Wei explain:

> Past US nuclear strategy was mainly aimed at Russia and its nuclear buildup was to counter nuclear attacks from Russia and from other nuclear powers. The United States made a unilateral adjustment of its nuclear strategy, and the reduction of the number of its nuclear warheads were not based on the reduction of Russian nuclear forces. . . . This shows that the United States . . . no longer recognizes Russia's parity with it in the nuclear area, and no longer cares about Russia's opposition.[30]

The Sino–Russian dynamic is unique in that it presents a situation where intent offsets hard capabilities. The extended cooperation between China and Russia and the joint positioning of the two countries against what they see as American hegemony provides China with confidence that, despite its sizable nuclear arsenal, Russia does not present an immediate threat to Chinese security. This calculation of risk is compounded

by the ongoing perception in China that Russia's power is declining and that it will not be able to sustain its large inventory of nuclear weapons, much less invest in advanced technology (a perception heavily influenced by the United States). While Power Transition Theory might portend that the Sino–Russian rapport will have an expiration date (with a declining power expected to act aggressively toward a secondary rising power), this possibility is less concerning to China when viewed in light of Russia's declining capabilities. A strategic pivot of this magnitude would take time—something China sees as not necessarily on Russia's side.

Taiwan—Intent without Means

While the present strategy of Russia is to use China to balance against the United States, the inverse is true in the case of Taiwan—another nuclear-capable neighbor of China. According to the United Nations (UN), Taiwan is not a sovereign state but rather a territory subsumed under the PRC. This understanding traces back to 1971, when a two-thirds majority of the organization voted to give Taiwan's UN seat to the PRC.[31] Shortly thereafter, the United States and China signed the Shanghai Communiqué in 1972, in which China unequivocally reiterated its position—and now the UN's position—regarding the so-called One-China policy. This policy recognizes the PRC as the sole legitimate government of China. Under this arrangement, Taiwan is viewed as a province of the PRC and not an independent state. The United States did not entirely concur with this characterization, and thus chose to insert its own understanding of the situation in the communiqué. According to the United States, "all Chinese on either side of the Taiwan Strait maintain there is but one China and that Taiwan is a part of China." This delicate wording and the United States's earlier concession to the UN expulsion of Taiwan appeased the PRC, while also keeping open-ended the question of who has ultimate authority.

Taiwan, which calls itself the Republic of China (ROC), disputes both characterizations, and this disagreement has led to half a century of cross-strait tensions. These tensions have varied depending upon the ruling party and the respective leader of the ROC. From the time of China's civil war until 2000, the Kuomintang (KMT) was the ruling party in Taiwan. From 2000 to 2008, the Democratic Progressive Party (DPP) replaced the KMT leadership. The KMT returned to power in 2008, but lost again to the DPP in 2016. Leaders from each party have taken different

positions on Taiwanese independence/Chinese rapprochement, but since the late 1970s, both parties have agreed that Taiwan will not seek its own nuclear deterrent.

US opposition heavily influenced this decision. In the early 1970s, the US government collected sufficient evidence to indicate that Taiwan had surreptitiously started its own nuclear weapons program. This evidence was outlined in a 1972 National Intelligence Estimate, which predicted that Taiwan could conduct a nuclear weapons test as early as 1976. This assessment spurred the involvement of the IAEA, which sent inspectors to Taiwan's Institute for Nuclear Energy Research. Demands from the IAEA and United States following the inspection caused Taiwan to shut down its research reactor and reprocessing center.

There is no evidence to indicate Taiwan resumed the pursuit of nuclear weapons after its 1976 shutdown. Though it has the technological expertise, it no longer has the infrastructure. Its three nuclear power reactors use low-enriched uranium provided by other countries, and the country does not have the capability to make highly enriched uranium. As a result, experts estimate that it would take Taiwan somewhere between one to eight years to develop a nuclear warhead and even longer to miniaturize this warhead to fit on a missile.[32] This timeframe, along with the lack of evidence that Taiwan is pursuing a nuclear option, leaves many in China dismissing Taiwan as a nuclear threat. In fact, when participants at the US–China Strategic Dialogues mention Taiwan, it is always in relation to speculation of US intervention. Taiwan, without the consideration of the United States, is not a threat. Another state which cannot be viewed in isolation is Japan.

Japan—Intent with Potential Means

Japan does not have nuclear weapons, and it has promised not to produce, procure, or store them in the future. The Japanese parliament passed a resolution to this effect in 1967. This resolution parallels Article Nine of the Japanese Constitution, which forbids Japan from having offensive military capabilities. From the Chinese perspective, however, these promises represent no real constraint on Japanese nuclearization. This is because Japan has the largest civilian stockpile of separated plutonium of all nonnuclear weapon states, including a stockpile of approximately 300 kilograms of plutonium acquired from the United States and Great Britain in the 1960s and an additional 45 tons of separated plutonium

produced by its civilian nuclear program. With its technological expertise, this is enough for Japan to produce thousands of nuclear weapons. Japanese leaders admit that the state has such expertise. In fact, a declassified 1969 document reveals that the Japanese government viewed this capability as leverage, mentioning that Japan will maintain its nonnuclear status, while also possessing the economic and technical means to "go nuclear" at any time. According to the document, this potential is what ensures Japan's security.

This strategy continues today, though doubt lingers regarding the durability of Japan's self-restraint. Some of Japan's top-level officials have already challenged the status quo, including Foreign Affairs Minister Taro Aso and Liberal Democratic Party Policy Research Council leader Shoichi Nakagawa. Others, like former Tokyo governor Shintaro Ishihara have gone a step further and actually recommended that Japan take tangible steps toward nuclearization: "If we don't show more military force, we'll definitely lose our presence on the world stage."[33] Such public statements are even more unsettling when placed in the context of the Japanese Prime Minister Shinzo Abe's administration's nationalist agenda and the cabinet's 2014 resolution to reinterpret Article Nine of the Constitution to allow for collective self-defense.

Japan's latent nuclear weapons capability and select Japanese officials' support of nuclearization is enough for China to perceive Japan as a potential nuclear threat. Yet these are not the only factors in the equation. China's perception of a Japanese threat increases exponentially when one considers the tumultuous history between the two countries. China has not forgotten the devastation caused by the Sino–Japanese War, and China's wounds are reopened each time a Japanese official attempts to rewrite history or visits the Yasukuni Shrine—a Shinto shrine honoring the war dead who served under the emperors of Japan. Even today, the Chinese Party uses historical references to Japanese colonialism and aggression to remind Chinese citizens and other nations of Japan's untrustworthy nature. One article states, "For a sovereign and independent nation to develop an appropriate degree of military strength is both understandable and justified, but development on this scale has to surpass the goals of peace and defense." This consideration is especially pertinent in Japan's case, claims the article, since Japan has a "history of numerous brutal invasions of the nations on its periphery . . . [and] which to date has shown no deep introspection as a nation."[34] The characterization of

present-day Japan through a historical lens heightens China's perception of the Japanese nuclear threat. This is not to say, however, that there are not legitimate contemporary concerns.

In addition to Japan's available fissile material, its technological capabilities, and its signals about considering nuclear weapons acquisition, Japanese leaders have also justified, over the past two decades, an expansion of the state's military power. This has led to an increased military budget and expanded scope of military service. In 1999 this took the form of a Japanese official stating that preemptive attacks on enemy targets were within the realm of Japan's constitutional rights. In the case of China, the most immediate threat is Japan's claim to the Senkaku/Diaoyu islands. Again, governor Ishihara weighs in on the subject. According to him, if Japan had nuclear weapons, "China wouldn't have dared lay a hand on the Senkakus."[35] The possibility of Japan using nuclear coercion to gain leverage in this situation is all too real for the Chinese, and several Chinese participants mentioned the Senkaku/Diaoyu islands as a distinct concern in the US–China Strategic Dialogues. Another scholar warned, "If Japan possesses nuclear weapons, it will be just like adding wings to a tiger and seriously threaten peace and stability in East Asia."[36]

The article continues by asking all East Asian states to retain "a high degree of vigilance" in the situation. A similar request is proffered by Zhao Xijun, the editor of the military publication *She Zhan*: "When there is a need, Japan can quickly manufacture true combat nuclear missiles. Therefore, people of the world should be highly watchful of the quiet rise of the Japanese nuclear deterrence capability."[37] Another article, published in Hong Kong's *Ta Kung Pao*, advises the international community to "express strong concern over Japan's keenness in recent years to develop nuclear weapons."[38]

But is China truly expected to sit and wait alongside other states for Japanese nuclearization? Is it enough to simply express strong concern? In most cases, the answer seems to be yes, but there are also subtle hints that China may be taking protective measures. One measure is to clearly communicate to Japan the credibility of China's nuclear deterrent. In a 2006 article in *Ta Kung Pao,* for instance, Wang Chi-Wen reminds readers that "Japan is surrounded by seas on all sides and its territory is small. Its people are concentrated in cities with a dense population. It cannot resist nuclear retaliation."[39] Another measure that China can take is to build up its nuclear weapons "just in case." A recent *Renmin Ribao*

article, for instance, explains that while China "promotes anti-nuclear proliferation and arms control . . . the complete reunification of China is yet to wrap up." The article goes on to specify that certain "disputes between China and some neighboring countries over the territorial sovereignty, the sovereign right over territorial waters as well as over the maritime rights and interests are yet to be settled, and accordingly that too requires proper handling."[40] China fears that Japan may soon shift its nuclear strategy to lay claim over disputed territory. This anticipated strategy shift is causing China to reconsider its own nuclear strategy and shift its force structure to accommodate it.

India—Intent with Limited Means

Like Japan, India shares a tumultuous past with China. As such, it might be expected that China would fear Indian nuclearization. In reality, however, while many Western texts initially presented the Sino–Indian relationship as precarious and as a possible pretext for a regional arms race, China has made it clear that it does not consider India an acute threat to its national security. This position was evident even in 1998 when India conducted its first aboveground nuclear test and declared itself a nuclear weapon state. Rather than alarm or fear, the sentiment most expressed by the Chinese press was regret. A Sino–Indian nuclear conflict was never seriously considered in China. Instead, the majority of attention went toward assessing the implications of Indian action on the global movement toward nuclear nonproliferation and disarmament. This was demonstrated immediately after India announced its tests, with the remarks of Chinese spokesperson Zhu Bangzao, who read aloud the Chinese government's official response to Indian action, stating that the tests demonstrated "outrageous contempt for the international community" and represented "a blow to international efforts to prevent nuclear weapons proliferation."[41] China's Foreign Minister Tang Jiaxuan, China's UN representatives Shen Guofang and Qin Huasun, and China's Disarmament Ambassador Li Changhe expressed similar concerns.

China's domestic press provides further evidence in support of China's disappointment, emphasizing India's abrogation of international law and its self-imposed isolation from the international community. The press also noted that the limited resources India diverted to achieve its nuclear weapon status harmed the state's potential for growth and economic viability. An article appearing in *Zhongguo Xinwen She*, for ex-

ample, claimed that India's nuclear tests had "fundamentally poisoned its environment for peaceful development" and significantly hampered India's potential for economic growth. In this way, it claimed, "India is acting like a person who lifts a rock only to drop it on his own feet."[42] The article did not express fear that an intrepid India would one day throw this "rock" at China. A similar ambivalence appears in China's academic literature.

In China's academic journals, the primary question explored immediately after the tests was not the impact of India's actions on China but the implications of India's actions on the international disarmament and nonproliferation movement more broadly. Moreover, some articles explored why India found nuclearization necessary in the first place, since it was not evident that such a move was necessary for Indian security. After the test, Indian Prime Minister Atal Bihari Vajpayee explained that his country pursued the nuclear route in response to the threat posed by the arms buildup of its neighbors, namely China and Pakistan. Yet, Chinese officials thoroughly denounced this claim, explaining that the Sino–Indian border dispute, the primary point of contention between the two countries, was a thing of the past: "Let bygones be bygones and look to the future," advised *Chinese Radio International*.[43] In most cases, outsiders reached the conclusion that India, or the Bharatiya Janata Party government more specifically, justified its actions by conjuring up the perception that China's nuclear status threatened Indian security but that this was a guise hiding its true intentions: the increase of party viability and state prestige.

Over time, China began to accept the reality of a nuclear India, and China's initial concern eventually dissipated into apathy. The buildup of Indian nuclear weapons over the past 15 years has been treated with similar insouciance. Today, experts believe India possesses approximately 80–100 nuclear weapons deployed across short-, medium- and long-range ballistic missiles. Though it predominantly relies on its land-based capabilities, it can be said to have a credible nuclear triad.

Of most concern to China is India's indigenously developed *Agni*-series. The *Agni*-III, for example, has a range up to 5,000 km, allowing it to target most of China's major cities. The *Agni*-V, currently in production, has an even broader range, allowing India to strike anywhere within China and beyond. The technology demonstrated by the *Agni*-V ICBM and in India's indigenous launch vehicles enables the state to pursue space

weaponization, most notably, the development of antisatellite weapons. According to the chief of India's Defense Research and Development Organization, these are the necessary components for India to protect itself from China and maintain a "credible deterrence capability."[44]

Despite China's apparent vulnerability to India's strategic nuclear forces and the future possibility of its strengthened space defenses, many in China show little overall concern. Part of this stems from the fact that India's ICBMs are still new and their abilities have not yet been confirmed outside preliminary tests. Expert Shih Chun-Yu explains, "Strictly speaking, India's 'Agni-V' is not really an intercontinental missile. Its launch was successful, but its accuracy and stability remain to be observed, and it is not sure to what extent it can threaten China."[45]

This type of downplayed assessment, while notable in the particular incidence of the *Agni*-V, is displayed quite often in Chinese commentaries on Indian nuclear capabilities. Chinese experts admit that the Indian government likely factors China into its nuclear weapons decisions, but those same experts emphasize that this consideration is not reciprocal. One expert at a strategic dialogue claimed, "China is not worried about India at all from a nuclear standpoint."[46] Another participant at a more recent conference opined, "China knows for certain that nuclear deterrence works well between China and India."[47] In other words, China is confident that its nuclear capabilities (as well as those of Pakistan) will likely keep India in check. As a consequence, it can afford to consider India among the less significant "small countries" on its periphery—unless this dynamic is disrupted by the United States.[48]

The United States—Intent and Extensive Means

As the world hegemon, the United States can influence the actions of other countries via its pocketbook and/or its promise of military protection. This means that the United States can significantly amplify the threat facing China. If the US intent is truly to contain China, then the United States can recruit assistance across the globe to help it achieve this objective. This is the luxury of a superpower, and it is precisely why China perceives the United States as its primary security threat.

In the nuclear realm in particular, this threat is heightened by America's development of BMD. The US government has repeatedly stressed that the purpose of this system is to defend the US homeland against an attack by a limited number of ballistic missiles launched from regional

adversaries like Iran and North Korea and it is not meant to protect against larger attacks from states like China and Russia. Yet this has done little to assuage the latter countries' concerns. China, in particular, repeatedly claims that the US BMD system threatens its state security and the stability of the world. The rationale behind this belief is equally part capability and part intent.

Though testing continues, the intent of US BMD is to provide the United States with the capability to detect and destroy incoming ballistic missiles. Currently, America's BMD system is structured to protect the US homeland against a limited missile attack from North Korea and Iran, but this design inevitably also thwarts a limited attack from China, since China's missiles are likely to take a similar trajectory over the Arctic.[49] This means that if China sends a ballistic missile to the United States, it most likely will be detected. A single missile will also likely be destroyed.[50] This likelihood diminishes as the number of incoming missiles increases, though the numbers are not yet in China's favor. At present, China has approximately 35 missiles that can deliver a nuclear warhead to the continental United States, including 20 DF-5s and fifteen DF-31As. By fitting a portion of its DF-5s with multiple independent reentry vehicles, China increases the total number of its deliverable warheads to approximately 55. Theoretically, this outnumbers America's 44 planned interceptors, but it also assumes China will have all 55 of its warheads after a first strike—an assumption China is not likely to include in its strategic analysis. To ensure a second strike, it must guarantee there are enough remaining missiles and warheads to outnumber US interceptors.[51]

The numbers game between the United States and China stands in stark contrast to the US position vis-à-vis Iran and North Korea. Neither of these countries currently has the capability to send a missile to the United States, much less one armed with a nuclear warhead. The United States argues that it cannot wait for these nations to develop this technology before it protects against them. Nuclear weapons inflict indiscriminate violence of unprecedented scope and the United States is not willing to risk an attack of this magnitude. Its defenses, it claims, are built with this in mind. China has difficulty accepting this explanation. In particular, it questions America's need for more interceptors. If Iran and North Korea are the primary threats, why are so many interceptors necessary? This increase and the continual enhancement of US intelligence, surveillance,

and reconnaissance, China claims, speak louder than the "seemingly pale and powerless soothing political statements" America provides.[52]

Chinese scientists point out the peril of the present situation, but they also warn that the situation could get worse. As professor of international relations Shi Yinhong points out, there is no guarantee that the United States will remain satisfied with only 30 or 40 ground-based interceptors.[53] Who is to say they will not build more? A Chinese scholar attending the 2011 US–China Strategic Dialogue made a similar point, arguing that the United States could easily and quickly advance from having 30 interceptors to having up to 300 interceptors as a part of its BMD system.[54] This, in addition to US nuclear superiority, leads many to believe "the United States poses a far greater threat to the world than 'the world poses to the United States.'"[10] So why does the United States find it necessary to invest in defensive capabilities? The answer, many argue, has to do with intent.

The majority of policy makers, academics, and military personnel in China believe that America's pursuit of missile defense technology is driven more by a desire to expand the range of offensive military action it can pursue with impunity than by a desire to protect the US homeland from so-called "rogue nations." Tian Yuan claims, "The intentions of 'Uncle Sam' are very clear, . . . to do the same old thing in a new guise and, on the basis of absolute superiority, to build a missile defense system to ensure that it is equipped with both spear and shield, thus reaching its aim of 'winning without fighting.'"[55] The analogy of the United States having both *spear* and *shield* is common in China. It means the United States is able to strike while blocking blows from an opponent. As it pertains to missile defense, possession of both a spear and a shield means that the United States is able to launch a preemptive attack without fearing nuclear retaliation.

In China's view, this does not just impact rogue nations; it impacts all nuclear weapon states—just consider the volatility of US enmity. While the United States may today be focused on Iran and North Korea, there are no guarantees that this focus will not one day shift to other states. Others push past the theoretical and argue that the United States has already shifted its focus and that its rhetoric on Iran and North Korea represents an impuissant attempt at diversion. A military panelist at a recent US–China Strategic Dialogue put it bluntly, "We're not idiots in China who think you are transparent in your BMD intentions. It is

incredulous to assume that the US BMD efforts are solely targeted at Iran and North Korea."[56] Other scholars agree, arguing that the amount of money America has invested to develop and deploy its BMD system (now close to $10 billion) is disproportionate to the aim of destroying missiles from small nations.[57]

National Defense University professor Zhang Zhaozhong elaborates upon this point. Zhang explains that while the United States claims that its BMD system is intended to deter states like North Korea, Iran, and Iraq, little empirical evidence exists to support the assertion that these states present a direct threat to American security. Writing in 2000, Zhang argued that the available evidence did not support the conclusion that North Korea possessed ballistic missiles or nuclear weapons. Moreover, Zhang stated that while Iran and Iraq might have tactical nuclear weapons, these weapons should be considered moot from the US perspective, because they can only strike targets within several hundred kilometers. Even if these capabilities were expected to increase, Zhang said, why would America propose a BMD system as the solution when other more economical solutions are available? He continued:

> Americans have always been impetuous; once they discover the evidence that these nations have missiles or nuclear weapons developmental capabilities, the Americans quickly use the methods of nuclear sanctions, and armed force to destroy such capabilities, so how is it that in this case they have the patience to wait. . . ? The American's development of the NMD [National Missile Defense] primarily is to target Russia and China since the United States knows that these two countries alone have the capabilities to threaten the American mainland.[58]

Zhang's words proved prescient in the case of Iraq, but his primary point was aimed at China and Russia.

Zhang is not alone in his convictions. It appears that the "true" intent of US BMD, countering Chinese and Russian nuclear forces, is either becoming increasingly apparent to those across China or such individuals are becoming decreasingly reserved in expressing this perspective. In fact, even China's Foreign Minister Tang Jiaxuan openly questioned US motives with BMD, asking, "Is [US BMD] really to defend against the missile threat from the few so-called 'problem states,' or for greater military advantage over other big countries?"[59] Tang and others think the answer is self-evident. As a consequence, an opposite strategy for China entails nuclear force modernization and buildup.[60] The US missile defense system, though, is only one aspect of what China perceives to be a grander

shift in US military strategy. Another less-explored component includes advancements in US conventional capabilities—the *spear* in the *spear-and-shield* metaphor.

Traditionally in China, the threat presented by an adversary's conventional military capabilities does not influence the state's nuclear strategy decisions. This is because, in general, statesmen in China have assumed that conventional weapons and nuclear weapons operate in different military spheres and serve different purposes. One type of weapon is not used to deter the use of another. However, this perception of categorical separation, a former mainstay of Chinese nuclear strategy, may be changing due to recent advancements in US conventional military capabilities and expressions of intent surrounding these capabilities.

The United States has consistently maintained the most advanced conventional military in the world. It has also developed and deployed one of the largest nuclear arsenals. The line between conventional and nuclear weapons has never been as clear in the United States as it has been in China due to the transition of the US nuclear strategy to limited deterrence in the 1970s. With the Schlesinger doctrine, the United States abandoned the belief that the threat of massive retaliation was sufficient to deter a nuclear first strike. Instead, the government sought to implement a policy that allowed the president to evaluate and deliberate options of scale. This strategy, which later evolved into the "countervailing strategy" outlined in Presidential Directive 59, stressed the importance of force mobility and the necessity of preplanned targets. It was also more open-ended on what type of attack (nuclear or conventional) precipitated such action. Today, the United States reserves the right to use nuclear force in response to a large-scale conventional attack and chemical or biological weapon attack. It is more flexible in its response and uses strategic uncertainty regarding first use to its advantage.

While clearly distinguished from China's No First Use policy, the US policy has traditionally still delineated between nuclear and conventional weapons. A nuclear response to a conventional attack, for instance, is only warranted if the destruction is of a sufficient scale. Recent developments in US nuclear strategy go one step further in diminishing the demarcation between nuclear and conventional weapons. With technological advancements in prompt long-range missiles, the United States can use conventional missiles to strike nuclear targets. In the 2001 *Nuclear Posture Review Report*, for instance, US Secretary of Defense

Donald Rumsfeld mentioned the necessity of a "new triad" complete with "new nonnuclear strategic capabilities" that will bolster the offensive capabilities of US military forces. In May 2003 the US Air Force officially requested funding for this mission, labeled Conventional Prompt Global Strike (CPGS). As envisioned, the mission of CPGS is to shorten the launch-to-strike time of America's high-precision conventional missiles and to distend their reach, enabling the United States to strike any target in the world in less than an hour.

One of the methods of achieving this aim is to suit nuclear-capable high-precision ICBMs or submarine-launched ballistic missiles with conventional warheads. More favorable methods include fielding advanced hypersonic weapons, hypersonic cruise missiles, and hypersonic gliders. These weapons would travel through the atmosphere, rather than above it, at a pace five times the speed of sound. To date, the United States has tested three such systems, including a boost glide vehicle, an Advanced Hypersonic Weapon, and a hypersonic cruise missile called the X-51 Waverider. The success of these tests varied, and the United States has not yet determined whether these weapons will be acquired and deployed as a part of CPGS. Presently, the entire program is in the embryonic stage of development, with the technology and the targets are still being decided. The target that appears most frequently in official discourse is an adversary's fortified, buried, or mobile nuclear forces. This description is sometimes left alone and sometimes contextualized in terms of the forces of "new proliferators" like Iran and North Korea.

The ambiguity surrounding CPGS has led to several misconceptions in China. First, there are those who overestimate America's current CPGS capabilities, portraying CPGS not as a concept but as a fully operational system or a system that will soon expand to include "tens of thousands of high-precision weapons."[61] Second, many in China seem to question US intent, arguing that the acquisition and deployment of high-precision, long-range, rapid launch weapons by the United States poses a distinct threat to China's nuclear forces and the nuclear forces of other nuclear weapon states.[22] Like with missile defense, these analysts do not believe the United States designed the CPGS system solely to target Iran and North Korea. As such, the broader argument has become that the American CPGS system threatens to disrupt the international strategic balance by allowing the United States "absolute security." One *PLA Daily* article warns, "People of the world should think about the

changes that will happen at that time [CPGS deployment] in terms of the United States' actions and methods of handling affairs."[62] Exactly what could happen? Many in China think US preemptive action is not out of the question. This is why they believe that other states, including China, may want to respond by developing their own hypersonic weapons and/or advanced nuclear weapons. Another response would be reconsidering No First Use.

United States—Supplying Means and Intent

In addition to the ability of the United States to develop missile defense and conventional counterforce capabilities to further its security, the United States also has the material means and the influence to supply specific states with nuclear capabilities and/or to implant the idea or exacerbate the idea of a "China threat." From the Chinese perspective, US "hegemonism and power politics" are responsible for creating most of the "nuclear storms" in the world today, including those situated on China's periphery. While each state has its own story, these stories are embedded within the larger narrative of US supremacy. China's relationships with its nuclear and nuclear-capable neighbors are situated in this larger context and, as a consequence, China must consider and anticipate US action when managing its bilateral regional deterrence relationships. Evidence of this consideration appears across all cases.

In the case of Indian nuclearization, for instance, though US officials were very vocal in expressing their opposition to India's nuclear tests, many in China doubted the sincerity of the US response considering the US provision of nuclear technology to India in the 1950s. Other Chinese reports and articles question US complicity after Indian testing and the short turnover the George W. Bush administration displayed in later agreeing to openly trade civilian nuclear technology with India. Many in China believe that the US actually supports India's nuclear weapons development because it provides a counterweight to China's rise. Any semblance of an arms race in the region can thus, from the Chinese perspective, be traced back to the United States. An article appearing in Ta Kung Pao, for instance, claims that while it may be difficult "to judge who should be held responsible for promoting conventional and nuclear arms races in South Asia, [the United States] will have a hard time 'escaping its connection'" to the buildup.[63] After all, the race began after the United States signed the nuclear technology-cooperation agreement

and the 10-year National Defense Agreement with India. Chen Xulong, deputy director of the China Institute of International Studies, Department of International Strategic Studies, provides a similar assessment, though his viewpoint is obviously influenced by his position: "In playing these nuclear cards with countries on China's periphery, the United States leaves the most good willed of people with no choice but to question its motives and ambitions."[64]

This statement implies that the United States is "playing" India to check China and Pakistan, but it could also hold true for other states in the region—particularly Taiwan and North Korea. Though the United States officially accepts the international community's recognition of the PRC as the legitimate representative of China, it also helps Taiwan balance the mainland's military power by providing it with a steady supply of arms. China argues that the weapon systems provided by the United States could be used by Taiwan in a war of independence, especially if Taiwan's defense is aided by US theater missile defense (TMD). According to one PRC official, this "would be tantamount to the restoration of a quasi-military alliance between the US and Taiwan."[65]

At present, Taiwan does not participate in the US TMD program, and there is certainly not a military or quasimilitary alliance between the two countries. This is not to say, however, that their relationship is not precarious as far as China is concerned. China has consistently opposed US arms sales to Taiwan, maintaining that such exchanges threaten China's national security. An accidental shipment of nuclear fuses in 2006 did not help matters. Though the fuses were returned, the incident seemingly lent credence to China's ongoing suspicion of a US containment policy. To some, America's interactions with North Korea further stoke this suspicion.

North Korea may be acting irresponsibly and in complete disregard of international law, but many in China feel as though it is doing so because the United States is forcing its hand. The dealer has provided the Kim regime with few options. As a result, to stay in the game, North Korea chooses to cheat. When North Korea withdrew from the NPT in 2003, for instance, Chinese reports depicted North Korea not as an iniquitous nation but more as a victim of US coercion. "With its most important national interests seriously threatened," claims *Xinhua* news reporter Ji Xinlong, "North Korea had no choice but to withdraw from the Nuclear Non-Proliferation Treaty to protect its national sovereignty,

survival, and dignity."[66] Wang Xinjun, a research fellow from the Academy of Military Science, takes a similar tone, explaining that North Korea's pursuit of nuclear weapons is a likely consequence of US power politics. "The main reasons for the nuclear crises," he explains, "are the hegemonic aspirations of some nations and the interventionism and double standards they practice."[67]

Ultimately, Ji and Wang argue that the North Korean decision to construct a nuclear deterrent is a consequence of US coercion. While the situation is clearly more complex, their simplistic rendering of the situation conveniently serves to further the characterization of the United States as a malevolent hegemon. Even more acrimonious are those who argue that North Korea's nuclearization is an *intended* consequence of US action. According to this account, the United States does not actually fear North Korea's nuclear weapons development but only uses this fear to justify an increasing American presence in Asia. After all, such development is likely to remain limited, and any launch is likely to be intercepted by US missile defense. As a result, Shih Chun-yu concludes that North Korean nuclear weapons development is "exactly what the United States wants, since it provides a pretext for legitimizing the US military presence on the Korean peninsula and seizing the opportunity to check China's rise."[68]

While Shih's point is extreme, he is not alone in reaching this conclusion. The majority opinion presents a more subtle interpretation of the situation, characterizing the United States not necessarily as an orchestrator but as a strategic opportunist who sees North Korean nuclearization as an excuse to exert greater military power in the Asia–Pacific and ultimately check the power of an ascending state. A prime example many cite is US TMD cooperation with Japan and South Korea. This began with the US provision of radar bases and Patriot missiles to South Korea in 1994 and continued with Japanese–US TMD cooperation in 1998. In this regard, the story of South Korea is that it serves as a conduit of US power and a means for the United States to encircle both North Korea and China. This is particularly the case when the United States conducts joint military exercises with South Korea on China's periphery. In the same vein, the majority of scholars and state officials in China see it is "entirely unnecessary" for Japan to be protected by TMD. Yet with America as its exemplar and abettor, Japan has manipulated the North Korean situation so that it appears to be a legitimate excuse

for Japanese–American cooperation as well as for Japan's overall military buildup. The blame here is more equally distributed, as both the United States and Japan are cast as offensive actors, but the threat China perceives from Japan would be undoubtedly less were the United States not involved. In fact, in many ways, South Korea and Japan are seen together in China as a collective front "by which the US can control the Asia–Pacific region."[69]

Interestingly, a similar argument is made in the case of Iran. While Iran is not situated next to China, its story is viewed as similar to North Korea's, with many in China claiming that the United States is exaggerating the Iranian nuclear threat to exert US authority. In this case though, military force is eschewed for economic sanctions. Yu Chia-Hou claims that the true intent of US action in Iran is to wage an "economic war" with China, since China relies upon Iran for fuel. This, he says, is a strategic, underhanded move made by the United States "to eliminate the China threat" without the direct use of military force against China.[70]

Less extreme interpretations see the US–Iran conflict less as a direct threat to Chinese security than as a stark example of the overall insecurity brought by US hegemony. "There is still some country trampling on the norms of international relations with its military superiority," says one article, and "This practice has forced a couple of countries to regard possession of nuclear weapons as a strategic pillar of safeguarding the national security and supporting the international status."[71] These statements highlight how China perceives US hegemony to be an anathema—and how it justifies its nuclear buildup.

Conclusion

For the most part, the gradual pace of China's nuclear buildup has allowed it to avoid the international limelight. It has carefully timed the rollout of new weapon systems and slowly added to its numbers—all while maintaining minimum transparency. Some analysts have even argued that China has become the "forgotten nuclear power."[72] However, it is worth remembering that China is the fourth-largest nuclear weapon state, and if it continues on its present trajectory, China might soon surpass France to be the third-largest nuclear weapon state in the world. This growth goes against the expressed interest of all NPT nuclear weapon states and is against the interest of other states, like India and Japan that consider a nuclear China to be a serious security threat.

At the same time, however, as this article demonstrates, the majority of nuclear weapon states lack either the means or the intent to present a clear threat to China, and those that have means and intent are perceived by China to have been abetted in some way by the United States. Consequently, a change in China's nuclear strategy and force structure will likely require US action.

While the most direct solution to stopping Chinese buildup may be a trilateral agreement between the United States, Russia, and China, placing mutual restrictions on all states' hard capabilities, this is not likely to happen soon, since the idea of a numeric threshold has become less and less relevant to China owing to the modernization of the remaining US and Russian nuclear forces. This has caused many in China to claim that a strict quantitative approach to nuclear disarmament is no longer sufficient. After all, what does it matter if there are fewer nuclear weapons if these weapons are upgraded to increase the likelihood of their use? Is this a true step toward global disarmament or simply a shift onto a different path in the same direction? Can one claim, as some have in China that "the nuclear arms race has changed from one based on quantity to one based on quality?"[73] If this is the case, then a treaty focusing on or at least incorporating qualitative restrictions might be more successful. In either case, though, since the focus is on hard capabilities, more transparency will be necessary.

From the US point of view, the security dilemma between it and China is exasperated by the United States not knowing exactly the extent of China's nuclear capabilities. According to the United States, without such a priori knowledge, any bilateral or trilateral agreement—whether focusing on quantitative or qualitative restrictions—will be futile. Of course, China could argue the same in terms of the nonstrategic nuclear weapons held by the United States and Russia, since these weapons have never officially been counted. Of more importance to China is the transparency of US intent. The logic in this case is that even if China reveals the structure and scope of its nuclear arsenal and the United States and Russia reveal the extent of their remaining nonstrategic nuclear force, China, before any agreement is signed, needs reassurance that the United States, in particular, will not use its knowledge of China's nuclear force to employ its strategic nuclear weapons or its advanced conventional weapons in a preemptive strike. Chinese leaders would want to have knowledge of and confidence in US nuclear intent. Ideally, for China

this means that the United States would sign a formal no-first-use agreement. In fact, China has repeatedly requested that all nuclear weapon states employ this policy. No other state has taken this step. A logical antecedent might be a statement clarifying US conditions of nuclear use.

To date, the United States has preferred to pursue a policy of first-strike ambiguity, with even the most recent *Nuclear Posture Report*, which is thought to be the most restrictive, leaving open the option of preemptive nuclear use in "the most extreme circumstances." This ambiguity, in conjunction with the superiority of US hard capabilities, amounts to a clear threat to Chinese security. The United States could mitigate this threat by issuing a statement specifying the circumstances under which it would consider a preemptive nuclear attack. A similar statement clarifying the intent of the US CPGS system would also lessen the threat China perceives from the United States.

Presently, there is not an equivalent document to the US *Nuclear Posture Review* outlining the US mission for CPGS. Instead, other states have had to rely on statements released by US administrations—statements, which, thus far, have not been reassuring. Both the George W. Bush and Obama administrations have stated that the United States reserves the right to use its CPGS missiles to attack another state's nuclear force. In most cases, these statements have been accompanied by a clarifier that the intended target would be a rogue state or a US "regional adversary." Without clarification, China is likely to assume—and prepare for—the worst. According to the 2013 edition of the *Science of Military Strategy*, "Once it [US CPGS] has functional capabilities, it will be used to implement conventional strikes against our nuclear missile forces and will force us into a disadvantaged, passive position."[74] It is in the best interests of the United States to not make China feel as if it is backed into a corner. The same can be said for Russia.

An explicit statement excluding Chinese and Russian nuclear forces from the US CPGS mission would go a long way in achieving this aim. It would also be beneficial if the United States made it clear that it will not suit its ICBMs with conventional warheads. China could match this move by providing clarification of its own. Currently, a few Chinese bases hold both conventional and nuclear missiles. Additionally, some of China's missiles, like the DF-21, can be loaded with nuclear warheads. This duality is problematic for multiple reasons. First, the coupling of China's conventional and nuclear forces can make it difficult to distin-

guish whether an incoming Chinese missile is conventional or nuclear. Second, if a state attempted to strike China's conventional weapons, the nature of their position would make it such that a state would also be attacking China's nuclear weapons—an offense that some in China have said warrants nuclear retaliation. These gray areas have the potential to inadvertently increase escalation. As a result, the United States would welcome a Chinese statement identifying which bases have which type of force, or, as an alternative, a promise that China will work toward force separation.

The key in this case and others is the perceived credibility of any promise proffered. This is particularly important in statements of intent, but even in cases where verification mechanisms are in place (such as in agreements limiting hard capabilities), cheating remains an option. For an agreement to work, the parties involved must have confidence that defection is unlikely. This kind of confidence results from trust, and trust requires mutual understanding formed through iterative interaction. Even when the United States and Soviet Union were rivals during the Cold War, they shared the experience of emerging into and managing through the nuclear age together, and thus, they had a mutual understanding of their responsibilities as superpowers. They sharpened this understanding with multiple high-level talks. These talks led to the establishment of the Anti-Ballistic Missile Treaty and served as precursors to subsequent arms control treaties.

China and the United States do not maintain the rapport that the United States and Soviet Union did during the Cold War, but efforts are being made to move in this direction. Official nuclear dialogues between China and the United States have long been stymied, but unofficial conversations present progress, especially the Track 2 and Track 1.5 dialogues organized by the Pacific Forum, Center for Strategic and International Studies, Center for Contemporary Conflict, Naval Postgraduate School, and Defense Threat Reduction Agency. These dialogues have occurred once a year every year for the past seven years, and in that time, the participant list has doubled in size. Moreover, while the first dialogue included only individuals from China's academic community, later dialogues have included active Chinese military personnel and state officials. In fact, the China Arms Control and Disarmament Association cohosted the past two conferences. As these conversations include more individuals of greater influence, the opportunity for mutual understand-

ing and trust is likely to increase. This increase in understanding and trust makes transparency possible, which, in turn, can allow bilateral and multilateral treaties to become a reality.

A similar process can occur through established multilateral forums, such as nuclear dialogues among the UN Security Council's five permanent members, which are also the five NPT nuclear weapon states. These dialogues have taken place annually for the past five years and have advanced the conversation regarding how the NPT nuclear weapon states foresee fulfilling their NPT obligations of disarmament, nonproliferation, and the peaceful use of nuclear energy. While still in its nascent stages, this group shows promise for pushing the disarmament agenda forward and for unveiling and actualizing the conditions for Chinese cooperation.

In his keynote speech before the 2009 UN Security Council Summit on Nuclear Nonproliferation and Disarmament, Chinese president Hu Jintao said that China would consider pursuing nuclear arms reductions along with the other powers when the time and conditions were right. He did not elaborate on this point, but given the evidence presented in this article, one can make the case for when such action might be more likely. China's present nuclear buildup and modernization is spurred by the perception that the United States is shifting to a more aggressive nuclear strategy, complete with advanced military technology. To the extent that the United States can convince China that its intentions with US missile defense and CPGS are benign and not directed at constraining China's rise, the likelihood of Chinese cooperation in disarmament increases. This transition is not likely to be immediate but will be the product of prolonged cooperation and patience.

As the perceived threat of the United States increases and this threat manifests into China's periphery, the pressure accumulates for China to take specific countermeasures, including the buildup and diversification of its nuclear force. From this perspective, if the United States is to engage China in a dialogue toward future multilateral disarmament, it will need to convince China that its intentions with US missile defense and CPGS are benign and not directed at constraining China's rise. The United States will also have to understand that the dilemma facing China is not one-dimensional, but multidimensional, with China having to contend with security threats at both the international and regional level. With this in mind, discussions of restricting US nuclear assistance and TMD participation might also have a place in negotiations and could increase

Chinese cooperation. Ultimately, as this analysis shows, a future triangular dialogue, as suggested by Cimbala, will need to look very different than the previous bilateral disarmament dialogues between the United States and Russia. The sooner this can be acknowledged and appreciated, the sooner its actualization becomes a possibility. SSQ

Notes

1. Stephen J. Cimbala, "Chinese Military Modernization: Implications for Strategic Nuclear Arms Control," *Strategic Studies Quarterly* 9, no. 2 (Summer 2015): 11–18, http://www.au.af.mil/au/ssq/digital/pdf/summer_2015/SSQ_Summer_2015.pdf.

2. Charles Ferguson, "Sparking a Buildup: U.S. Missile Defense and China's Nuclear Arsenal," *Arms Control Today* 30, no. 2 (March 2000): 13–18; Baohui Zhang, "US Missile Defence and China's Nuclear Posture: Changing Dynamics of an Offence—Defence Arms Race," *International Affairs* 87, no. 3 (May 2011): 555–69; Hui Zhang, "China's Nuclear Weapons Modernization: Intentions, Drivers, and Trends" (presentation, Institute for Nuclear Materials Management, 53rd Annual Meeting, Orlando, 15 July 2012), http://belfercenter.ksg.harvard.edu/files/ChinaNuclearModernization-hzhang.pdf; and Baohui Zhang, *China's Assertive Nuclear Posture: State Security in an Anarchic International Order* (New York: Routledge, 2015).

3. Lowell Dittmer, *South Asia's Nuclear Security Dilemma: India, Pakistan, and China* (New York: Routledge, 2005); and Lora Saalman, *The China–India Nuclear Crossroads* (Washington, DC: Carnegie Endowment for International Peace, 2012).

4. Gregory Koblentz, *Strategic Stability in the Second Nuclear Age* (New York: Council on Foreign Relations, 2014), 20.

5. A large caveat is necessary whenever one attempts to conduct primary source research on a subject with national security implications. This is especially true in particularly opaque countries like China, where one must be aware of the possibility of strategic misinformation. In fact, an explicit admission of such practices is contained within China's classified People's Liberation Army Second Artillery Force manual. It is beyond the parameters of this article (or the author's abilities) to distinguish with certainty, which information has been falsified and which information is authentic. Rather, the aim of this study is to illuminate the Chinese perspective as seen through the lens of the state. An example in favor of direct interpretation comes from the Sovietologists of the 1970s and 1980s who predicted that the Soviet nuclear strategy was based upon winning a nuclear war. With the benefit of hindsight, scholars now see that these analysts overestimated the aggressiveness of the Soviet Union and too readily dismissed the reassurances issued by the Soviet government as propaganda. While certainly not everything that was said was true, more of it was true than US experts wanted to believe. It is easy to see how a similar mistake could be made today in regards to China, especially considering the present context of mutual distrust.

6. This analysis includes Israel, which has not admitted to having nuclear weapons but is known to have its own nuclear arsenal. Available information indicates Israel's *Jericho* III intercontinental ballistic missile has a minimum range of 5,000 kilometers.

7. Shannon N. Kile and Hans M. Kristensen, "World Nuclear Forces," in *SIPRI Yearbook 2014: Armaments, Disarmament, and International Security*, edited by Stockholm International Peace Research Institute (Oxford, UK: Oxford University Press, 2014), 287–354.

8. The information presented is based upon data collected from over 1,000 primary sources, including Chinese newspaper articles, academic journal articles, public speeches, military manuals, and Track 2 dialogue notes from 1991 to 2013.

9. Barack Obama, "Remarks by the President on the Iran Nuclear Deal" (speech, American University, Washington, DC, 5 August 2015), https://www.whitehouse.gov/the-press-office/2015/08/05/remarks-president-iran-nuclear-deal.

10. This conclusion was supported by the International Atomic Energy Agency's confirmation that Iran's program complied with Nuclear Nonproliferation Treaty requirements.

11. The Chinese government's claim of ignorance in this regard strains credulity when one considers declassified reports confirming the use of chemical weapons in the Iran–Iraq War in the 1980s and China's reported role in selling dual-use chemical and chemical weapons-related production equipment to Iran in the early 1990s. Earlier Chinese reports also acknowledge North Korea's possession of chemical and biological weapons. Since not all of this information was available to the public at the time of this statement, the government's assertion of these countries' "innocence" can be seen as strictly propagandistic—serving to persuade the Chinese public of the peril of US hegemony.

12. Bao Erwin, "'Axis of Evil' is Nonexistent," *Xinhua*, 3 February 2002.

13. Wanng Chong, "Iran Nuclear Crisis Tests China's Diplomacy," *Zhangguo Qingnian Bao*, 18 January 2006.

14. Yu Song, "The Korean Nuclear Issue Makes US–Japanese Alliance Closer," *Zhongguo Tongxun She*, 19 October 2006.

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16. "China Expresses Deep Regret over Pakistan's Nuclear Tests," *Xinhua*, 28 May 1998.

17. Li Hongmei, "Carrier Domineering Mentality Obsolete," *Renmin Ribao*, 30 December 2010.

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20. Zheng Hong, "The Thick Nuclear Haze Is Flowing in the Sky of South Asia," *PLA Daily*, 3 June 2002.

21. Luo Zhaohui, "JFJB [*PLA Daily*] Interviews PRC Ambassador on Anti-terror [sic], Other Ties with Pakistan," *PLA Daily*, 30 July 2009.

22. Shirley A. Kan, *China and Proliferation of Weapons of Mass Destruction and Missiles: Policy Issues* (Washington, DC: Congressional Research Service, 5 January 2015), 6, https://www.fas.org/sgp/crs/nuke/RL31555.pdf.

23. Mark Stokes, *China's Strategic Modernization: Implications for the United States* (Carlisle, PA: Strategic Studies Institute, 1999), 204.

24. Zhang Zhixin, "Features of Russian–US Relations at Present and Chinese Countermeasures," *Wen Wei Po*, 21 August 2008.

25. RIA Novosti, "New Cold War: Russia, China to Coordinate Response against US Global Missile Shield," *GlobalResearch* (web site), 10 January 2013, http://www.globalresearch.ca/new-cold-war-russia-china-to-coodinate-response-against-u-s-global-missile-shield/5318335.

26. It has also been argued that Chinese and Russian perceptions of a post-unipolar order differ, and thus the cooperative relationship that has characterized the first half of the twenty-first century is no longer guaranteed. See Susan Turner, "Russia, China, and a Multipolar World Order: The Danger in the Undefined," *Asian Perspective* 33, no. 1 (2009): 159–84, http://www.jstor.org/stable/42704667?seq=1#page_scan_tab_contents.

27. Shih Chun-Yu, "Russia Puts Forward New National Security Guidelines," *Tao Kung Pao*, 17 January 2000.

28. Yan Zheng and Ma Jian, "Russia's All-round Countering of NMD [National Missile Defense]" *PLA Daily*, 23 February 2001.

29. Pang Zhongying, "People's Observations: China's International Status and Foreign Strategy after the Cold War" (speech, Qinghua University, 16 April 2002), reprinted in *Renmin Wang*, 5 May 2002.

30. Wang Guosheng and Li Wei, "US Comprehensively Adjusts Nuclear Strategy," *PLA Daily*, 30 January 2002.

31. This switch was carried out with United Nations (UN) General Assembly Resolution 2758, which expelled Taiwan and charged it with "unlawfully" occupying its UN seat. Though the United States initially contested this move, wanting both the People's Republic of China and Taiwan to retain UN membership, it ultimately acquiesced and voted with the majority.

32. Vincent Wang, "Taiwan: Conventional Deterrence, Soft Power, and the Nuclear Option," in *The Long Shadow: Nuclear Weapons and Security in 21st Century Asia*, edited by Muthiah Alagappa (Stanford, CA: Stanford University Press, 2008), 404–28.

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Iran's Path Dependent Military Doctrine

Erik A. Olson

Abstract

The key element of Iran's military doctrine is its emphasis on ballistic missiles. This results from a path dependency created by historical contingencies and critical events, including the Iranian revolution, the Iran–Iraq War, and Chinese support. Iran's continued focus on missiles is a less-optimal approach to its own security needs or those of its regional allies. At the same time, significant institutional obstacles caused by path dependency challenge Iran's ability to adjust its military doctrine. Iran's missile path dependency also creates wider implications for Middle East security while offering opportunities for US cost-imposing strategies against Iran.

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Iran has the largest missile force in the Middle East, and this force is growing in size and sophistication. In May 2014 Iran's supreme leader, Ayatollah Ali Khamenei, stated that any expectation Iran would limit ballistic missile development was "stupid and idiotic," and that the "main duty of all military officials" was the mass production of missiles.[1] Khamenei's statement and Iran's multi-decade effort to build its missile industry and arsenal demonstrate the importance of ballistic missiles in Iran's military doctrine. The country's military doctrine defies simple categorization into offensive, defensive, or deterrent models.[2] It is designed to deter adversaries and retaliate if deterrence fails. While Iran also uses insurgency and terrorism to build influence, destabilize its enemies, and exploit seams in the regional security architecture, its missiles are—by design—Iran's most advanced military force. They are a key aspect of Iran's doctrine, providing significant deterrent value and a retaliatory threat, while indirectly supporting Iran's unconventional forces. The emphasis on ballistic missiles was based on assumptions regarding

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the nature of the threats Tehran faced and ultimately was incorporated into military doctrine.

The principal source of doctrine is experience and, as such, relies on an accurate interpretation of history.[3] Historical examples demonstrate that states often do not adapt their military doctrines to new circumstances, in part because of institutional inertia, which limits future options and increases the risks of military defeat. Path dependency theory, a concept within historical institutionalism, explains this process, providing an analytical tool for evaluating the appropriateness of a state's military doctrine and strategy and its ability to adapt to emerging threats and opportunities. In the case of Iran, continued emphasis on expanding its ballistic missile arsenal is the result of a path dependency that incentivizes continued missile development but impedes changes to military doctrine. This article identifies the historical events that influenced Iran's path dependency and military doctrine—the contingencies and critical junctures that perpetuated its choices—and considers the implications of path dependency on regional security in the Middle East. Iran's path dependency offers the United States and its partners an opportunity to design cost-imposing strategies that constrain Iran. Recent developments, including the Joint Comprehensive Plan of Action (JCPOA) and the threat from the Islamic State of Iraq and the Levant (ISIL), have superseded the context under which Iran originally formulated its current military doctrine. These developments provide a rationale, though not an assurance, that Iran will adjust its military doctrine to deemphasize the threat from the United States and instead create a more-balanced military appropriate to defend itself and its allies from regional competitors and terrorist groups.

Path Dependency and Iranian Military Doctrine

Path dependency theory was originally employed to explain how inefficient standards or technologies become dominant, whereas other theories predicted that market efficiency would prevail.[4] While scholars continue to refine the theory, it is increasingly applied to analyze a wide variety of social, technological, and economic processes and, more recently, international relations and politics, including those concerning Iran.[5] Applied to politics, Margaret Levi describes path dependency as, "once a country or region has started down a track, the costs of reversal

are very high. There will be other choice points, but institutional arrangements obstruct an easy reversal of the initial choice."[6]

Other researchers offer two definitions of path dependency. The first definition simply states that "history matters"[7] when considering the outcome of a process and that "past conditions exhibit a persistent influence on a dynamic process."[8] The more demanding definition, applied by scholars and used in this article, identifies contingent events—sometimes viewed as inconsequential at the time—as ultimately influencing the process through institutional patterns or event chains.[9] The contingent events may be relatively small and seem insignificant at the time but, ultimately, can have large and enduring consequences, challenging political science theories that attribute "large outcomes to large causes."[10] A path-dependent process limits options, because, once a path has been set, changes are difficult, in part because the cost of changing paths rises over time.[11] Path-dependency researchers also identify the importance of critical junctures in the formation of path dependency, occurring after contingent events, creating "enduring institutions," and reducing the range of possible outcomes.[12]

Academics have articulated several ways path dependent processes occur. For example, political scientist Scott Page identifies four possible causes for path dependence: increasing returns, self-reinforcement, positive feedbacks, and lock-in.[13] Most germane to this study, researchers argue that with every step in a direction, positive feedback and self-reinforcement makes it difficult to reverse paths.[14] The outcome of the process is then reproduced, even though the original circumstances no longer exist. In the case of Iran's military doctrine, the predicating circumstance for Iran to develop a missile force was to retaliate proportionately to missile attacks from the Saddam Hussein regime in Iraq, a cause that no longer exists. However, Iran has found other rationalizations. Security expert Shahram Chubin alludes to this in his explanation that Iran's justification for missiles has expanded to include deterrence and retaliation against Israel and, as necessary, to defend fellow Muslims.[15]

Path dependency offers additional insights when applied in concert with existing international relations theories that have provided a useful framework for evaluating Iran's foreign policy and military strategy. Of interest to this article, the various trends of realism accurately capture Iran's desire for self-help and, at important times, the regime's penchant for placing its national interest above its own moral concerns—best

exemplified by Ayatollah Ruhollah Khomeini's ruling that the tenants of Islam could be suspended in the interest of the state.[16] However, realist academics acknowledge that states' judgments are prone to miscalculation and biases, at times in favor of "existing doctrines and policies."[17] Path dependency can be used to describe how this may occur despite what may be expected under standard, rational choice models in international relations.[18]

Path dependency also provides a useful tool to analyze military doctrine because of its focus on institutions: the formal and informal rules that structure decision making and compel or resist change. Institutions play an important role in the formation of military doctrine, because a nation's identity and experience shape both institutions and doctrine.[19] According to political scientist Paul Pierson national defense policy requires institutions to form, because such policy is a public good and a focus of politics.[20] Yet paradoxically, while necessary to create doctrine, researchers have also found institutions are subject to positive feedback and induce self-reinforcement, making them prone to path dependence.[21]

Military doctrine is a critical component of grand strategy,[22] designed to help states organize and plan for future conflict based on its experiences.[23] Analyzing military doctrine presents several challenges, including a lack of a universal definition. Few states, including Iran, formally publish their military doctrine, and even if openly declared, the most critical aspects may be ambiguous or obscured or may not "approximate comprehensive statements on doctrine."[24] Properly evaluated, military doctrine can provide insights into a state's thinking about the use of military power to accomplish national goals and offer a lens to evaluate that state's "view of reality" through its unique cultural grammar.[25] Doctrine exists at multiple levels of conflict—from providing guidance on tactical employment of weapons to strategic-level doctrine.[26] This article focuses on the strategic level of doctrine, described as the "expression of thought about the nature of the strategic questions confronting militaries," and the "most visible expression of a military belief system."[27]

Some aspects of the strategic level of doctrine may be analogous with the US understanding and use of the term *strategy*, creating the possibility of confusion. Iranian officials consistently use the term *doctrine* to describe military principles and orientation, which informs that term's use within this article. Iranian officers may be more inclined toward applying the term *doctrine* because of their familiarity with its use in religious studies. Other states outside the West base their use of the strategic level of

doctrine on the military's role and relationship within the government, which also likely informs Iran's definition.[28] Adding to the challenge of designing an appropriate and efficient military doctrine, a nation's doctrine may appear appropriate in a stable security environment, increasing a state's confidence in its doctrine and masking the need to continuously evaluate it. Military doctrine should mature and adapt to the strategic environment. Instead, because it draws heavily from history and experiences, doctrine often stagnates, creating by its inertia a potential threat to the survival of the state.[29] As Maj Gen J. F. C. Fuller, British Army, wrote, "Once a doctrine and its articles become dogma, woe to the army which lies enthralled under its spell."[30]

Thus, a principal task of military doctrine is to correctly identify the threats to the state and the appropriate military tools to address those threats. Like other aspects of doctrine, the willingness or ability to identify the enemy can become resistant to change, reflecting animosities and biases built up and self-reinforced over time. This can in turn also prejudice a state's investments in military tools. Doctrine may also "stress one type of force or weaponry over another for geographical, technological, economic, or political reasons."[31] However, if a state's military investments do not meet its security needs or are not adapted as the strategic environment shifts, the military doctrine may increase a nation's vulnerability to attack and defeat.[32] Political scientist Deborah Avant notes that oftentimes a state's security goals require a military to be prepared for a number of contingencies and security threats, and if the threats are of a similar nature, a state merely must ensure it has the appropriate means to meet the threat.[33] However, presaging Iran's emerging security dilemma, if there are multiple threats and the nature of the threats fundamentally differ from each other, its military doctrine must correctly identify the distinctions and train, equip, and field the force needed to address each threat.

These criticisms suggest that a nation's ability to successfully defend itself or prosecute a war is dependent upon its ability to design, implement, and adapt its doctrine as security needs change. During periods of instability or oscillations in the security environment, leaders must arbitrate among competing instincts of consistency and adaptation of its military doctrine. To do so in a timely manner, leaders require foresight to discern whether change is needed, self-awareness of rigidity within their own military thinking, and political will and capital to enforce difficult

decisions upon what may be a hostile military bureaucracy. Even more difficult is the task of analyzing a nation's military doctrine as an outsider to the governing system, especially in a system like Iran, which is influenced so deeply by dissimulation.[34]

Understanding Iran's Military Doctrine

The preamble to Iran's constitution identifies the religious nature of its military's mission, stating that the military will fulfill, "the ideological mission of jihad in God's way."[35] The constitution formalizes Islam as the basis for doctrine, stating, "In the formation and equipping of the country's defence forces, due attention must be paid to faith and ideology as the basic criteria." The constitution also quotes the Qur'an, in Surat al-Anfal, "Prepare against them whatever force you are able to muster, and horses ready for battle, striking fear into Gods [*sic*] enemy and your enemy, and others beyond them unknown to you but known to God."[36] While inferring a theological basis for a defensive or deterrent military doctrine, the verse may also provide the regime with justifications to expand its military capabilities. Iranian army regulations from the early 1990s recognize the importance of Islam as a guide for military doctrine, stating that, "In organizing and equipping the Armed Forces, the basic precept is Islamic ideology."[37]

Even though Iran does not openly publish its military doctrine, its order of battle, military actions, foundational documents, and military culture provide insights into its military doctrine. The major attributes of Iran's hybrid military doctrine include identifying the United States as the nation's primary security threat, commitment to Iran's religious and revolutionary identity, and emphasis on developing ballistic missiles. The degree to which these are mutually supporting and linked to Iran's grand strategy will dictate how well its doctrine supports its goals, including the survival of the nation's model of governance and the expansion of its influence.[38]

While conforming to the state foundational principles, Tehran's doctrine provides some tactical flexibility. In a 2014 speech, Supreme Leader Khamenei evoked this idea, "Tactics can be changed, methods can be changed, but principles should remain strong and solid. This is the secret to the solidity of the Revolution and the progress of the country."[39] While tactically flexible, some academics point to an ingrained "ideological rigidity" within the ruling elite that may impede needed reforms.[40]

Regime officials consistently claim Iran's military doctrine is defensive. For example, Iranian president Hassan Rouhani stated Iran's military doctrine is "based on defense" and that Iran does not "design any weapon for aggression."[41] In 2012 the Iranian air defense commander declared, "Iran's military doctrine, which is based on the noble Islamic teachings and Iran's constitution, is purely defensive."[42] Similarly, in 2014 the chief of staff of the Iranian Armed Forces, Maj Gen Hassan Firouzabadi, declared Iran's defensive doctrine was based on deterrence.[43] These statements reflect Iran's desire to be viewed as a responsible and nonthreatening regional military power but do not provide a comprehensive description of the country's military doctrine.[44] Iran's use and support of terrorism and the nation's growing ballistic missile capabilities are incongruent with regime officials' benign descriptions.

Iran consistently identifies the United States as its main adversary, though recognizing that the Iranian military would likely fare poorly in a conventional conflict with the United States.[45] In response, Iran has developed asymmetric-warfare concepts to deliberately avoid US strengths and negate US military advantages, including swarming small-boat attacks in the Strait of Hormuz and salvo ballistic missile launches to overwhelm missile defenses.[46] These tactics provide Iran an asymmetry of both costs and technology to use against the United States. Because of its focus on the United States, Iran has not invested in conventional military capabilities highly susceptible to US military superiority, such as fighter aircraft or bombers. While efficient in planning for a war against the United States, these foci have resulted in an imbalanced conventional military that cannot consistently project force across the spectrum of military operations.

Iran's order of battle provides tangible evidence of the rapid expansion and the dominant role ballistic missiles play within its military doctrine. By some estimates Iran's ballistic missile arsenal has grown to well over 1,000 ballistic missiles, providing Tehran with its greatest force-projection capability and its most credible deterrent.[47] According to the 2012 US Department of Defense *Annual Report on Military Power of Iran*, in the last 20 years "Iran has placed significant emphasis on developing and fielding missiles to counter perceived threats."[48] In February 2015 the director of the Defense Intelligence Agency testified that "Iran's overall defense strategy relies on a substantial inventory of theater ballistic missiles."[49] Demonstrating this, Iran's fifth five-year development plan for the years

2010–2015 calls for the "quantitative and qualitative development" of the missile force.[50] Its sixth five-year development plan identified as a goal increasing missile technologies to enhance Iran's "deterrent power."[51]

Self-sufficiency is another significant aspect of Iran's military doctrine. Its growing missile arsenal symbolizes resistance to US efforts and is a part of Iran's "self-sufficiency jihad" to develop a domestic military industry and wean itself from reliance on foreign military technology.[52] Iran applies the religious term *jihad* to provide the effort with religious authority and context. Self-sufficiency incentivizes further investment in Iran's domestic aerospace industry, relevant missile technologies, and other equipment and personnel.

Its ballistic missile industry has steadily expanded over the past 25 years and currently includes several different industrial groups under the Ministry of Armed Forces Logistics and its subordinate Aerospace Industries Organization. The US Department of the Treasury designations and United Nations Security Council Resolutions give some indications of the size of Iran's missile industry, which includes the Shahid Bagheri Industrial Group, Shahid Hemmat Industrial Group, Fajr Industrial Group, Shahid Sattari Industries, Ya Mahdi Industrial Group, Parchin Chemical Industries, and Ammunition and Metallurgies Industries Group.[53] These industrial and missile industry groups likely employ engineering students from various Iranian universities linked to the Iranian government. According to Israeli defense analyst Uzi Rubin, Iran possesses a cadre of technical experts drawn from over 250,000 students in technology and science programs.[54]

In comparison to missiles, Iran's other major weapons systems have experienced less quantitative and qualitative growth, reflecting the country's military modernization and investment decisions within its doctrine. In 2004 Anthony Cordesman, an expert in Middle East militaries, wrote that Iran's inventory of combat aircraft, tanks and armored personnel carriers, and small boats are all technologically obsolete in comparison to other regional states.[55] There is scant evidence to suggest this has fundamentally improved in recent years.

Iran's leaders often have made pragmatic decisions in the face of existential pressures that appear in contradiction to its religious and revolutionary narratives consistent with the rational-actor model. This is in step with Iran's use of *maslahat*, or expediency, to calculate the cost-benefit of its response to critical issues.[56] While used at times in Iran's

foreign policy decision making, Iran's military culture does not espouse or incentivize such pragmatism. Instead, Iranian military doctrine includes a complex mix of revolutionary and religious beliefs, as well as US training provided to Shah Mohammad Reza Pahlavi's military prior to the Islamic Revolution.[57] While US influence has receded with time, Iran's leaders are reinforcing the religious and revolutionary character of its military culture through its training and selection of senior military officers. This is demonstrated by Iran's continued celebration and "nurturing a culture of resistance, jihad, and martyrdom to strengthen its staying power and intimidate its enemies."[58]

Colin Kahl, professor of security studies, recognizes that a military's organizational culture shapes behavior through education, training, and doctrine that "creates a certain degree of path dependency."[59] This is evident in Iran's military culture through its belief that religious faith provides an advantage over its adversaries and a way to overcome superior technology.[60] A senior Iranian air force officer described faith as an additional war-fighting principle, "For us there are 10 principles, which are linked to faith, a war veteran's spirit, and martyrdom-seeking spirit."[61] According to political scientist Saeid Golkar, such ideological indoctrination makes up 30 percent of the Army of the Guardians of the Islamic Revolution's (IRGC) training.[62] To receive promotion in the IRGC an officer must demonstrate technical prowess, education, and loyalty to the supreme leader as well as strict adherence to Shia Islam, self-reinforcing the revolutionary and religious ideals within its military culture.[63]

Contingencies and Critical Junctures

Neither preordained nor an accident of history, Iran's current military doctrine is instead the result of an iterative selection process consistent with path dependency. Under this process, early contingent events—such as the Iranian revolution—and specific critical junctures strengthened institutions and organizations that provided self-reinforcing momentum to an emphasis on ballistic missiles. Consistent with path dependency, Iran's emphasis on missiles was largely unpredictable from its initial conditions but provided the impetus for later developments. The critical junctures identified here include the ballistic missile attacks against urban targets during the Iran–Iraq War, known as the War of the Cities, and China's support to Iran's military during the early 1990s, when Tehran began to build a missile industry.

Contingent Events: Revolution and War

In path dependency theory, contingent events, "set into motion institutional patterns or event chains that have deterministic properties," according to sociologist James Mahoney.[64] Several contingent events, including the Islamic Revolution and the Iran–Iraq War, have had a persistent influence on the regime's current military doctrine and emphasis on ballistic missiles. The 1979 Islamic Revolution unexpectedly transformed the prevailing political, social, and military orders. After the revolution, the new government had no defined defense policy other than a rejection of the shah's arms purchases.[65] Middle East anthropologist William O. Beeman states that the new Islamic government's concerns "transcended matters of military and power," as it was often far more interested in its ideology and "religious sensibility."[66]

Consistent with his earlier criticism of the shah, Khomeini halted additional purchases of military technology to reduce foreign influence. The first postrevolutionary defense minister, ADM Ahmad Madani, confirmed the new policy in early March 1979: "One of the biggest treasons perpetrated by . . . the former regime was the purchase of technology, and this policy was carried out in the worst possible manner . . . to make us dependent on the foreigners and foreign advisers."[67] The new Iranian government also cut military spending and refused to accept delivery of some weapons already purchased by the shah. At the same time, due in part to Khomeini's anti-Israeli and anti-US policies, the regime also placed restrictions on the nascent ballistic missile development, previously done in cooperation with Israel.[68]

The revolutionaries specifically treated air force officers with suspicion, due to these officers' close identification with the shah and the United States.[69] Several hundreds of lower-ranking military officers were retired or imprisoned after the revolution.[70] The discovery of a plot to overthrow the regime in July 1980, months before the start of the Iran–Iraq War, likely bolstered the clerics' distrust of the air force. Known as the Nojeh coup, officers loyal to the shah—many from the air force—planned to bomb Ayatollah Khomeini's residence and spark an uprising.[71] The coup failed and the plotters, including some of Iran's best-trained pilots, were executed.[72] Given the purges of the military ranks, there were likely few officers willing to advocate for retaining some aspects of the shah's military doctrine when the regime was incentivizing religious ideals and revolutionary fervor while punishing those who clung to the past.

Iraq's invasion was also a contingent event in the path dependent process. Iran's new government and its military were ill prepared for Saddam Hussein's invasion of Iran in September 1980. The chaos of the post-revolutionary period, including the purge of some of Iran's most experienced officers, led the regime to increasingly rely on the hastily organized IRGC. While the invasion was a shocking setback to the nascent government, it took Iraqi missile attacks against urban populations to change Iran's approach to the war and, eventually, Iranian military doctrine.

Critical Juncture: The War of the Cities

The War of the Cities was a critical junction in the process leading to Iran's current path-dependent military doctrine. Tehran's inability to respond proportionately to the Iraqi missile attacks early in the war or to deter Iraq from continuing the attacks was not only a further indictment of the shah's military doctrine but also left an indelible psychological mark on the Iranian government, people, and the IRGC—motivating a deep need to acquire ballistic missiles. This event is a critical juncture as Iran's subsequent emphasis on missiles hindered the development of other military technology, reducing its options for change.

At the beginning of the war, Iraq held a decisive advantage in missiles, using Russian rockets to attack military targets and cities near the fighting.[73] Iran attempted to respond to Iraqi missile strikes by using its US-supplied F-4 aircraft, but the attacks did little damage to Iraq, and due to sanctions, Iran could not replace the aircraft it lost to Iraqi air defenses.[74] This may have justified the regime's suspicion of the Western-trained and -equipped air force and the shah's focus on airpower. The failures motivated the regime to acquire missiles and implement a crash effort to build an indigenous missile industry, though it took Iran until 1985 to acquire and respond in kind to Iraqi missile attacks.[75]

Given the sole authority over the missile program, the IRGC made its initial purchase of surface-to-surface missile systems (SCUD) from Libya and Syria—also acquiring technology and equipment from China to produce artillery rockets.[76] Iran was able to use its missiles to attack the Iraqi capital due to Baghdad's proximity to the Iranian border.[77] That same year, the Iraqis fired 39 missiles at Esfahān but were unable to strike Tehran until 1988—the year that saw the greatest number of missile strikes by each side. Between February and April 1988, Iraq launched approximately 160 extended-range SCUDs at Tehran and attacked other

Iranian urban centers, while Iran fired 70 missiles at Iraqi cities, mostly Baghdad.[78] The IRGC progressively acquired missiles with longer ranges and heavier payloads but was never able to match the frequency of Iraqi missile attacks because Iran lacked access to military hardware and funding.[79]

The War of the Cities did not result in large casualties, with some estimates claiming Iraqi missiles killed 2,000 Iranians. However, the attacks hurt the population's morale.[80] Rubin links this feeling of frustration and helplessness to Iran's current missile program, now viewed as a "hallowed legacy of fortitude and perseverance in the face of a mortal enemy."[81] As a result, Iran's leaders promote and incentivize missile procurement and production. For example, then-Iranian president Akbar Hashemi Rafsanjani stated in 1988 that missiles were "the most important and most essential weapons in the world."[82]

Due to the War of the Cities, Iran's leaders have learned the importance of developing a domestic missile-production capability to deter adversaries and, if deterrence fails, to defend the population and support its morale by retaining appropriate retaliatory capability. Control over the missile program also gave the IRGC a significant advantage in money and prestige over the regular military. In addition, the IRGC controlled the purchase or smuggling of sensitive technologies and the cadre of scientists and engineers associated with the missile program.[83] Thus, the IRGC became the supplier, customer, and commanders of Iran's ballistic missile force. Because of its complete monopoly on missiles, the IRGC is naturally the leading advocate for further development of the missile force.

Critical Juncture: Chinese Support

Chinese support to Iran's missile development program in the early 1990s is the second critical juncture that furthered path dependence within Iranian military doctrine. During this time, Iran's nascent domestic missile projects were vulnerable to disruption because its aerospace industry was heavily dependent on external support, including missile technology, technical training, and assistance. Without the technological and political commitment of the Chinese, Iran would have been unable to make sufficient progress toward Tehran's missile arsenal to justify emphasis within its doctrine.

Iran's military and economy were severely weakened after the Iran–Iraq War ended, and it faced continued economic and military sanctions. In

response to Western sanctions, Iran turned to Russia, China, and North Korea to modernize its military. Its military purchases in the early 1990s could have been an opportunity for Iran to make different choices regarding Tehran's perceived need to focus on missiles. Even though Iran was able to upgrade some nonmissile forces, it continued to work toward building a stronger missile force. Saddam Hussein's rapid defeat in Kuwait at the hands of the US-led coalition added to Iran's conviction that it needed a strong missile force to deter what it viewed as an aggressive and unchecked US military.[84]

Despite US sanctions, China, Russia, and North Korea were willing to supply arms to Iran. These nations were also initially willing to work with Iran on missile projects despite the goals of the US-sponsored Missile Technology Control Regime (MTCR) to halt the spread of ballistic missiles. The United States was able to convince the Russian government to cut arms sales to Iran in the mid-1990s, though Moscow likely sold Iran some missile technology.[85]

The Russian decision to cut arms sales, along with Libya's decision during the Iran–Iraq War to end missile sales to Iran, likely discouraged Iran but also reinforced that Tehran needed a stable partner willing to continue providing it technical support in the face of US pressure. China filled this role during this crucial period through its ally, North Korea. During this time, China sold Iran antiship cruise missiles and several missile systems, while North Korea sold Iran SCUD missiles. The Chinese commitment to Iran's missile program was influential because of Beijing's status as a growing world power. While important, North Korea's support to Iran was less influential because such support was politically untenable without Beijing's blessing or at least passive approval and served as a conduit for Chinese support.[86]

Throughout the1990s, several US officials publicly accused China of supporting Iran's missile program, including selling machine tools and guidance equipment to Iran.[87] Writing in 1990, Sinologist Dennis van Vranken Hickey assessed that the US response to China's missile sales was "mild and not surprisingly appears to have had little effect."[88] China denied the US accusation that it supported Iran's missile program and promised the United States Beijing would abide by the MTCR. In late 1991 and early 1992, the United States sent multiple delegations to China to convince Beijing to end its ties to Iran's missile program and adhere to the MTCR.[89]

In perhaps the key moment, in February 1992 China promised US Secretary of State James Baker to abide by the MTCR. However, in the face of mounting pressure from the United States in light of evidence of China's continued cooperation with Iran, China clarified that its promise did not include the MTCR annex, which identified dual-use missile components. Gordon Oehler, the former director of the Central Intelligence Agency's Nonproliferation Center, stated that after 1992 China stopped transferring complete missiles and instead transferred missile-production technologies and components.[90] When faced with building evidence of Chinese support to Iran, according to international affairs specialist John Garver, Beijing found other ways to support Iran's missile program even when it eventually ended direct support:

> Repeated Chinese pledges to Washington regarding nonassistance to Iran in the missile area did not, in fact mean the end of such assistance. By circumventing in various ways U.S. pressure, Beijing demonstrated to Tehran its reliability as a weapons partner; it demonstrated that China was willing and able to help Iran meet major objectives even when those objectives made unhappy the arrogant U.S. superpower.[91]

China's most significant contribution to Iran's missile program was providing scientific expertise and cooperation, including assistance with plans, sensitive components, and support in building missile production and testing facilities. According to Sinologist Bates Gill, "The transfer of expertise and production technology generally attracts less attention than the transfer of complete systems, but may have greater long-term significance for the military balance in the region."[92] Chinese assistance reportedly included technical assistance to Iran for developing Tehran's capacity to conduct research and development for solid fuel propellant manufacturing, such as large propellant mixers and casting chambers.[93] Iran's aerospace industry benefitted through interactions with the Chinese missile experts. China reportedly provided guidance and propulsion systems applied to Iran's Shahab-3 medium-range ballistic missile program.[94] The Fatah-110 short-range ballistic missile appears to be an improved, guided version of the Zelzal rocket, itself originally from China.[95] Missile defense specialist Steven Hildreth reports that China purportedly provided Iran with the CSS-8 and M-11 short-range ballistic missiles.[96]

Chinese support to Iran's missile program fit well into Tehran's desire for rapid progress on its domestic missile production, while maintaining its political independence and receiving technical know-how. Without China

as a missile benefactor at a time when deterrence against the United States was of growing importance, Iran's leaders may have been forced to choose a different approach to the country's military doctrine, including favoring a different technology.

Implications of Continued Path Dependency

A critique of Iran's military doctrine must acknowledge the nation's remarkable record since the end of its war with Iraq. Tehran advanced its nuclear program, increasing its deterrence while avoiding a large-scale and potentially damaging military conflict. Perhaps most importantly for Iran, the country has maintained its ideology and system of government while avoiding the wave of popular revolution that swept through the Middle East, sparked in part by its own 2009 election-related unrest. However, as true for military doctrine as it is for financial disclaimers, past performance may not be indicative of future results. The dynamic security environment in the Middle East should compel Iran to create a balanced and flexible military force, doctrine, and strategy that can support a range of policy options across a spectrum of military operations against a wider set of security threats. Under continued influence of path dependency, Iran's missile arsenal will make qualitative and quantitative improvements, increasing its combat capability. However, ballistic missiles are not a panacea for all of Iran's security challenges. Iran's military doctrine is becoming incompatible with the security environment and Tehran's policy goals, because of the regime's continued doctrinal focus on the United States in spite of the increased threat from sectarian-based terrorism and militancy.[97] This focus on ballistic missiles has created a capabilities shortfall and a strategy deficit; missiles alone cannot defend Iran or its allies from the growing threats of ISIL and sectarianism—threats that are much less responsive to the logic of deterrence empowered by Iran's missile arsenal.

Additional Missile Development

The most tangible and immediate result of Iran's path dependency is further missile development, including greater range and accuracy of its missile arsenal. Iran is "pushing ahead in guidance, warhead design, range-payload and numbers, creating a missile force that can be turned to any number of destabilizing purposes."[98] The nation's sunk costs in

the aerospace industry may also encourage continued dependency on and improvement of its missile programs beyond what may appear appropriate for its defense, including building intercontinental ballistic missiles (ICBM). Despite statements by senior military officers that Iran has no need for missiles with a range of more than 2,000 kilometers, according to several estimates, Iran may be close to testing an ICBM, a unique capability for a state without a nuclear weapon.[99] For the foreseeable future, Iran's missile arsenal will remain Tehran's most capable force projection weapon system—what Cordesman refers to as replacing, "weapons of mass destruction with weapons of mass effectiveness."[100] In a test of path dependency, more accurate missiles would, as Iranian international relations specialist Kamran Taremi notes, "obviate the need for maintaining a large number of missiles to ensure a hit."[101]

In response to the growing Iranian missile arsenal, regional states are purchasing and fielding ballistic missile-defense systems. According to the Stockholm International Peace Research Institute, the Gulf States' recent defense imports were mostly missile-defense equipment, representing 7 percent of the total global defense imports.[102] Though it is a significant aspect of US policy in the Middle East, academics have warned that US ballistic missile defense may be insufficient to defend the Middle East from an expanding Iranian missile arsenal.[103] Positive feedback between Iran's missile development and regional ballistic missile defense may occur as each side increases its capabilities to create or maintain a military advantage. Given that the costs of missiles are currently less than the cost of missile-defense options, Iran may simply respond by building more missiles in hopes of taking advantage of the cost asymmetry. Regional states would likely respond with additional missile defenses. Their interests and those of the United States would continue to be vulnerable to Iran's missiles under this scenario, though with US support, the regional states are unlikely to be defeated in most scenarios where Iran would risk launching ballistic missiles.

Iran's missiles, even if mated with a nuclear weapon, will not address all the country's security challenges. As political scientist Stephen Cimbala notes, despite some thinking that a nuclear weapon can make up for a weak military, conventional military capabilities are more important, not less, when a country becomes a nuclear power.[104] Without new investments to modernize Iran's other military services, Tehran's dependence on missiles may create an unstable deterrence, as missiles cannot

be returned to base once launched and a weak conventional military may encourage an adversary to attempt a decapitation or disarming strike. Additionally, states targeted by a future Iranian missile attack may be unable to discern whether Iran is attacking with weapons of mass destruction or conventional missiles, increasing the chances of a catastrophic miscalculation, such as a nuclear counterlaunch on warning in response to a conventional missile attack by Iran.

Iran's continued investment in missile systems—including potentially an ICBM, more accurate ballistic missiles, and other technological advances—increases the threat to regional critical infrastructure, US military bases, and perhaps US territory. However, unless an adversary launches an attack to destroy the regime rather than a more limited aim, severe retaliatory missile strikes by Iran would be counterproductive in most conflict scenarios to Tehran's overall goal—the survival of the current regime. Because Iran lacks escalation dominance against the United States, Tehran's retaliatory choices would need to be precisely calibrated proportionately to prevent further escalation by signaling a willingness to continue the conflict at the current level or deescalate. While an underreaction may invite additional attacks, a disproportionately greater missile response would risk a deeper conflict that would play to the conventional military strengths of the United States and its allies. This is the type of conflict Iran has sought to avoid. Iran may seek to use its missiles to respond disproportionally and pressure an adversary to terminate the conflict, though it is unclear if Tehran would be able to effectively employ salvos of missiles to overcome missile defenses.[105]

Further maturation and development of Iran's missile force holds the possibility of evolving in tandem with Iran's doctrine. For example, continued advancement in the accuracy of Iran's missiles could encourage the regime to incorporate more offensive, or even preemptive, elements of strategy and doctrine. Any attempt at undertaking offensive warfare would certainly require Iran's religious leaders' approval, as traditionally within Shia Islam only the Hidden Imam has the authority to declare offensive warfare.[106]

Influence on Iran's Counterinsurgency Campaigns

Iran's path dependency negatively affects its counterinsurgency campaigns, both at home and abroad. Tehran has generally avoided large-scale internal unrest, destabilizing insurgencies, and the civil wars recently

experienced in other Middle Eastern countries, though it is not immune from these events. Since its inception, the Islamic Republic has fought various insurgencies, including Kurdish and Baluch insurgents and leftist and terrorist groups. However, the regime has prevented insurgents from holding territory or severely testing its authority. While unlikely to threaten the survival of the regime, continued insurgency contests Iran's status as a regional power, contradicts its narrative of pan-Islamic leadership, and distracts from its larger foreign policy goals. By failing to address minority grievances, the regime is perpetuating low-level conflict that may grow as a result of sectarian conflicts in Iraq, Syria, and Afghanistan.

Iran's reticence to consider local autonomy or rights guaranteed in its constitution may partially stem from a false confidence in its military prowess, including its missiles, to defeat insurgents. The regime used ballistic missiles on several occasions in the late 1990s against rebels in Iraq and, reportedly, more recently in Pakistan.[107] However, Iran's military has been unable to defeat the various insurgent and terrorist groups, demonstrating the limit of its emphasis on ballistic missiles against these threats. A continued doctrinal focus on missiles limits modernization of ground and aviation forces and improvements to Iran's counterinsurgency strategy.

Lacking modern conventional military tools, the regime is leaning on its Quds Force, militant coreligionists, and allies—such as Iraqi Shia groups and Lebanon-based Hizballah—to fight against ISIL and other groups. Such tactics and operations may eventually defeat ISIL, but in doing so Tehran is exacerbating sectarian tensions by alienating Sunnis, further reducing the legitimacy of the Syrian and Iraqi states, and increasing the threat of terrorism inside Iran's borders. The Iranian regime is attempting to cynically rationalize its actions by invoking conspiracy theories, including the idea that the United States created ISIL, while denying the fact that Syrian president Bashar al-Assad's regime used chemical weapons against fellow Muslims.[108] Such rationalization may inspire or convince some people of its logic, raising the risk to US and Western forces in the region, but it will not reconcile the growing dissonance within Iranian military doctrine.

Iran's leaders may be sensing the vulnerability of their border and the need to modernize their ground forces. In May, the IRGC ground forces commander, Brig Gen Ahmad Reza Pourdastan, stated the ground forces "should be strengthened so that we can buy tanks, develop our systems and overhaul our helicopters, because the battle is between ground

troops."[109] Even if Iran increases funding to the ground forces, including modernization of its major systems, the force's strategy and doctrine must be updated to address these challenges.

Will Iran Significantly Change Its Military Doctrine?

According to theorists, a path-dependent process does not exclude adjustments to a system or minor alterations; rather, it posits that major change is difficult to achieve and may require a significant external stimuli.[110] In the military context, an exogenous shock may be a battlefield defeat threatening the survival of the state. Exhibiting the link to path dependency, changes in doctrine may be viewed negatively by a military because it rejects the existing paradigm, may be both expensive and risky, and may run counter to military plans for conflict.

While this article has argued that a path dependency exists in Iran's military doctrine, as exemplified by its consistent emphasis on ballistic missiles, this does not mean Iran is incapable of any change. Indeed, Tehran has made some adjustments to its doctrine since the end of Iran's war with Iraq, though these changes have not altered the doctrine's most significant aspects, including emphasis on building a ballistic missile arsenal and identifying the United States as the country's main enemy.[111] Despite this, Iranian leaders have shown a propensity for ingenuity and audacity, traits that have served them well since the Islamic Revolution and may demonstrate the flexibility to change doctrine prior to a defeat or significant setback.

Iranian leaders could justify changes to military doctrine because, while the threat of conflict with the United States remains possible and the likelihood of military conflict with regional states is growing, conflict with Sunni extremists is a near certainty. The nature of ISIL's threat to Iran and its allies requires different weapons and strategies than what Tehran has planned for through its doctrine, including reexamining its strident anti-American orientation—a foundational policy of the Islamic Republic. Once considered impermissible by the Iranian regime elite, high-level bilateral dialogue between the states holds the potential to reduce animosity between Iran and the United States, or at a minimum provide moderates within the regime the opportunity to deemphasize this aspect of Iran's foreign policy.[112] The shared interest in defeating ISIL in Iraq could also demonstrate to Tehran the benefits of passive regional coexistence. Ali Shamkhani, Iran's secretary of the Supreme National

Security Council, alluded to such a possible way forward in December 2014, stating, Iran and the United States can "behave in a way that they do not use their energy against each other."[113]

Beyond the threat posed by sectarian-fueled conflicts, Iran may also view security vulnerabilities, including cyber attacks against its nuclear facilities, the presence of unmanned aerial vehicles in its airspace, and regional conflicts as exogenous shocks requiring changes to military doctrine. The regime appears to have made some progress addressing these issues, though it is unclear whether Iran's efforts are marginal advances in nonpriority areas or represent a true doctrinal shift. Iran retains several options for adapting its military doctrine to address the emerging threats, including refocusing domestic military industry away from ballistic missiles and toward systems more useful in fighting militants and terrorists.

While path-dependency theorists state that exogenous shocks are necessary to overthrow the inertia of path-dependent systems, other academics suggest an internal change is also needed. For example, political scientist Joseph Nye opined, "Although a crisis is usually necessary for a transformational policy to succeed, it is never sufficient."[114] According to this thinking, even a subtle and pragmatic change envisioned by Shamkhani may require a new Iranian leader. Supreme Leader Khamenei may be unwilling to risk political instability if the regime's carefully crafted and rigorously defended anti-American political narrative is set aside. Others within Iran's clerical elite who are more inclined toward such a change may be waiting until Khamenei's death and the subsequent leadership transition before advocating such a change of the regime's foundational policy. Early indications after the nuclear agreement are that the supreme leader is not considering fundamental changes to Iranian policy.[115] A change to Iran's missile emphasis may signal what its leaders are unwilling to state publically.

Iran's military may also face increasing interservice rivalry as its military services fight for money, resources, and attention. Such rivalries often lead to an inefficient or confused defense policy and may impede doctrinal reforms.[116] While the US military has experienced several periods of intense interservice rivalry, Iran's bifurcated military structure appears to foster even greater competition—one that could work to stifle change to military doctrine.[117] This may be especially true because change from the current doctrine may negatively affect the IRGC's—the most-favored service—most-favored system: ballistic missiles.

Iran may be considering purchasing some advanced conventional weapons systems after the lifting of arms sanctions in less than five years' time. For example, Iran's defense minister stated that Iran will purchase Sukhoi-30 fighters from Russia.[118] While such a purchase of advanced weapons systems outside of missiles would demonstrate Iran acknowledges the need to upgrade its military, the acquisition may not represent a true change in doctrine but a marginal adjustment to placate elements of the military. The true measure of a doctrinal change would be whether a purchase significantly alters the military balance against its adversaries and changes Tehran's approach to warfare.

Cost-Imposing Opportunities

Path-dependency analysis can assist policy makers by identifying Iranian proclivities that lead it toward inefficient or suboptimal strategies, which is critical to applying cost-imposing strategies.[119] Iran's inertia allows the United States, in close partnership with regional states, to use its relative economic strength and military advantage to design a regional security architecture using cost-imposing strategies that exacerbate the imbalance within Iran's military and contains its destabilizing behavior. Cost-imposing strategies can be used to steer Iran toward unproductive resource allocations strategically disadvantageous to its overall interests.[120] In the current context, continued ballistic missile development is a less-efficient and less-effective means for Iran to address its security needs and those of its allies. As military historian Bradford Lee describes, cost-imposing strategies take advantage of an adversary's "strongly vested interests or inflamed emotions," which Iran displays toward its ballistic missile capability. Lee further describes how cost-imposing strategies are most effective against powers that have "expansive political ambitions" greater than their economic strength and possess few allies, a description that fits Iran well.[121]

To apply a cost-imposing strategy, the United States and its allies must use diplomatic and military tools to exploit and reinforce Iran's preference for missiles. This includes taking advantage of Iranian leaders' practice of linking missile advances with resistance to the United States. In December 2015 Iranian president Rouhani, a purported political moderate, ordered an expansion of the ballistic missile program in response to new US sanctions designed to punish Iran for continued missile tests.[122] The hardliners within Iran's military, underrepresented

in Rouhani's administration but with responsibility for the defense of the Islamic Republic, likely view missiles as an avenue to retain the anti-American orientation of the state and military doctrine.

Additional US sanctions, such as those recently announced by the US Department of the Treasury, can increase Iran's costs to access material and military technologies, though the sanctions' greater impact may be on encouraging Iran to develop more missiles instead of spending on a more-efficient and more-effective military modernization program.[123] While the JCPOA calls for the removal of arms sanctions within the next decade, the United States and its allies must redouble sanctions-enforcement actions, signaling a willingness to suspend the lifting of sanctions if violations are detected. If not, Iran will procure arms before it fully meets its commitments, undermining the agreement and increasing the possibility of regional conflict.

Ballistic missile defense is a necessary tool in a cost-imposing strategy, challenging the credibility of Iran's missile-based deterrence and retaliatory capabilities. Ballistic missile defenses compel Iran to continue to make investments to maintain a credible deterrence, contributing to an unbalanced military capability. The current ballistic missile defenses fielded in the Middle East are susceptible to being overwhelmed by Iranian missiles and rockets, and the cost asymmetry currently favors Iran. In response, the United States and regional states should speed the creation of a regional ballistic missile-defense architecture, integrating sensors, and command-and-control networks with national missile defenses.[124] Researchers have noted accuracy improvements in Iran's missiles would make missile defense a costly but "attractive option."[125] Technological advances, specifically directed-energy missile defenses, according to the US Missile Defense Agency, can "shift the calculus of our potential adversaries" once brought into the ballistic missile architecture.[126] Directed-energy missile defenses holds the possibility of significantly reducing the efficacy of missile attacks at a greatly reduced cost, shifting the cost-asymmetry against Iran.[127] Experts point out that directed-energy weapons still require large investments, but the technologies have "steadily and quietly matured."[128] As part of a cost-imposing strategy, US investments in directed-energy weapons should expand.

The United States should also employ diplomacy against Iran as part of a cost-imposing strategy, in spite of the regime's continued animus toward the United States. Though dialogue with Iran may appear slow,

inconclusive, and possibly tactically counterproductive, the United States should continue to engage Iranian elites and the Iranian public. Persistent diplomacy can empower Iranian officials willing to consider a new security paradigm and erode the persuasiveness of the regime's anti-American message. The United States should use diplomacy to demonstrate to the Iranian public that Tehran's continued missile investments are a waste of funds and do not make their country safer. Diplomatic interaction also may provide the first subtle indications that Tehran is willing to deemphasize the anti-American orientation of its military doctrine, allowing the United States to reciprocate such signals and adjust its own policy with less political risk.

Applying a cost-imposing strategy based on insights gained from a path-dependency perspective that exploits Iran's preference for ballistic missiles is not without risk and will likely require years of patient execution to succeed. This approach will support US attempts at rapprochement, demonstrating to Iranian leaders that the cost of competition is too high to continue unabated.

Conclusion

Iran is on the horns of a dilemma—facing a choice of adapting its military doctrine and strategies to confront an emerging threat or maintaining its current focus against what it views as its enduring menace. Modernizing its air, naval, and ground forces would increase Iran's ability to fight across the spectrum of military operations against regional competitors and ISIL, though these investments would likely be vulnerable to US and regional militaries. Alternatively, Iran could maintain its focus on the United States and further advance its missile arsenal, gaining additional prestige while building toward a missile that could hold US territory at risk, though this would be of limited utility against insurgents and terrorist groups.

Iran's growing missile capabilities are increasingly capable of attacks against infrastructure, military targets, and populations, but without modernization of its other military services, Iran's conventional military will remain a weak joint war-fighting force. If Iran decides to modernize its air, naval, and ground forces—even if they remain no match for US forces—Tehran will be better equipped to defend its allies abroad, project force, and intimidate regional states in concert with its existing missile arsenal. Iranian leaders would also have more military options

and confidence to pursue their objectives, increasing the possibility, duration, and destruction of conflict in the Middle East. If reconciliation between the United States and Iran is not yet politically possible, US policies should ensure Iran's military does not develop into a more-balanced force. In deciding how to proceed, Iran's leaders will seek to maximize the utility of its doctrine, strategies, and policies, though as with other states, Tehran's ability to adjust is constrained by its history and institutional inertia. Insights gained from path dependency theory can contextualize Iran's policy options, identify how and when Iran makes significant shifts, and inform a cost-imposing strategy that restricts Iranian actions. SSQ

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Relations and dialogue with the United States have long been debated within Iran—though officially Iranian officials have been reticent to reconsider relations absent a complete change in US policies. For example, in 1998 Khamenei stated, "By constantly repeating the phrase 'negotiations with America' and 'relations with America,' they want to break the taboo of this issue." Later in the same speech, Khamenei opined that, "Establishing relations and a dialogue with America has no benefits for the Iranian nation."

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Biotech Business Lessons for Defense Acquisition

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Abstract

The desire to innovate and transform defense acquisition is ill-informed regarding the true meaning of innovation and transformation. The Department of Defense (DOD) would be best served by radical modifications driven by a capitalist market approach to freedom and accountability. A fruitful shift in DOD weapons acquisitions would embrace concepts from the biotech industry—such as being science-based and open to innovative applications of technology—and implement required changes in doctrine and organization. While the need for reform is obvious, the will to reform is less evident. However, examples and lessons from private business sectors would serve DOD interests well.

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Acquisition reform! No other two words so stress or trouble acquisition professionals—other than perhaps *program cancellation*. The latter is so seldom uttered, and even less-often actualized, that its significance is effectively removed from the defense acquisition lexicon. Indeed the two words that create the most anxiety inside both the government acquisition community and their defense contractor counterparts is *acquisition reform*.

Granted, the history of acquisition reform is replete with unfinished and/or unsuccessful reform efforts.[1] During the last half century, reform efforts have rarely changed the status quo and even more rarely fixed any protracted shortcoming of weapons systems acquisition or removed barriers. Since the 1960s saw the first calls for reform, little real change has made acquisition jobs easier, more efficient or effective, or demonstrably faster. Possibly the most notable example was technology executive David Packard's departure from the DOD, where he briefly served as a

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deputy secretary, following unrealized reforms in the early 1970s.[2] Most notably, "fly before buy," a reform plan aimed at developing prototypes and competition between contractors prior to awarding defense contracts and entering production of new systems, did not endure. Underlying incentives of both the DOD program managers and defense contractors remain unchanged, and the division of labor balance between the services and the Office of the Secretary of Defense (OSD) remains dysfunctional, with duplicative tasks and decision authorities. The typical change has been to add more oversight, more work, and more time to accomplish the same task. A few things are certain: (1) the amount of documentation has greatly increased; (2) the influence of non–decision makers has proliferated; (3) unity of command on major defense acquisition programs is nonexistent; and, perhaps most critical, (4) there is a shrinking competitive defense industry. Today acquisition reform is yet again attracting considerable attention within the DOD and Congress. The current budget environment and the inability of previous reform efforts to gain traction or produce desired results precipitate another attempt at improvements. Can we treat DOD acquisition as a therapeutic area addressable through lessons from industry—particularly biotech business approaches? The answer is, "Yes." This article first discusses some of the problems with the current DOD acquisition process. Next, it uses Amgen, Inc. as a case study of lessons to be learned from the biotech industry. It concludes with recommendations for DOD exploitation.

Current DOD Acquisition Problems

The acquisition process is awash with subtleties that allow influence and direction on how to design and accomplish strategies and tasks leading to milestone decisions. Absent unity of command, various stakeholders influence program managers and sway priorities within programs.[3] The large number of associated subprocesses opens the door for direction and coercion that hinders efficient and effective completion. Further exacerbating the DOD's problems is a massive oversight structure. This complex structure consists of statutes, circulars, regulations, directives, instructions, policies, rules, standard operating procedures, cultural expectations, ways of doing business, and stakeholder interests—all of which burden the acquisition process and remove the authority of program managers while diluting accountability.[4] It also contains hundreds of processes, flows, meetings, and approvals required to move an acquisi-

tion program through DOD requirements, across hurdles, and eventually to a decision maker. All the while, various stakeholders and influence peddlers impose extra requirements or alternating acquisition strategies.

While the acquisition regulations (DOD 5000-series of documents) are pending revision, one can expect little change. Whether reissued as a directive or an instruction and regardless of the 5000's provisions, the processes and methods are so firmly ingrained that change will be slow, superficial, or absent altogether. If by some chance the new series is permissive of real tactical and operational change, institutional and bureaucratic inertia will stymie those provisions. Within a bureaucracy, absent a new proscribed process, the old one will prevail because, as organizational management expert Peter Drucker is purported to have quipped, "Culture eats change for breakfast."

The prevailing and persistent inertial tendencies within the DOD bureaucracy are composed of a multitude of personnel, within the services and OSD, whose positions exist to perform checks and oversight. However, redundancy exists in oversight, which often undoes, redoes, and second-guesses service decisions, creating work, rework, and a copious amount of wasted activity throughout the processes.[5] Such oversight and redundancy slows programs and adds millions to their costs. At the levels of the services and the OSD, much of the oversight is inherently not value-added and usually serves to stymie decisions already made by more senior personnel and those closer to the program. In fact, the OSD increasingly usurps the services ability to manage programs. Removing OSD redundancies and control would allow the services to better address their particular needs. Service-based control without such pervasive OSD interference frees the services to better tailor programs, coupled with and reflective of specific mission needs.[6] The recent call to tailor program requirements is destined to fail unless continued functional area demands for non–value-added processes are denied.[7] However, permission to tailor program requirements, obtaining concessions from specific functional processes, is unlikely to be granted. Admission that particular processes or actions are tailorable repudiates what functional personnel hold dear—that their hurdles are vital to some moral or ethical responsibility to protect or safeguard. Unfortunately, in the collective minds of the functionals, acquiescence to any tailoring undermines uniform application of procedures and threatens the creditability of the functionals' positions. Moreover, a tailored process becomes pre-

cedence for additional requests. The functional is undermined and its personnel exposed as being without meaningful work—billets vulnerable to poaching or deletion. Stripping a bureaucracy of its layers is very difficult. Overhead and bureaucracy is overly populated by petty tyrants that slow and thwart accomplishments. These maintain an outsized role relative to their value creation. The bureaucracy will fight to preserve itself, for example the jobs of the staffs that fabricate import in their roles.

Other problematic issues are the low percentages defense firms reinvest in research and development (R&D) and the way defense R&D currently operates. The DOD's R&D funding mechanisms, driving top-down strategic plans often disconnected from capabilities and technologies, block the innovation the DOD seeks. The existing defense establishment's planning process fundamentally limits the way innovation currently gets inserted. Therefore, already realized ideas and technologies are built into the five-year plan and subsequently put into decades-long programs of record. This creates two deleterious effects. As a first consequence, it locks ideas into long program schedules, which results in delayed technology insertion—sometimes long after commercial obsolescence.

A second concern is the barrier to entry that this method of R&D funding has with respect to small innovative companies joining the defense acquisition community. The DOD's small business provisions notwithstanding, innovation has a difficult time breaking through to the defense business. Small businesses possessing disruptive, creative, or simply value-enhancing innovation experience immense difficulties entering the defense marketplace. Often the path to entrance is to sell the idea or be subsumed by an existing large defense contractor, thus enabling and perpetuating the previously cited deleterious effects. Small business difficulties aside, many innovative departures from established value chains are the products of large businesses—a growing number of which choose not to do business with the DOD, for examples 3M and Apple (neither of which are defense contractors). These latter firms consciously choose not to participate in the defense acquisition community because of the DOD's value-destroying process requirements, reporting requirements, and intrusive management, while innovative newcomers are blocked by the DOD's R&D methodology and its virtually impenetrable layers of bureaucracy.

Lessons from Biotech

Over the past two decades, personal conversations with numerous program managers, several system program office directors, and program executive officers regarding the perception of acquisition reform have often wound down with a familiar refrain. Following the suggestion to incorporate business ideas to reform various aspects of the weapons acquisition processes, the histogram of responses produced one clear quip that overwhelmingly constitutes the mode: "We deal in life and death; if business gets it wrong nobody dies. If we get it wrong, people die." The implication is that the DOD cannot apply innovation and efficient methods from private industry sectors to major defense acquisition. Until now there was little to counter that argument, and it thwarted further advocacy for business methods. However examining the case of Amgen, a very innovative private-sector biotechnology company, an enlightened argument emerges. In drug development, if a firm gets clinical trials wrong, more than a pilot, tank crew, or special operations team might die; thousands or tens of thousands of people could be affected—along with the survival of the company. While not the only biotech firm in the United States, Amgen is the industry leader not only in market share and revenue but also in the robustness of its R&D pipeline in a growth industry. Amgen serves as a logical model for DOD innovation and acquisition approaches. Applying broad innovation and information technology (IT) from the biotech industry and other private-sector applications can move the DOD toward a new era of productivity and respectability in several ways, including economic processes, science and technology to drive results, and R&D funding. However, this move requires bold, brave, and, at times, outspoken leadership.

One observation is the disparity between the DOD and Amgen, with respect to detailed microeconomic business processes as well as broader operational and strategic decision making. The biotech industry is using proven cutting-edge technologies to rapidly advance their business and, more importantly, improve the lives of patients. The differences between the Amgen approaches and DOD acquisitions are striking. The speed of incorporation and the willingness to accept and act on change are glaring differences, with the advantage going to the private sector. In 2014 Amgen embarked on the Reaching Amgen's Full Potential program—composed of a number of initiatives designed to propel the company forward over the next 10 years. The radical difference in the concep-

tualization of this program versus DOD reform efforts is the underlying notion of facing the brutal facts confronting the company and the industry over the next few years as opposed to the DOD approach of always putting the solution in the out years.[8]

Similarly, the undersecretary of defense for acquisition, technology, and logistics (USD [AT&L]) has said, "We need to face the truth in this business."[9] Facing the brutal economic facts, Amgen is confronting pending expiration of patent protection on two major drug products, the advent of biosimilars, and the continual competition from traditional chemical-based drugs. A DOD analogy is the growth of antiaccess/area denial capabilities and the narrowing of the technology gap between the United States and its potential enemies. Amgen has taken an aggressive approach to leverage technology and push for needed changes to the industry that not only benefits its bottom line but most prominently improves patients' lives and supports the industry as a whole. The DOD has yet to act, merely adding to requirements rather than displacing lower-risk areas. As the outcome for the customer is of primary concern at Amgen, considerable attention is devoted to aligning business strategy to customer needs. On the contrary, the defense acquisition community continues to pursue all possible strategies. The DOD is bogged-down in the "shots on goal" mentality, pursuing every opportunity it can partially fund at a buy-in budget level—thus, inefficiently consuming resources and starving the most promising winners.

The Amgen example shows the crucial and valuable nature of a chief executive officer's (CEO) attention to initiatives.[10] However, even more decisive is the nature of the initiatives themselves. After 24 months, the company still was not talking about organizational box shuffling. Acknowledging that the process will be a three- to five-year effort, the understanding is that organizational modification will be an outcome, not a driver of change. Innovation and technology will change the approach. Offices will not simply be renamed to indicate reform. New ways of doing business are incorporated into existing business areas or functions.

At the forefront is the adoption of proven technology to drive results. Not the least of which is initial "manufacturing of the future" techniques that leverage technology to produce successful drug batches 9 percent more often than the industry norm. This particular technique, using continuous monitoring and real-time deviation notification, serves to reduce costs of goods manufactured and to increase productivity (drug

production). Another technology being leveraged to reduce capital costs is the implementation of newly developed disposable plastic bioreactors to replace room-sized operations that require cleaning between batches and best serve one volume of production. The new plastic bioreactors reduce turnover time between batches and allow for simultaneous production of multiple products, yielding increased production in the same space.

For Amgen, several ongoing and new projects leveraged innovative applications of analytical methods. From analytics applied to hard science to physician education to contract maximization, Amgen applied technology and new methods to large and rich datasets to innovate across the business—creating value. Conferring with leading firms from other industries, analytics produced new opportunities for sector growth, profit increases, and enlarged marketplace exposure. One key observation was the distinction between analysis and analytics. The former provides prospective on accomplishments; the latter informs relative to leveraging multidisciplinary and cross-industry possibilities to drive the future.

Beyond the significant cost reductions and quality increases produced by manufacturing process technology insertion, changes are occurring in the R&D domain as well. The notion of working *with* the Food and Drug Administration (FDA), rather than being confrontational, is serving to trim the time it takes to progress from drug discovery to patient access.[11] Among Amgen's initiatives is the desire to reduce the time between molecule discovery and commercialization from 15 to 10 years. Any reduction in this timeline will save billions of dollars across the research, translational sciences, development, clinical trials, and commercialization activities—savings that reduce the cost of and speed of access to both lifesaving and life-affirming treatments.

One such success was realized on a recent effort to forego traditional clinical trials in favor of virtual ones. Granted, this was not a drug product but a software model to provide predictive modeling for personalized medicine. Amgen sought and received initial approval to develop the "device" using virtual trials, which will save millions of dollars and speed this treatment tool to health-care providers years earlier than under the traditional approach. The FDA is looking for ways to quicken the pace of new treatment methods and tools. Working collaboratively, rather than antagonistically, opens opportunities to produce real results.

Coupling drug commercialization with device delivery methods as an integrated product is another way to leverage technology. The future

of biologic drug treatments contains more self-injected methods with embedded monitoring and wearable signaling technologies to increase treatment efficacy. By continually leveraging new technology and employing existing technologies from other industries, biotech and pharmaceutical companies produce not just incremental improvements for patients but also radical and revolutionary new treatments. This activity is the innovation that eventually produces transformative change. Said another way, innovation is value creating, and it begins with R&D.

In the multibillion dollar biotech and pharmaceutical sectors, R&D is an integral requirement to be part of the industry. The FDA does not contract with drug companies to develop treatments and cures aimed at specific health needs, funding research and making progress payments as products move through clinical trials. The companies themselves must invest in R&D from their revenue streams. The biotech and pharmaceuticals sectors invest in excess of 20 percent of their annual revenue into development of their future product pipelines. In fact, the US IT sector has an even higher percentage for R&D; and practically every industrial sector's R&D exceeds that of aerospace and defense. The US aerospace and defense industrial sector spends 3 percent on internal R&D.[12]

Complementing Amgen's technology strategy to improve drug development and manufacturing has been a shift in fundamental drug-development doctrine. Previously, the biotech industry as a whole focused on shots on goal. This mantra existed from the industry's emergence in the late 1970s until recently. The idea was to put money into as many promising therapeutic areas as possible. This approach can be likened to the proliferation of defense acquisition programs, some of marginal benefit; however, the volume of shots on goal absorbs resources from clear priorities.

Recently, the shift has been away from the shots-on-goal approach toward a "pick the winner" paradigm, looking across the therapeutic area research and the pipeline of possibilities to pick the molecule most likely to succeed and investing heavily in that one. This move is a further narrowing of the biotech business model within the area of human therapeutics. Early biotech firms, Amgen included, not only focused on human biologics but also on plant and animal biology for a variety of outcomes.

The pick-a-winner approach is focused on particular areas of research. Within the DOD, the Defense Advanced Research Projects Agency (DARPA) has this mission. However, the DOD has a poor track record and continues to fail more often than it succeeds in translating basic research to applied aspects across what is referred to as the *valley of death*, "the difficulty of covering the negative cash flow in the early stages of a startup, before their new product or service is bringing in revenue from real customers."[13] The biotech industry has better processes for translational science, allowing potential treatments to survive this kill zone. The short-term nature of DARPA projects and its raw research nature, while interesting, are usually not tied to the applications within existing or anticipated acquisition programs of record. The largest culprit in the DOD's failures to bring innovation across the valley of death is typically funding. It is symptomatic of a disconnect between the research agency and the program office in how to apply basic research, if any application is pursued at all. In the private sector, such research is closely tied to corporate goals and aims—in biotech to targetable drug products.

Another way biotech R&D is different from that sponsored by the DOD is the science-based nature of the business. In biotech it is widely accepted that "science makes money"—whether high science or low science, does not matter, as long as it helps patients and makes money.[14] Too often in the defense industry a misguided, contrary notion that money makes science prevails—thus, producing billion dollar efforts to "bend the laws of physics" and produce program results before the science is there. Often DOD expenditures prove nonproductive, with the breakthrough and eventual solution coming from outside the program or even external to the DOD. In the biotech industry, firms follow the science.[15] When the science fails to proceed, the lessons are documented, shared, and then applied wherever applicable to other related targets. The deadend is not bombarded with funds to break through the science. In fact, the notion of failing fast is rewarded. In biotechnology, you want to either succeed quickly or fail fast.[16] Indeed, "failure is regarded as part of the process."[17] Early realization and pronouncement—confession—of impracticality or impossibility saves millions of dollars and allows for quick refocusing to other potentialities. Both the personnel that succeed fast and those who help in fast-failure are sought out by others encountering emerging issues. Their insight and experiential wisdom is valued. The goal is to quickly reach a decision on feasibility and producibil-

ity. Those who save years and millions by clarifying difficulties and/or exposing impossibilities early are considered valuable assets and prized within the firm. They are leveraged to better pick the winners.

Unlike the DOD in the acquisition process, the FDA provides a binary decision at the milestone review point—not continuous involvement inside clinical trials. This is radically different from DOD processes, which have numerous, if not all, stakeholders involved throughout the acquisition process. The amount of time the FDA is actually engaged is minimal. The approach methodology and strategy is up to the company; the FDA simply confers approval or disapproval, based on what the company demonstrates. In between FDA decision reviews is autonomous time where drug companies are engaged in value-added activities. During this time, the FDA is not engaged, not receiving briefings, not requiring reports, not inserting requirements, not providing ideas or asking "what ifs." Juxtapose the FDA approach, leveraging free enterprise methods, against that of the DOD, creating conditions for centralized decision making. Granted, there are consultation and direction meetings with the FDA. However, these are typically held at the request of companies, not the FDA, and serve to elicit the FDA or gain insights on novel or innovative approaches.

Recommendations: Exploiting a Capitalist Market Approach

To the detriment of weapons-systems research, development, test, and production, market forces simply do not operate in the defense industry. A truly market-driven economy can greatly inform proposed changes and radically improve defense processes, talent management, and output realization. This view is not acquisition reform as seen before; market function requires real change, not reform of existing mechanisms. Thus, a revolution is needed—not evolution. Agility and innovation create disruptive change, often drastically altering the status quo. Unfortunately, previous DOD reform efforts were more akin to machinations superimposed on existing defense acquisition processes and structures.

Therefore, the DOD must revolutionize the process, not merely swing the pendulum. Since establishing the current structure during the McNamara era, the four or five large-scale reforms have failed. Sadly, defense professionals still live and operate in the McNamara era. The processes used today are merely broader and fatter versions of what was developed in the 1950s and inserted into the DOD in the 1960s.

Given that the defense acquisition community is the world's largest socialist economy, we must come to understand that, "Minor adjustments and corrections to the present acquisition process simply will not accomplish this vital job."[18] We should not obsess over the large aspect of this characterization of the defense establishment. The point is to recognize and comprehend the socialistic nature of the defense community. To that end, we must realize that the laws, policies, and regulations Congress and the DOD have promulgated are based on the assumption that the defense community is a free-enterprise system governed by competition.[19] To any attentive observer, this assumption is incorrect, *prima facie*. At best, the defense marketplace is a duopolistic monopsony, an environment where there are two suppliers and one buyer with dogmatic rigidity and no strategic economic approach.

In reality, we more often have one supplier for major defense end items. The strategic macroeconomics require us to understand that many defense firms operate and act—to some significant extent—like autonomous agencies of the government.[20] Major defense firms, with the notable exception of one, do not operate in the private, commercial sector of the economy.[21] The defense contractors are more akin to wholly-owned subsidiaries or autonomous agencies of the federal government.

The DOD and Congress must partner to abandon the current governing structure and adopt one that promotes the function of a capitalist market in weapons acquisition. This imperative represents a giant doctrinal shift. One big lesson from biotechnology specifically, and of a market economy more generally, is that the outcome of science + the market exceeds that of bureaucracy + federal funding (science + market > bureaucracy + tax dollars).[22] The forces that drive behavior and the nature of decision making are radically different in the market, and these differences serve to vector companies toward innovation and value creation.[23] Capitalist incentives drive down costs, reduce schedules, and improve performance. Further, the socialist nature of funded R&D and progress payments belie market mechanisms.

A strategic reorientation toward a free market would require defense firms operate and focus on value creation. Such a focus would force defense firms to iterate through value propositions and offer incremental upgrades to systems. If R&D were required via the private-sector model, the change would likely result in fewer funded programs that produce intensely determined research to add radically new or meaningful in-

cremental value. The free-enterprise method also solves another problem of centralized planning. Bureaucrats are not technologists and are completely unfamiliar with the science of emerging opportunities, lack technical depth regarding core technologies, and are ill-equipped to predict the next big leap forward. A top-down, directive approach does not create value or discover new ideas; clever people, properly incentivized, do. The point is—defense firms should fund their own R&D and bring products to market faster, with iterative innovative value, if not radically revolutionizing an approach. Prevailing defense acquisition conditions deliver neither timely technology, appropriate innovation, nor the potentiality of value. Significant change is needed, and to realize such, the DOD must implement radical previously "inconsiderable" alterations. Foremost, among these initiatives is, shed the morass of rules, procedures, policies, laws, and accepted ways of doing things. To be successful, the DOD must establish a framework of policies and approaches that allows the market to work.

From exposure to drug discovery and development, one obvious direction for defense acquisition reform is to remove the proscriptive nature of oversight, with all its required reviews and intrusive micromanagement of how tasks are approached and accomplished. A radical leap forward would be to mimic the drug approval process. The FDA does not dictate or instruct how a firm will reach the decision points associated with clinical trials. The decision points are hurdles that must be cleared via demonstration that criteria are met.

Sure, there are rules and lots of compliance, but drug companies are far freer to determine how to show safety and efficacy. The FDA establishes hurdle criteria, not continuous monitoring and proscriptive actions throughout the phases. Drug companies determine how to show safety and efficacy; then the FDA evaluates and renders judgment. Imagine the possibilities if defense program managers were left alone to develop programs and show performance at milestone reviews for approval or disapproval. Many people know what needs to be done, as studied evaluations have repeatedly pointed the way toward meaningful reforms, but lack of will, acquisition competence, or proper situational catalysts remain absent.[24] Without precedence, the current national fiscal crisis should be a catalyst and a long-standing one.[25] No amount of wishful thinking by the services or the DOD will remove the downward pressure on budgets; so a serious, radical shake-up of the process is ab-

solutely essential. Laws must be changed, accountability imposed, and program managers liberated to execute programs.

Implementing private-sector incentives is more than telling defense leaders to "operate more like a business"—a phrase that borders on laughable, given that few defense leaders or members of Congress have ever operated or functioned in a competitive business environment. Further, simply demanding results will not guarantee them, especially without realistic understandings of the environment and sound application of market principles. Fortunately, the private-business arena is replete with models and examples for improving the defense marketplace. The challenge for the DOD is to learn and accept those examples. We must also face the possibility that the DOD does not possess sufficient quantities of market-informed leadership and must seek such leadership externally. The barriers to business people serving tours in the DOD must be evaluated. It needs to leverage business experience as it did in the Second World War; lacking it internally, we must embrace exogenous sources. Private-sector firms readily employ cross-industry personnel to leverage R&D, process, and manufacturing knowledge for new applications and technology acceleration as a best practice. The DOD should do the same.

Transformation

Much of recent reform hinged around the idea of transformation and transformative initiatives.[26] Unfortunately, transformation is not something one drives within a defined temporal space. Rather, it is the combination of several factors that receive recognition upon reflection. Nothing suggests that transformation is a completely passive happenstance; actions to shepherd events are possible. However, the key ingredient in a transformative period is technological change, which is difficult, if not impossible, to invent or schedule.[27] Transformation contains three components: (1) technological change, (2) doctrinal change, and (3) organizational change.[28] While difficult to create all three components simultaneously on a programmed schedule, efforts can be made to observe and orient around ongoing changes and build synergies where possible.[29] Thus, leveraging technological developments appears critical to making valuable changes. Specifically, those changes that orchestrate both organizational and doctrinal moves to propagate, rather than ig-

nore or thwart, inclusion of advancing technology to realize successes—defined by peer leadership and/or market share.

What if the rest of the world did acquisition and infusion of technology the same way as the DOD? Imagine the state of computing capabilities if the IT industry took the same approach. Rather than continuous incremental updates via model improvements, what if the IT industry opted for revolutionary changes in 30-year chunks? The first personal computers would not have been commercialized but incorporated into a decades-long R&D effort to ultimately arrive at integrated phone/computing devices, denying the customer any value in the interim.

Large, complex, and expensive aspirations typically underperform relative to simpler, less-expensive alternatives.[30] Systematic progressions in capability and capacity should be preferred to revolutionary desires, decades in their attainment. The scientifically possible rather than by the bureaucratically imaginable should fuel the driving forces of the DOD acquisition process.[31] Weapons-systems acquisitions should be science-based and produce value-adding increments on a time horizon that feeds users' needs for increased capability. However, the established practice of funding major programs is to excite the bureaucracy, creating a situation where the possible matters less than the desired.[32] While a few Strategic Defense Initiative (SDI), Star Wars–like initiatives, might be worthy of pursuit, a whole portfolio of such technology-stretching programs is ill-advised and unproductive relative to war fighters' needs. By the time a system is fielded, it is already obsolete, and while in development the system likely consumed immoderate resources. Such large long-term strides do not maintain technological currency and are not consistent with free-enterprise business practices. Hence, there is no evidence of such projects at Amgen. Remember: succeed or fail—*fast*.

Unfortunately, the reality of multidecade program development—now followed by more decades of production—applies to far too many defense programs, of which we have too many, and contributes to a persistent inability to meet the expectations of cost, schedule, and performance. The fast and simple upgrade (iterating through versions to the next generation of capability) is much less glamorous but delivers timely, functional, and valuable solutions to the user. Additionally, studies show that the costs of separate, competing, incremental improvements are consistently less than the ultimate price tag of a large revolutionary program.[33] Therefore, prudence suggests that the lessons of private industry are worthy of

incorporation into, if not outright replacement of, the DOD's acquisition approaches. Some argue evolution precludes revolution, but evolution in a market-oriented manner creates the conditions for revolution, just as the car replaced the buggy; the mobile phone supplanted Ma Bell; and petroleum displaced whale oil. Revolution is more likely in such an environment than the current monopoly/duopoly situation sanctioned by a government or department unwilling or unable to deviate.

Areas to Exploit

What can the DOD acquisition community do in the areas of technology, doctrine, and organization to usher in real transformative or innovative impacts?[34] Under the heading of technology, the possibilities are broad, but first the DOD must incorporate technology faster. The length of DOD development programs, striving for large-block revolutionary jumps, creates diminishing manufacturing sources that further delay and complicate production and sustainability in the field. This approach to technology overly complicates programs of record and invites gold-plating of all aspects of weapons systems where each stakeholder must insert their update because there is only one chance in a decade, and as such, requirements creep becomes a serious problem to system completion.

The pick-a-winner approach applied to DOD acquisition would prioritize not only requirements but also programs, based on progress and milestone success. The budget would be allocated across programs based on likely—not optimistic—costs, using analytics to predict financial outcomes rather than program managers being incentivized to go with the lowest number in the estimated range of costs. This approach produces a shortened list of acquisition programs with a greater chance of timely completion, for example resources proportional to requirements or vice versa.

Additionally, the use of analytical methods (analytics) is underutilized. Some are as simple as earned value management (EVM). This simple quantitative evaluation of weapon systems progress is much maligned, despite its validated ability to predict acquisition delays and cost problems. Rather than embrace EVM analysis, many program managers throughout the DOD attempt to discredit EVM insights and refuse to incorporate them into their decision making or undermine the system by constantly changing the baseline against which measurement occurs.

From simple parametric methods to more complex simulation results, technology needs recognition in the DOD as not just data but as information. This change requires a significant quantity of personnel with the analytical aptitudes to convert data into information and effectively communicate information as knowledge.

One of the most-critically valuable changes available to the DOD is to leverage non-rebaselined, EVM-produced information into automatic program decisions. Such a change in doctrine could impose a "kill switch" for programs that exceed the range of recoverability as defined by EVM research on DOD acquisition experiences. This automatic kill-switch would terminate the program and force it to restart as a new request within the acquisition process. While some may argue such a kill-switch is the purpose of the Nunn–McCurdy amendment, this is not the case. Nunn–McCurdy simply requires reporting to Congress and permits rebaselining.[35] Based on Amgen's experience and other empirical knowledge, the tracking and association of project scope and cost is not beyond available capabilities. Maintaining properly scaled and scoped baselines is critical to understanding project performance and projected profitability (or lethality, in DOD parlance).[36] Unadulterated EVM data produces decision-quality information. However, in the absence of quality, unbiased decisions, the time has come for an automatic, analytically-driven kill-switch for programs in unrecoverable financial or schedule situations. Changing doctrine to use technology in this manner is a simple but effective use of analytics and could quickly be extended to unfavorable results from modeling and simulation technologies.

Other key changes in philosophy revolve around firm technology baselines, clearly understood software maturity measurements, and budget stability. The notion of concurrency has been somewhat discredited by the F-35 Joint Strike Fighter experience, as highlighted by USD (AT&L) Frank Kendall's reference to it as "acquisition malpractice."[37] Even though the fighter failed previously, it returned as a major acquisition program.[38] We need to firmly protect the notion of clearly defined and firmly adhered to requirements and the meaning of software maturity, informed by testing throughout the component coding and integration processes.[39] This concept is especially important since software comprises an ever-larger percentage of program components.

Moving to a framework focused on attributes of rapid delivery of "affordable systems that are available when needed and effective when

used" requires a culture change.[40] This is a doctrinal issue, in which the DOD must jettison its cumbersome requirements process, not the least of which involves excessive administrative layers and management oversight: plan, prebrief, brief, replan, rebrief, review, prebrief, brief, higher-level oversight/input, brief, changes, and more briefs.[41] Radical change is needed to strip the process of the many opportunities bureaucrats possess to insert themselves between program managers and program or weapon system delivery. The size and role of the OSD should shrink and return to policy and guidance. This notion entails eliminating redundancy in OSD acquisition offices. At a minimum have either the services or the OSD perform tasks that are currently duplicated. There is no need for both to go through the same decision processes. This change could accompany infusion of a "succeed quickly or fail fast" mentality. While such changes require managing risks, oversight is meant to mitigate risks; however, the historic growth of layered oversight has smothered discerning risk trade-offs. The entire process could be better performed by the services or program execution officers (PEO) rather than the OSD.

One further doctrinal change concerns budget stability. While many recommendations could be expounded upon here, suffice it to say, better planning around annual continuing resolution authority would help. However, given chronic underexecution of multiyear funds already in the possession of program offices, the budget is more often a scapegoat for underperformance than its cause. The real challenge here is to deliver on programmatics to create credibility in engaging the legislative branch to make changes that promote budget stability. The DOD could make significant progress here by adopting program performance (EVM-connected) metrics to replace the current, sole focus on percentage of budget spent. The DOD could undertake to work with Congress, since the latter wants better acquisition results too. If the DOD shows progress, Congress will help. Making honest calls—supported by real analytics, based on transparent assumptions, and promoted by experientially fortified leaders—would increase credibility and foster program successes. The DOD could build rapport with Congress by demonstrating successes, building on earned credibility to gain dispensations, changes, and wider latitude. Follow-through is essential, but careful cooperation and negotiation with Congress can produce advancement for the weapons acquisition community.

Organizational changes are certainly necessary—but not with a focus on the boxes in the wiring diagram. Within the structure, the DOD needs less oversight, more decision-making authority at lower levels, and increased accountability at *all* levels.[42] To ensure a disciplined process is used to identify, introduce, filter extraneous input, and employ technology, the PEO organizational structure should include a risk-management function. Currently, program managers are allowed to self-assess their risks—thus, producing a subjective, noncalibrated risk matrix that is only as good as the words used to "sell" the assessment, usually to an inattentive or technically uninformed audience. No objective, cross-organizational risk assessment is produced for the PEO, to say nothing of risk management at the service level or across all DOD Major Defense Acquisition Programs/Major Automated Information Systems or lower-level acquisition category programs. A risk-management function within the services would serve to inform with respect to the disparity between various program managers' risk tolerances and calibrate risk factors across programs. Fortune 500 firms have strategic risk-management offices, managing strategic corporate risks with respect to normalized risk appetite across the company's operating and compliance areas. Additionally, the software-certification organizations need to be answerable for arbitrary decisions that cripple simple, straightforward solutions. The one-size-fits-all approach is not just systematic of software-certification requirements but also applies to much of the acquisition process. While DOD officials talk about what needs to be done, seldom is resolute action taken. The current review and reform efforts championed by Congressman Mac Thornberry (R-TX) show promise, as they are exploring root causes.[43] A great first step would be to heed the old legal admonition that "good cases make bad law." To that end, statutes and regulations that sprouted from problems with specific programs but not systemic to the acquisition community deserve elimination. The fundamental shift required for the DOD is to reward the people who come forward to identify problems and save years of effort and funds. The current culture derides, if not outright punishes as naysayers, personnel who point out obstacles and often implies that such employees are disloyal to the program, the service, and the country.[44] Thus, very few people, and virtually no one with perceived gravitas, comes forward to dispel rampant optimism. In fact, gravitas is often bestowed upon those who speak from the script. Joined by an interested Congress, the

DOD may make progress toward needed reforms, but history suggests a certain amount of skepticism. Again, much anticipation is accorded Congressman Thornberry's indication that we are going to do reform different this time.[45] The most basic and influential reforms require Congress and the DOD to undo the misaligned incentives and refocus laws and regulations to inspire free-market behavior.

Conclusion

No matter where we start or which process we touch first, no doubt exists that the defense acquisition community needs reform. At the tactical and operational levels, we can look at things like software and program management accountability. But, we must not confuse symptom treatment as a cure. The disease within defense acquisition has metastasized across the tactical, operational, and strategic levels.

To produce effective and lasting reform, technological developments must be identified, as they are in the private sector, and leveraged to produce value-added results. The DOD must transition to a strict use of analytics and refine its strategic acquisition view, doctrine, and culture. After the strategic nature of the defense market is understood, a host of statutory and regulatory changes are required to shift from a socialistic approach to capitalistic incentives. Afterward, the DOD should build a new organizational structure around its acquisition efforts—a structure that enables decisions and solutions, not one that impedes progress. Among a multitude of other things, the DOD must change its understanding and approach to the defense economy and the number of programs pursued. Those two changes will create conditions that logically move the horde of other needed reforms.

In accomplishing acquisition reform, lessons from the biotech industry could be applied to the DOD as a prescription for what ails it. The application of innovative technology, relentless pursuit of the science, and a willingness to yield to facts distinguishes the biotech industry from defense. Strict adherence to the results of science versus bowing to dogma or predetermined concepts reveals the magnitude of what can be accomplished. As with private industry, the DOD should face facts, admit truths, and embrace radical change. Despite what many may think, businesses confront life and death challenges too, and their methods are applicable to weapons acquisition. SSQ

Notes

1. To expropriate a phrase, the history of acquisition reform might better resonate as "delusional repetition of discredited mistakes." David Brin, *Existence* (New York: Tor, 2012), 385. This is a result of failing to recognize the brutal facts comprising defense acquisitions.

2. J. Ronald Fox, *Defense Acquisition Reform, 1960–2009: An Elusive Goal* (Washington, DC: Center of Military History, United States Army, 2011), 78–79.

3. The de jure organizational structure within the acquisition community is clear-ish, but the de facto structure realizes the influence of user commands and other interested parties. Program managers must please multiple bosses.

4. The singular visual example of the complexity, indeed iconic within the acquisition community, is the wall chart depicting the "Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System." See http://www.public.navy.mil/spawar/PEOC4I/ASPG/Documents/APSG_Manuals/files/Integrated_Def_Acq_Management_Frmwk.pdf.

5. The McCain provisions incorporated into the fiscal year 2016 National Defense Authorization Act, while well intentioned, are likely to add another layer of bureaucracy. Giving the service chiefs a formal role, without removing the service secretary's role, will not reduce bureaucracy but exacerbate and grow it inside the services, much like it is duplicative between the services and the OSD.

6. William J. Perry, former secretary of defense, interview with the author, Stanford University, 3 February 2014.

7. Department of Defense Instruction (interim) Number 5000.02, 26 November 2013. The terms "tailor," "tailored," and "tailoring" appear in this document no less than 41 times. Tailoring of milestones, decision points, and phases is defined as milestone decision authorities (MDA), having full latitude to adapt programs in the most effective and efficient structure as much as needed to accommodate the characteristics of the product being acquired and to the totality of circumstances associated with the program—including operational urgency and risk factors.

8. James C. Collins, *Good to Great: Why Some Companies Make the Leap—and Others Don't* (New York: HarperCollins, 2001).

9. Frank Kendall quoted in, David Martin, "F-35: Looking at Most Expensive Weapons System Ever," *60 Minutes*, 16 February 2014, http://www.cbsnews.com/news/f-35-looking-at-most-expensive-weapons-system-ever/.

10. The success of long-term initiatives hinges on CEO tenure. Much has been written about DOD senior leadership turnover and the lack of traction gained by their reform attempts. "Fire and forget" or "implement and exit" are not viable strategies for fundamental reform.

11. Confrontation is pervasive between the OSD and services' program offices and descriptive of the DOD's relationship with Congress.

12. Héctor Hernández, Alexander Tübke, Fernando Hervás Soriano, Antonio Vezzani, Sara Amoroso, Mafini Dosso, et al. *The 2013 EU Industrial R&D Investment Scorecard* (Seville, Spain: Joint Research Centre, European Commission, 2013), 42.

13. Martin Zwilling, "10 Ways for Startups to Survive the Valley of Death," *Forbes*, 18 February 2013, http://www.forbes.com/sites/martinzwilling/2013/02/18/10-ways-for-startups-to-survive-the-valley-of-death/.

14. Gordon Binder and Philip Bashe, *Science Lessons: What the Business of Biotech Taught Me about Management* (Boston, MA: Harvard Business Press, 2008), 171.

15. "Be Science-Based" is the Amgen value with primacy of place, supporting the mission "To Serve Patients." See Amgen, "Mission and Values," 2015, http://wwwext.amgen.com/about/mission_values.html.

16. This notion is also prevalent in IT device, data, and services companies like Microsoft, Google, and Amazon, as well as innovation firms such as SRI International and 3M.

17. Binderand Bashe, *Science Lessons*, 203.

18. Fareed Zakaria, "Why Defense Spending Should Be Cut," *Washington Post*, 3 August 2011, 7; and J. Ronald Fox, *Defense Acquisition Reform, 1960–2009: An Elusive Goal* (Washington, DC: Center of Military History, United States Army, 2011), 207.

19. Ibid., 193.

20. Given references to the current DOD agencies as the fourth estate, I submit major defense contractors comprise the fifth estate.

21. Boeing is the "one" meant here, as it is the one major defense firm that most people reference when the subject of dual-use production arises. However, even this one is tenuous, as the Boeing Defense Group is far removed legally from the Boeing Company's commercial product lines. For a discussion of dual-use concerns, see Richard A. Bitzinger, ed., *The Modern Defense Industry: Political, Economic, and Technological Issues* (Santa Barbara, CA: Greenwood Publishing Group, 2009), 132–37.

22. Cynthia Robbins-Roth, *From Alchemy to IPO: The Business of Biotechnology* (Cambridge, MA: Perseus Publishing, 2000), 16.

23. The current buzzword is *innovation*. Little evidence exists to suggest the use of the word by the DOD hierarchy is anything more than a substitute for *transformation* or merely a collection of good ideas and best practices. *Innovation* entails a radical departure from the status quo—a combining of technologies to produce existing products in a new way or to create something entirely new. The essence of innovation—the "new"—is value creation. To embrace innovation means to become more like 3M, Amgen, SRI International, Google, Amazon, Apple, and so forth. Innovation requires allowances for creative thinking, freedom of action, and multidisciplinary/cross-industry collaboration.

24. Usually, momentous changes to the DOD result from "burning platforms." The last major reform, while not aimed at or the result of acquisitions per se, was a burning platform. The fireball that ended the Iranian hostage rescue attempt in the desert outside Tehran produced the Goldwater–Nichols Defense Reorganization Act six years later.

25. DOD purchasing power is not to return. Even if sequestration is repealed and defense budgets again climb upward, the national fiscal crises can only be averted by inflationary policies that erode the value of the debt and associated government unfunded liabilities, which, by conservative estimates, exceed $75 trillion. Thus, any restored defense budgets will provide near zero or negative real purchasing power.

26. An interesting word choice as biologically *transformation* is what a cell does when it becomes cancerous. More accurately, transformation is the process for converting normal cells into tumor cells. Brent R. Stockwell, *The Quest for the Cure: The Science and Stories behind the Next Generation of Medicines* (New York: Columbia University Press, 2011), 85.

27. Napoleon Bonaparte dramatically changed the way war was fought, but he did not drive the technology component of that era's transformation. He took advantage of the innovations in firepower technology by changing the fighting doctrine and organizational structure within the Grand Armée. However, he did not create all aspects of the transformation. He merely possessed the genius, lacking in others, to discern what the change in technology offered and capitalized upon it to his advantage.

28. Air Command and Staff College, "Strategy and War" course, Maxwell AFB, AL, October 2005. See also, Thomas C. Hone and Norman Friedman "Harnessing New Technologies," in *Transforming America's Military*, edited by Hans Binnendijk (Washington, DC: National Defense University Press, 2002), 31.

29. Note the application of John Boyd's famous OODA loop: observe, orient, decide, and act. Quick action is required to leverage change; this notion is not unrelated to an oft repeated business mantra: innovate or die!

30. Daniel Ward, *Changing Acquisition Culture: What and How* (Washington, DC: Center for National Policy, November 2013), 5, http://cnponline.org/p/changing-acquisition-culture/.

31. P. W. Singer, *Wired for War: The Robotics Revolution and Conflict in the Twenty-First Century* (New York: Penguin Books, 2009), 46.

32. Ibid., 56.

33. Mark A. Lorell, Michael Kennedy, Robert S. Leonard, Kenneth Munson, Shmuel Abramzon, David L. An, and Robert A Guffey, *Do Joint Fighter Programs Save Money?* (Santa Monica, CA: RAND Corporation, 2013), 39.

34. Word choice is far less significant than attaining meaningful change on cost, schedule, and performance, which all increase user value. A cheaper process allows transfer of funds for operational needs or a shortened upgrade cycle; faster process puts capability in war fighters' hands sooner; and performance of requirements is user value.

35. Department of Defense Authorization Act, 1983, Pub. L. No. 97-252, 10 U.S.C. § 2433 (8 September 1982). This law is also known as the Nunn–McCurdy Act for the principle sponsors of an amendment thereto requiring the DOD to report to Congress whenever a major defense acquisition program experiences cost overruns that exceed certain thresholds. Readers can find an online version at Cornell University's Legal Information Institute's website at https://www.law.cornell.edu/topn/department_of_defense_authorization_act_1983.

36. The DOD argument against business practices is the absence of a profit motive. The line goes something like this: "We can't do that because we don't have the ultimate measure of profit." The DOD could effectively use lethality as a measure for decisions. If a project or activity does not increase battlefield lethality, we should look very hard at it. Treat lethality as a proxy for profit. This substitution permits free-enterprise, decision-making analysis inside the DOD.

37. David Martin, "F-35: Looking at Most Expensive Weapons System Ever."

38. Fox, *Defense Acquisition Reform*, 37, 55, and 178. These pages address concurrency failures in the 1960s that later became acquisition policy recommendations in the late 1980s.

39. Once asked by a general officer why DTS did not work like TurboTax®, I responded that, if Intuit built it instead of a defense contractor, it would. However, that would require the DOD to possess the expertise to properly define its requirements and accept the bid of software experts, rather than accepting lower bids from firms that know the buy-in game and are willing to work on something for decades. This also hints to the problem of progress payments on schedules.

40. Ward, *Changing Acquisition Culture*, 1.

41. A PEO, who will remain anonymous, initiated a review of the administrative requirements associated with delivering a program. Findings indicated that three years of planning, approvals, documentation, and briefings were required on programs. Interestingly, the DOD wants program delivery in those same three years. The administrative burden outside of coding a single line of software or bending the first piece of sheet metal consumed the entirety of the desired acquisition timeframe.

42. The best way to accomplish this is the wholesale abolishment of some boxes.

43. Steven P. Bucci and Emil Maine, "Thornberry Initiative for Effective Defense Acquisition Reform Appears Promising." *Issue Brief* (Heritage Foundation), no. 4106, 12 December 2013, http://www.heritage.org/research/reports/2013/12/thornberry-initiative-to-reform-the-defense-acquisition-process.

44. Such disciplinary action is not manifested as overt punishment but in loss of regard with respect to the programmatics, in meetings, or among the group and a lack of recognition or promotion.

45. Mac Thornberry, Congressman (R-TX), interviewed by Vago Muradian, *This Week in Defense News*, 29 January 2013. Available online at "Rep. Thornberry Interviewed on This Week in Defense News," *YouTube*, 29 January 2013, http://www.youtube.com/watch?v=bXpH7lEdyO0.

A Reality Check on a Cyber Force

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Abstract

It is premature to call for a separate cyberspace armed service, independent of the other services and agencies, to project power and protect vital US national security and economic vitality interests. There are four key prerequisites before achieving this goal: 1) a unique, strategic military capability unachievable by any of the other services and agencies; 2) corresponding technological advances; 3) an unrestricted battlespace; and 4) political champions to maneuver the bureaucracy and pass legislation.

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Today, the Internet has become a key enabler of wealth generation, economic revival, human development, and poverty alleviation. Developed societies as a whole depend on cyberspace equities to prosper, and access to the domain is a requirement for developing countries to move toward prosperity.

The world is dependent upon a new domain that is ambiguously defined and for which national security implications are only now beginning to be cogently understood by senior leaders around the world.

Concurrent with this dependence is the presence of malicious actors who erode security and trust by exploiting technical vulnerabilities and human complacency that enables espionage, crime, and nation-state aggression. Thus, economic vitality is held at risk, and the national security apparatus is struggling to determine how to move from insecurity as the

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norm to a domain of human activity wherein trust, security, and sovereign control of malicious activities reign.

To address aspects of the national security implications of cyberspace, the Department of Defense (DOD) has identified cyberspace in military strategy and doctrine as an operational domain in which to organize, train, and equip forces to ensure it has the necessary capabilities to operate effectively across all operational domains of warfare.[1] With this designation comes significant implications that include defending, exploiting, sustaining, and evolving capabilities in pursuit of national objectives. The designation of cyberspace as an operational military domain also brings with it a debate about how to structure US military assets to realize their full potential and whether the current military construct can support its maximum development. This debate is framed around two questions. Can the current DOD establishment meet the demands, obligations, and future requirements of the cyberspace domain? Or, is a separate force, independent of the other services and agencies, needed to project and protect vital US cyberspace interests?[2]

In a January 2014 *Proceedings* magazine article, "Time for a US Cyber Force," Adm James Stavridis, US Navy, retired, and National Security Agency (NSA) planner David Weinstein draw strong parallels to Brig Gen William "Billy" Mitchell, US Army, and his quest for a separate US Air Force (USAF) following World War I. They call for a separate and independent cyber force to fully develop, defend, and exploit America's newest war-fighting domain.[3] Using Mitchell's argument as the historical context, they recommend we learn from history to avoid the bitter debates of why and how cyberspace should be managed and to realize that a new contested domain requires a separate force free from the other services' internal influences, biases, and priorities. In their words, "We are once again at the beach at Kitty Hawk, . . . [and] let's not wait 20 years to realize it."[4]

Stavridis maintained this position in December 2015 before the Senate Armed Services Committee. In his testimony he continued to advocate for a separate cyber force, highlighting that "the sooner we have not only a cyber command, but, in my view, a cyber force—small, capable—I think we would be well served."[5] Similar viewpoints have been recounted by other officials, including Secretary of Defense Ashton Carter, who indicated that a separate cyber force is one possible future for the DOD.[6] However, it is premature to consider a separate cyberspace

force independent of the other services for several reasons. We believe four particular criteria should be met before creating a separate armed cyberspace service. These include a unique, strategic military capability unachievable by any of the other services or agencies; corresponding technological advances; an unrestricted battlespace to develop, test, and refine theories, weapons, and tactics of cyberpower; and political advocates who can maneuver the bureaucratic and legislative terrain needed to create a separate military service. This is not to say these are the only criterion, rather that without them the case for an independent cyberspace force lacks sufficient rationale. We further conclude that instead of a new cyber force, a new cyberspace *agency* be optimally designed, free from the other services' internal influences, biases, and priorities, to compete within the current threat environment until the criteria for creating a separate cyber force are met.

It is not the purpose here to outline why or how a separate force can or cannot be established. Instead, we analyze the parallels being drawn between how the USAF was created and the proposed formation of a separate US Cyber Force. Specifically, we focus on the 20 years of airpower development and debate Stavridis and Weinstein would prefer we avoid. The debate for a separate cyber force should not center on whether the cyberspace arm is subservient to the other services in a manner similar to the air force debate. Rather, it should focus on whether or not a separate branch of the armed services could match and exceed existing services' and agencies' capabilities without degrading core missions and at a resource savings that can overshadow the disruption and overhead costs of establishing a new military branch.

For the air domain, the unique capability developed into strategic bombing and the capacity to strike an adversary's homeland without the need for land invasions or sea battles.[7] The technological advancement that realized the capability was the long-range bomber, such as the B-29, and delivery of atomic weapons.[8] The unrestricted battlespace was the European and Pacific strategic bombing campaigns of World War II. The leadership and proponents for a separate air arm included senior leaders such as presidents Franklin Roosevelt and Harry Truman; Army generals Dwight Eisenhower, George Marshall, and Henry "Hap" Arnold; and Assistant Secretary of War for Air Robert A. Lovett, among others. This is not to say these were the only criterion. Rather, without

them the case for an independent air force would have certainly lacked rationale, and the same applies to cyberspace today.

A Distinct Strategic Capability

Because the missions of the services and the combat support agencies are so ingrained and dependent on cyberspace, the first criterion to be met in the discussion of a separate cyber force is that of a distinct strategic capability unique enough that only a separate service could provide it. Otherwise, a separate cyber force would require a profound cost-benefit analysis so monumental in savings and mission advancement the services and agencies could not refute, dispute, or refuse its potential. At the present, neither exists. If the former did exist, would we know what it looked like? Chief of Staff of the Air Force Gen Mark Welsh III provided a potential view during his Air Force Update speech in September 2014.

General Welsh stated the USAF needs "an air component commander capability to sit in the Air Operations Center when the big fight starts, hit the cyber easy button and watch the enemy RPAs (remotely piloted aircraft) pool at his feet. Or when the enemy starts to shoot missiles toward friendly forces, employ a tool that allows these missiles to sit and sizzle on the pad or go half way, turn around, and go home."[9] He followed the comment with the question of who might be working the solution and how it could be expanded "in a big way." Meant to be forward leaning and thought provoking, Welsh's comments fortuitously highlight two existing aspects of cyberspace: cyberspace power theories are primitive but evolving and, much like the early theories of airpower, can be perceived as a panacea above existing weapon capabilities and strategy.

These perceptions seem reminiscent of the interwar air power theories developed by Giulio Douhet and Mitchell. David MacIsaac provides a treasure trove of intellectual analysis on early airpower theories in his influential essay "Voices from the Central Blue: The Air Power Theorists."[10] One of MacIsaac's more interesting cogitations is the vision that airpower "invariably outran the reality of the moment" clouding the debate with disappointment and derision based on aspirations that airpower could "provide quick, clean, mechanical, and impersonal solutions to problems which others had struggled for centuries."[11] The "cyber easy button" proposed by General Welsh bears a similar resemblance and therein lies a strategic paradox: the vision of a great capability beyond the means of

the services but dependent on them to develop it. Douhet and Mitchell well understood this paradox and the reliance on biased army and naval officials to advance airpower's role, strategy, doctrine, and capabilities.

Though for dissimilar reasons, both theorists surmised airpower could not reach its potential while dependent on another service for its development. Douhet called for an "independent air force armed with long-range bombardment aircraft," while Mitchell, less concerned of the particular delivery vehicle, focused on "centralized coordination under the control of autonomous air force command."[12] During their time, both men's ideas eclipsed the strategic utility of the air domain and the airplane remained deferential to land and naval forces.

Today, each of the armed services and several government agencies currently have significant equity in the cyberspace mission. The 2014 *Quadrennial Defense Review* entrenches this commitment on the part of the DOD with the requirement for cyber mission forces sourced via the services.[13] Additionally, the DOD includes the NSA and Defense Information Systems Agency, the missions of which heavily reside in the cyberspace domain and in most cases outpace the services' capacities and capabilities. Cyberspace visions appear on a similar track. Evolving cyberspace capabilities exist but rely on the services and support agencies for their development and thus remain constrained by each accordingly. Additionally, cyberspace maneuvers are largely tactical, precisely targeted, and/or so shrouded in secrecy that they remain useless to the public debate of establishing a separate cyberspace force. Separate military services are not created based on threat alone. Thus, creation of a separate cyberspace force is unlikely to precede the development of a unique strategic cyberspace capability.

Corresponding Technological Advances

The theory of strategic bombing required technological advancements and weapon systems to progress from thought and debate to reality. Long-range bombers, advanced bomb sights, and atomic weapons all contributed to its evolution. Strategic cyberspace development must include similar technological advancements, whether they are software, hardware, or human presence in the battlespace.

Again, looking at the path to USAF independence, the long-range bomber underpinned the ambition and premise for service equality. The ability to attack an enemy's heartland without a land invasion funda-

mentally changed America's strategic approach to war, and the role of the B-29 Superfortress cannot be overstated in this regard. Considered the "greatest gamble of the war," the $3 billion development and subsequent deployment of the B-29 to the Pacific theater in 1944 marked the point where air-domain technology converged with interwar theory and propelled airpower into an independent, rather than a complementary, role in World War II.[14] Commanded by General Arnold and the Joint Chiefs of Staff in Washington, DC, the B-29s were organized under the Twentieth Air Force and remained autonomous from the three Pacific theater commanders: Adm Chester Nimitz, Gen Douglas MacArthur, and Gen Joseph Stilwell.[15]

To put the strategic impacts of the B-29 into perspective, "with high explosives alone, the Twentieth Air Force levelled 2,333,000 homes in Japan, and most of the business and industry in sixty cities."[16] The conventional bombing campaign killed "at least 240,000 and wounded more than 300,000."[17] During March through June 1945 alone, Japanese deaths reached 127,000 in its six largest cities.[18] By any measure, the devastation provided by the B-29 produced strategic options and effects not seen prior to its arrival in the Pacific. Coupled with the atomic bomb, the B-29 provided President Truman with a one plane, one crew, one bomb, one city capability that destroyed Hiroshima and Nagasaki, forcing Japan's unconditional surrender while avoiding a difficult and costly land invasion. In his words, airpower had developed to a point "equal to those of land and sea power," and its contributions to strategic planning were as great.[19]

Technological advances in cyberspace pale in comparison with regards to the overall devastation and political impact of airpower. There are various flavors of digital intelligence tools and disruptive techniques, with the most sophisticated employing multiple, previously unknown (zero-day) vulnerabilities against software code and some using trusted hardware vendor certificates to cloak their presence. The standard bearer of such advanced techniques is the precision-guided malicious software (malware) Stuxnet. The code, so precisely written, activated only after verifying it was indeed in the Natanz nuclear facility's internal network by comparing the exact size and number of centrifuges operating in the facility. Stuxnet has been tagged as the first specifically designed cyber weapon ever deployed. [20]

Stuxnet certainly created in the mainstream an awareness of the interdependence between physical platforms and the ability of software to trigger effects in cyber control systems to produce effects in the physical world. Exaggerated claims that see parallels between malicious software and the use of atomic weapons assert that this cyber-enabled tool is something new in history.[21] Stuxnet set the Iranian nuclear enrichment program back months to years and accomplished what was previously only militarily possible via kinetic means. As has been documented, the technical sophistication of the malware is evidence of a team that had "the detailed pin-point manipulations of these sub-controllers indicate a deep physical and functional knowledge of the target environment; whoever provided the required intelligence may as well know the favorite pizza toppings of the local head of engineering."[22] Further, it has been noted that Stuxnet programmers were "in a position where they could have broken the victim's neck, but they chose continuous periodical choking instead. Stuxnet is a low-yield weapon with the overall intention to reduce the lifetime of Iran's centrifuges and make their fancy control systems appear beyond their understanding."[23] That the programmers chose not to resort to more drastic measures, demonstrates intent to disrupt the data flows on which humans relied on to ensure the proper functioning of the centrifuges. The result was damaged centrifuges and a delayed nuclear program rather than the destruction of the nuclear centrifuges on a scale of a bombardment that might cross the use-of-force threshold. Hence, Stuxnet appears as a software tool enabling sanctions enforcement.

The challenge with Stuxnet—and other similar cyber weapons—is that discovery leads to obsolescence because the designs can be unlocked by anyone with the skill set to reverse engineer them. Additionally, secrecy and nonattribution prevail as essential aspects in their development and deployment. These factors highlight the juvenescent state of the cyberspace battlefield, prevailing technologies, and the current abilities of the services and combat support agencies to meet national requirements. Therefore, the impact of creating a separate cyberspace service has not reached a point technologically where the benefits can outweigh the costs to the current service and agency structure. That is not to say cyberspace is uncontested or the United States is not dangerously vulnerable. Rather, the risk-benefit analysis, especially with the standup of US Cyber Command (USCYBERCOM) and the cyber mission forces,

remains in favor of the current military service construct shaded by the culture of secrecy in the intelligence community.

An Unrestricted Battlespace

More than 45 years after researchers at the University of California–Los Angeles first connected to a computer at Stanford University and two decades since the explosive Internet expansion of the early 1990s, global interconnectedness has literally changed the political and social fabrics of every developed and developing nation. Today, societies rely on elements of cyberspace for commerce, education, social networking, and control of public utilities. This interconnectedness has fundamentally shifted the way nations and societies conduct and resolve conflict because it provides a level of engagement, good or bad, at speeds and depths not previously known. Malicious cyber actors exploit vulnerabilities in these digital systems and pose "a significant threat to the national security, foreign policy, or economic health or financial stability of the United States. The malicious cyber-enabled activity must have the purpose or effect of significantly harming or compromising critical infrastructure; misappropriating funds or economic resources, trade secrets, personal identifiers, or financial information for commercial or competitive advantage or private financial gain."[24] These activities spurred Pres. Barack Obama to declare a national emergency in April 2015.[25] As the nation faces this emergency militarily, speed and depth of capabilities to defend the nation remain largely undeveloped and untested.

One might argue that this national emergency presents America with an "unrestricted battlespace" where the military can develop, test, and refine theories, weapons, and tactics of cyberpower. After all, it would appear that the US government and private sector are constantly interacting with adversaries in the domain, and thus, the military has plenty of opportunities to refine the tactics and strategies in a way that was not possible in the air domain. However, the current skirmishes in cyberspace occur during peacetime that is not unrestricted. Being prepared to advance the "use of force" or "armed conflict" levels if necessary is not the same as testing them in an operational environment against a dynamic adversary. As an example, Stuxnet only introduced us to the fringes of what is possible. As bestselling author and cybersecurity researcher Peter Singer puts it,

> Yet for all the ways it could change how we engage in military operations, cyberwarfare's greatest legacy may not be any single capability or function. More likely, it will be how this new form of engagement mixes with other battlefield technologies and tactics to create something unexpected. The airplane, tank, and radio all appeared during World War I, but it wasn't until the Germans brought them together into the devastating blitzkrieg in the next global conflict that they made their lasting mark.[26]

Again, Stavridis and Weinstein contrast this as the "beach at Kitty Hawk" with respect to the first powered, controlled, and sustained heavier-than-air human flights by the Wright brothers in December 1903. Few, if any, could have forecasted four decades later a nation would lay in both physical and political ruin primarily as the result of the weaponized evolution and employment of the air domain. That evolution did not come easy as it covered two world wars, countless billions of dollars of investment, and incredible losses of life. Put another way, the utility and lethality of the airplane of the mid-twenthieth century existed because of the merger of resources, science and technology, courage, and experience underpinned by the political will to push its capabilities through an unrestricted battlespace. This is not unique to the air domain, and one can draw similar analogies to the sea and land domains. Examples include the aircraft carrier, submarine, tank, rifle, and the forces organized, trained, and equipped to operate them. All earned their places in America's arsenal through the crucible of war.

Enduring forces, technologies, tactics, techniques, and procedures in the cyberspace domain have to travel a similar path. The difference between cyberspace and the other domains resides with the direct access to a nation's cities and its people who rely on and share the same infrastructure as military forces. Again, looking to Singer, "By the end of World War II, all sides were engaging in strategic bombing against the broader populace, arguing that the best way to end the war was to drive home its costs to civilians. As cyberwarfare becomes a reality, the same grim calculus will likely hold true."[27] This calculus reflects political will more than technological advancement, although each requires the other. When the political will to strike a nation's centers of gravity through cyberspace emerges, so, too, will the reality of its strategic effects and weaponry and with it the competency to engage in an informed dialogue on how best to man, train, and equip US cyberspace forces. Ultimately, much like airpower, cyberpower will not achieve rapid and unrestrained growth without the existing security competition among great

powers leading to total war. It is there where concepts and ideas thought of during peacetime are tried and tested in practice. Until then, the true effects of a separate cyber force will remain as controversial as Douhet's and Mitchell's prophecies during the interwar years. Emotions will play a significant part in the conversation, and the need for a separate cyberspace force will not extend beyond the abilities of the services and agencies to meet US national interests and objectives.

At some point each service will have to divest and return focus on core missions with cyberspace merely as a medium and not the focus of the mission. As each service dedicates resources and is shifting toward cyber operations, it creates a tension within the core competencies. This could translate into strategic cyber thought, but it then becomes more and more divorced from each service's favorite means even as it converges on their theoretical ends (for the USAF, striking at strategically important targets without having to go through the terrain- and physical-based slog to get there). Within Gen Welsh's vision of cyberpower, the USAF would have to devote resources toward "strategic strike" that may not even employ airpower. The resourcing and advocacy for this may be present in the USAF, the other services, or developed and expressed by USCYBERCOM. While it may require a separate cyber force to fulfill that vision, the time for a separate service remains premature.

Political Champions

Assuming there exists a unique strategic capability in cyberspace with equivalent technologies proven in unrestricted warfare, the emergence of a separate force still requires leadership to maneuver the political and bureaucratic terrain. Because of the many actors and processes that shape force structure decisions, political champions are necessary both inside and outside the military establishment. In what David Sorenson, professor of international security studies at the Air War College, classifies as the national interest paradigm, choices about military force levels "stem from strategic assessments guided by a combination of national interests and international threats to such interests." Ultimately, competing priorities shape military investment decisions.[28] Simply stated, resources are finite, competition for them is intense, and compromises matter.

General Mitchell's quest for a separate USAF following World War I is one precedent in creating a new armed service when technology and operational need required it. However, the rapid pace of change in cyberspace

has not allowed time for cyberspace leaders to emerge on par with the skills and leadership qualities of General Arnold. Arnold, who trained with the Wright brothers, was a strong advocate of the airplane, evolved airpower theory through practice, and dabbled in the private sector by founding Pan American airlines.[29] During the interwar period, there was a 20-year gap in which leaders such as Arnold, Mitchell, and General Carl "Tooey" Spaatz could develop their technological and leadership skills. Cyberspace does not have such leadership that has been cultivated within the cyberspace career fields and resourced to experiment with tools and techniques, design operations, war game, and think about cyberspace in the upper operational and strategic levels of warfare.

Generals Marshall and Arnold fully understood the nation's political and bureaucratic environment. With the advocacy of presidents Roosevelt and Truman, these two generals transformed an air force consisting of just over 1,200 mostly obsolete aircraft in the Army's smallest combat arms branch at the outset of World War II into its largest and most-technologically advanced branch by the end of the war—a first in American military history.[30] Along the way they created an equal status of the air arm with the publishing of the War Department Field Manual 100-20, *Command and Employment of Air Power*, and gained a seat at the table in the Joint Chiefs of Staff for Arnold, the nation's top Airman.[31] But it did not come at the expense of the other forces, as Marshall was keen on building a balanced force. While building the US Army Air Forces (USAAF), he also built the largest Army in US history and reorganized the Department of War from the "fiefdoms of the chiefs of infantry, cavalry, field artillery, and coast artillery" into the three commands: the army Ground Forces, the Services of Supply, and the USAAF.[32] The reorganization provided the USAAF with "sufficient clout to move their requirements with dispatch through the War Department General Staff."[33]

While building the USAAF, Marshall and Arnold had to "continually fend off congressional demands on the question of an independent air force," a trend originated in the interwar years that gained additional traction during the war. With an eye to the future, the generals successfully deferred the discussion until after the war and concentrated on victory and building the legitimacy of airpower and the nucleus of Airmen needed to sustain it.[34] As previously noted, this included the high-risk development of the B-29, the autonomous standup of the Twentieth Air Force, and the fusion of the bomber and the atomic bomb that

pushed the world into the nuclear age. The underlying goal was not just air force independence but also to establish a USAF in the postwar national security reorganization that allowed for its own budget and to seamlessly fit into a "coordinated organization of ground, air, and naval forces in operational theaters, each under its own commander, and each responsible to a supreme commander."[35] The push for a unified, integrated defense establishment, supported by President Truman, General Eisenhower, and many others, became part of the National Security Act of 1947 that established the National Military Establishment, secretary of defense, Joint Chiefs of Staff, the National Security Council, and the Central Intelligence Agency in addition to the USAF.[36] Air force independence was established, but in the context of much larger national security changes to deal with the postwar world order.

With the exception of Admiral Stavridis, there do not appear to be many leaders—military, congressional, or otherwise—backing the formation of an independent US cyber force at this time. Most observers agree the United States is dangerously vulnerable in cyberspace, but they do not look at it as a purely military problem that a separate force could solve. Throughout 2015, numerous influential congressional, government, military, and industry leaders presented multiple differing views on the threats posed by nations and actors in cyberspace. Internationally, nations worldwide are pushing their own plans to organize, train, and equip for cyberwarfare. As one article succinctly puts it, "Countries toiled for years and spent billions of dollars to build elaborate facilities that would allow them to join the exclusive club of nations that possessed nuclear weapons. Getting into the cyberweapon [*sic*] club is easier, cheaper and available to almost anyone with cash and a computer."[37] Despite this threat, the call for a separate US cyber force is nearly nonexistent. This does not prove one is not needed. Merely, it speaks to the lack of political champions for such change to the military establishment.

Time for a Cyber Agency

Without a doubt, the nation faces a national emergency in cyberspace, and something must be done. Indeed, it may require not a new armed service, but a new act of Congress reordering the national security apparatus. From a military perspective, the standup of the USCYBERCOM as a subordinate unified command under US Strategic Command (USSTRATCOM) seems to satisfy the current appetite for restructuring.

Looking to the future, the next logical step toward a cyber force, as Stavridis points out, is a modification to the Unified Command Plan raising USCYBERCOM to full combatant command status. In fact, it is a question the Senate Armed Services Committee asked Adm Michael Rogers, current commander of USCYBERCOM, as part of his confirmation process in March 2014.[38] The question was, "What are the best arguments for and against taking such action now?" Admiral Rogers replied there were no impediments to an elevation in status other than an increase in staff to accomplish "administrative functions" such as budgeting and force management at that level. As for the benefits, Rogers stated, "Elevation to full unified status would improve resource advocacy, allocation and execution by improving input to Department [DOD] processes and eliminating competition in prioritization. Additionally, alignment of responsibility, authority, situational awareness, and capability under a single commander would improve cyberspace operations and planning."[39]

In an act of patriotism, Stavridis and Weinstein proposed a solution they deemed necessary to contend with the current threat environment. The current malicious activities in cyberspace should be evidence enough that warfare in cyberspace, unhindered, will occur, and the United States should take action now to begin the organizational processes to prepare for combat. However, a cyber force is currently the wrong construct through which America assures its national security and economic interests. Competition in cyberspace today is characterized by international interaction where states and nonstate actors compete with each other in direct contact that is often short of armed conflict and only ambiguously within the framework of use of force. Military advocacy has been to "open up" or "expand" the scope of what fits into a "legitimate use of military capabilities" framework. For many others, both interagency and internationally, this militarizes cyberspace and generates consternation. Therefore, as a nation, we must think deeply about what cyber operations should be able to accomplish in pursuit of our national interests and protecting our values, not just in war but in peacetime. A broader restructuring of the US national security apparatus is necessary to counter the threat.

Within a new national security framework for cyberspace, a cyberspace agency could be created and modelled after the National Oceanic and Atmospheric Administration, the Public Health Service, or the Coast Guard rather than the Army, Navy/Marines, or USAF. This should not

hinder the evolution of the capabilities within the services, but it should develop within the context of enhancing their missions much like the aircraft carrier in the Navy and rotary-wing operations in the Army. Neither changed the fundamental need for strategic bombing nor the tactical enhancements airpower provided existing core service functions. It would thus be a uniformed and even armed service in the sense that it is designed to operate across both civilian and military mission spaces, likely with some level of counterintelligence and even law enforcement authorities and in close cooperation with the private sector. Thinking through and optimally designing this structure is a wicked problem.

Conclusion

Without question, the United States faces unprecedented threats in cyberspace while the military services and combat-support agencies continue to feel their way around the terrain, developing both offensive and defensive capacity. Because of these threats and the uneasiness that comes with them requests for changes in the military force structure have surfaced, including Stavridis's and Weinstein's calls for a US cyber force independent of the other services. The basis of their argument is that the United States traveled a similar path in creating an independent air force, citing General Mitchell's crusade following World War I as an historical precedent. However, a better framework to assess whether the threats warrant a separate US cyber force is to analyze the key criteria reached by the USAAF during World War II that persuaded legislators, military leaders, and the American public to establish an independent air force. Specifically, these criteria are a unique, strategic military capability; equivalent technological advances; an unrestricted battlespace; and political champions to maneuver the bureaucratic and legislative terrain.

Using the USAF's path to independence as a basis, an analysis of cyberspace force capabilities reveals that the services and combat-support agencies can meet current strategic national requirements. Technological advances remain tactical and secretive. Though contested, cyberspace is still bounded by reality and has not evolved to an unrestricted battlespace. And political champions calling for a separate US cyber force are scarce at the present time. Even with developments of the strategic bombing theories, the advent of long-range bombers, World War II, and top US leaders who backed a separate air force, competing visions and interservice maneuvering won the day by dividing responsibilities for

the air domain among each of the combatant arms. The emergence of a separate cyber force may be as difficult, with an additional challenge. In strategic air warfare, much of the required technology was embodied in the airplanes and bombs, while in cyber warfare, the experiential requirements of highly educated and trained personnel may prove the principal mobilization concern. Cyberspace is fundamentally different from the physical domains in that it is more about outthinking an adversary. This is a new paradigm in that we are only at risk to the extent we allow logic to exploit our unknown cyber insecurities and potentially create effects.

Unfortunately, the criteria presented here will likely not be reached until after the first overt, nation-state war that extensively includes cyberspace. Much like World War II, this future war will look different than anything seen to date but will surely be won by the nations that can control cyberspace in a way the Allies controlled the skies in Europe and the Pacific. Debates and hypothetical conjectures about the potential effects of cyber as a source of vulnerability or as an aspect of national power will continue. A restructuring of the US national security apparatus is necessary to operationalize cyberspace for the purposes of projecting national power, defending our critical infrastructure and key resources, developing and testing tactics and techniques for war and countermeasures short of war, and thinking about deterring others from doing the same to us. While the technological advances will likely lag, ultimately, nothing shapes and evolves military capabilities like war. Just as in 1947, any discussion of a separate cyber force should not be separated from discussions of how to optimize the design of the entire national security establishment to pursue national interests in the new domain. Indeed, it took the complete alteration of the US national security structure to create the USAF in 1947. Without a cogent understanding of cyberpower and the dynamics of conflict in the domain, we cannot say for sure that a separate armed service will best be focused on combat, as opposed to fulfilling national objectives up to and including, but not limited to, combat. Stavridis's reference to the "beach at Kitty Hawk" highlights the infancy of lucid strategic thinking about cyberspace outside of the niche cyber-warfare community. There has been an almost 30-year heritage of cyber operations that has failed to synthesize a coherent theory of cyberpower in pursuit of national interests.[40] The time between the creation of the US Army Air Corps in 1926 and the end of World War II framed

the airpower debate, tested its major concepts and theories, developed distinct air domain technologies, and set the conditions for a separate air force to further US development and exploitation of the air domain. Three decades of discussion about a domain that is largely invisible and cognitive has failed to provide a strategic context within which to analyze the touchstones necessary to sway lawmakers, military leaders, and the American public to the idea of a separate force to pursue US national interests in cyberspace. SSQ

Notes

1. Joint Publication 3-12 (R), *Cyberspace Operations*, 5 February 2013, I-1. The definition of cyberspace as published in joint doctrine states cyberspace is "the global domain within the information environment consisting of the interdependent network of information technology infrastructures and resident data, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers" (v). It further explains cyberspace in terms of three layers: physical network, logical network, and cyber-persona. For the purposes of this article, this is the definition that will be used to assess and analyze the merits and challenges of establishing a separate US cyber force. However, the authors contend cyberspace (as defined here) is in fact not the domain but rather the tools and platforms used to operate within the electromagnetic spectrum. Cyber and electronic warfare are both converging, and this convergence must be appreciated; however, it is beyond the scope of this article to discuss the convergence of the two as operational domains of conflict. We focus solely on the doctrinal cyberspace, while encouraging the cyber/electronic-warfare communities to consider their interrelationships and dependencies in further discussions of creating on cyber force.

2. This is not a new discussion. Indeed, many point to the same question about a US space force and the previous three decades of debate on the topic. Our intent here is to address one analogy and not all possible analogies connected to the creation of separate armed services for domains. Briefly, the difference is that in space, strategic effects on targets cannot be made. This also represents a reflection of the fact the United States has not experienced an unrestricted battlespace in either domain where political will unleashed all capabilities to confront an adversary.

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Autonomy and the Future Force

Wg Cdr Andrew Massie, RAF

Abstract

While autonomy is decision making independent of outside control, delegating authority for successfully dispersed and disaggregated operations is antithetical to our current practice. At one end of the spectrum of the human–machine interface is remote control—human input to generate a direct machine response with no authority granted to the machine to decide and act. At the opposite end of the spectrum, recourse to human supervision is absent and the machine intelligence can be exploited to its maximum potential by being freed to react to its environment. This is also the regime where the Department of Defense (DOD) would face the greatest organizational and cultural challenges in exploiting autonomy. The irony is that to harness the full potential of autonomy, we have to trust machines and free decision makers.

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> *As our understanding of the history of technology increases, it becomes clear that a new device merely opens a door; it does not compel one to enter. The acceptance or rejection of an invention, or the extent to which its implications are realized if it is accepted, depends quite as much upon the condition of a society, and upon the imagination of its leaders, as upon the nature of the technological item itself.*
>
> —Lynne White Jr.
> *Medieval Technology and Social Change*

In framing the third offset strategy as being centered upon human–machine collaborative combat networks, Deputy Secretary of Defense Bob Work recognized a social and technology trend that will undoubtedly

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have a huge impact upon humanity.[1] The challenge, as historian Lynn White, Jr., proffers, is the extent of our ability to turn this concept into concrete combat capability. If the DOD wants to grasp this new idea and use it to strategic advantage, leaders must seize the opportunity to shape the narrative about machine autonomy and help create a future based on strong US Air Force (USAF) contributions to the multidomain fight. Clearly delegating authority needed for successfully dispersed and disaggregated operations is antithetical to our current practice. Autonomy and its attendant benefits can only be achieved by a change in human–machine relationships to one of mission command. At its core, our ability to harness autonomy is a test of our ability to *trust* machines and, therefore, to delegate authority for decision making and action. Generally this will entail less control and more observation for machines and men.

The deputy secretary has presented five building blocks for this kind of autonomy; however, as they stand, these blocks merely describe a spectrum of activity that ranges from machines that think to machines that think and act. While differentiating between physical and cognitive tasks is important, recognizing environmental complexity and the implications of adversary responses is more important for the DOD. The department must develop a framework to articulate the differing types of tasks and, therefore, highlight those areas where autonomy is a "natural fit" and those where more work is required to inculcate trust or apply safeguards necessary for human–machine collaboration to succeed. This article will therefore propose a framework for understanding autonomy, based upon the nature of the environment in which a task is conducted, to determine the relative propensity for humans to trust machine outputs and therefore employ them effectively. It will then consider the implications of accepting autonomy as a source of strategic advantage in the third offset strategy against great-power adversaries. Ultimately, our ability to recognize and harness the positive opportunity autonomy offers will determine our ability to reap the benefits information technology offers. For this reason, an appreciation of the fundamentals of autonomy is crucial for the DOD to step forward with confidence. To start the process of shaping the future force, we must first clearly articulate what we mean by autonomy.

What is Autonomy?

The Industrial Revolution augmented and substituted manual human labor with machine labor.[2] The implications for the conduct of war were tremendous growth in speed of maneuver, the destructive power of combat forces, and the development of military bureaucracies to manage delivery of military forces on a huge scale. Beyond simple linear growth, the Industrial Revolution—along with later development of the internal combustion engine, the jet engine, and rocket propulsion—enabled powered flight and access to outer space. As we stand at the dawn of an Information Revolution, information technology promises a comparable exponential advantage to that offered by machine over manual labor—but this time in machine cognition and data computation over the human brain. The advantage of the search engine, like the jet engine previously, may dwarf the gains currently conceivable.

The 2015 Defense Science Board (DSB) Summer Study task force went a long way toward describing *how* machine autonomy might offer the DOD a competitive advantage and, therefore, *why* it should be broadly accepted; however, in describing autonomy's use the task force omitted a definition of *what* autonomy is. Without this crucial appreciation, the military professional lacks the insight necessary to generate an informed understanding of autonomy's potential and pitfalls. According to the DSB, autonomy "results from the delegation of a decision to an entity which is authorized to take action within specific boundaries."[3] The crucial takeaway from this definition is that to be autonomous is to be free to make decisions without external intervention. In essence, harnessing autonomy is a test of one's willingness to relinquish control. Under this definition, a broad array of machine tasks can therefore be termed autonomous.

Additionally, we must highlight the critical strengths of the human in the human–machine team and be aware of the *irony of automation*: in a worst case scenario, if we expect a human to step in and override a system, that person requires all of the situational awareness and skill needed to conduct the task absent the machine.[4] So, if the cost of maintaining a large workforce was the driver in accelerating autonomy, the irony of automation might make us reevaluate the expected benefits.

The Machine Autonomy Framework

Since autonomy is the delegation of decision making, a critical facet of USAF understanding of the use of autonomy is related to the question of trust. Like all human interactions, decision making and trust go hand in hand. With a choice, we will give the most responsibility to those whom we believe most capable of conducting a task. Mission command involves communicating intent and an appreciation for *why* a task has been set but does not determine *how* it must be conducted; a competent subordinate will exercise their best judgment dependent upon the circumstances. However, when delegating authority, we set bounds on the activity our subordinates undertake. Approaching one of these boundaries invokes the need to report up the chain for clarification or further guidance. Therefore, supervision is inherent in any command relationship and will vary with circumstance and task complexity. The same logic is true for machine as for man.

As autonomy is decision making independent of outside control, it is critical we recognize there are degrees of autonomy just as there is a spectrum of tasks to be conducted; therefore, the bounds that we place on authorized actions determines the degree of autonomy afforded.[5] At one end of the spectrum of the human–machine interface is remote control—human input to generate a direct machine response. In this instance, no authority is granted to the machine to decide and act; it merely responds directly to a human input. The control philosophy for Reaper or Predator remotely piloted vehicles (RPV) would be illustrative of this interface. In this case, an action is not *autonomous* but *controlled*. It is a direct response to a deliberate stimulus with no need to make an independent decision.

Somewhere in the middle of the spectrum is a machine that can assess its environment, prioritize a list of possible solutions to a problem, rank them, and request an operator's input. The machine can harness the advantages of rapid data manipulation, but a human supervisor is necessary to determine the actual course of action undertaken. Anyone familiar with the health monitoring systems in modern aircraft, such as those tracking fuel or engine performance, will be wholly familiar with the value of this type of activity in reducing operator workload. An extension to this level of collaboration is the recognition that a machine might conduct the task required, such as the routine balancing of fuel between tanks to

maintain aircraft center of gravity, but faced with a nonstandard problem, the decision to act will be commanded by a human.

At the opposite end of the spectrum is a machine afforded the latitude to assess its surroundings, trawl its database for possible responses, rank and weigh those responses, determine the optimal course of action, then enact its derived course of action. As an example, a computer virus detection mechanism or firewall is a capability that should be activated then left to perform its task independently. Recourse to human supervision is absent, and the machine or machine intelligence can be exploited to its maximum potential by being freed to read and react to its environment. It is undoubtedly to this end of the spectrum that most autonomy detractors are drawn and where the specter of the "killer robot" exists. Coincidentally, this is also the regime where the DOD would face the greatest organizational and cultural challenges in exploiting autonomy.

Tasks and Trust

The development of a useful understanding of the spectrum of tasks and their associated levels of trust requires a framework to distinguish between the nature of differing military tasks and the intendant effects upon the need for human supervision.[6]

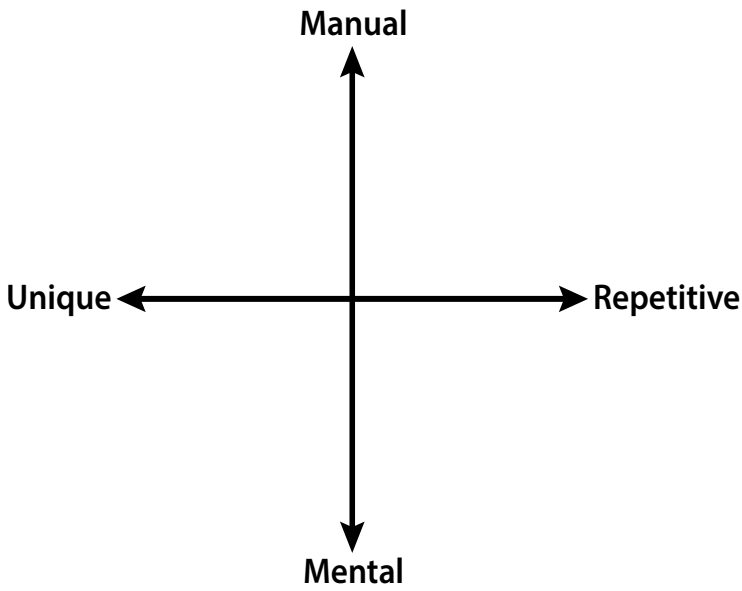

Figure 1. A framework for task classification

Along the horizontal axis in figure 1, tasks can be determined by environmental novelty. Those tasks on the left-hand side of the chart are described as unique and those on the right as repetitive. A variation in task or variation in the environment largely determines the changing factor along the horizontal axis. Due to these two factors, repetitive tasks are those where the environment in which the task is conducted and the task's output is unchanging. On the other hand, unique tasks are conducted in a changing and unpredictable environment or reflect a demand for variable outputs depending upon a specific requirement.

Crucial to the application of autonomy in military affairs is the recognition of the roles of unpredictability and adversarial action in conflict. While the advantages afforded to industrial production facilities are obvious examples of a manual repetitive task (the right-hand side of the chart), the battlefield and shop floor are dichotomous due to the presence of a reacting adversary (the left-hand side of the chart). In integrating autonomous machines into our inventory we must recognize the presence of a thinking and noncooperative actor as the baseline standard for interface in many military tasks—a concept Clausewitz articulated on the first page of book one of *On War*.[7]

Figure 2 deductively shows the implications of environment novelty upon the level of human–machine collaboration. Where outcome certainty is low, trust will be low, and the need for human supervision will be high to ensure the expected task is conducted appropriately. While this will undoubtedly change with time, in the near term, it is intuitive to say one will have low trust of machine decision-making success in complex changing environments and, therefore, will need to ensure a high degree of human supervision. A current example of this is the level of human supervision applied in the operation of the MQ-1 and MQ-9 RPVs. High environmental uncertainty, low trust, and high human supervision lead us naturally to a default human–machine relationship of strict control and, at its most extreme, remote control—or nil autonomy. While it may sound trite, the experience of any new instructor pilot with a novice student will attest to the desire to be prescriptive and offer direct commands over a more laissez-faire approach: the instructor's "skin is in the game," and mission success dictates this default human response. With experience and exposure comes greater subtlety in response. The same will be true of our interaction with machines over time.

The vertical axis in figure 1 differentiates between machine output. Mental tasks are referred to in the DSB study as "autonomy at rest," while manual tasks are referred to as "autonomy in motion." On the same vertical axis, we see these dual possibilities information technology offers: one is machines used to do lower-level mental tasks; the other is one of empowering machines themselves to enter the human realm of decision making in some limited capacity. With mental tasks, artificial intelligence (AI) offers the opportunity to harness the power of data computation to perform tasks that free the human to exercise unique attributes of creativity and intuition. On the other hand, by pairing AI with robotics, we gain the ability to advance the power of machine labor with machine cognition.

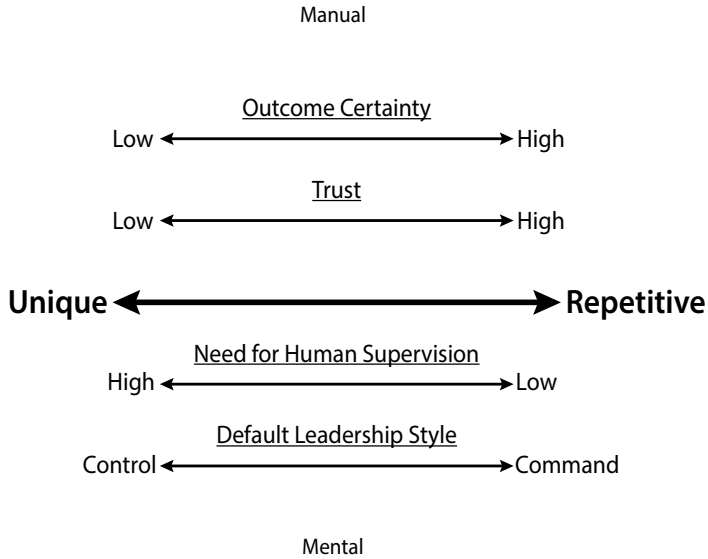

Figure 2. Insights on the horizontal axis

Where outcome certainty is high, trust is high, as the machine can comfortably and reliably meet the task. The autopilot used in climb, cruise, and descent of modern airliners is a clear example of our confidence in machine decision making and action. The need for human supervision exists but is low, and the default human–machine interaction can be "hands-off"—to command a range of activities and then sit back and monitor. However, this need not be a benign environment. In a high–intensity peer conflict, autonomy may be delegated to defensive systems, such as a Patriot battery, to scan a cleared free-fire area, detect

movement, determine a threat through prescribed algorithms, and engage on machine command. The important point to note is the inverse relationship between our confidence in an outcome and the need for direct input: low confidence equals control, high confidence equals command but with more autonomy.

Commanding or Controlling

The application of this two-axis approach to different types of tasks illuminates significant insight for the DOD and the USAF. Regardless of whether the task is mental or manual, it is clear that the novelty of the environment in which a machine (or human) is operating is a significant discriminator in terms of autonomy. This should be no surprise, as at its core, autonomy is a question of delegated decision making: the more novel an environment, the more challenging to delegate authority. In complex, wide–area security operations over the last 15 years, we have learned the hard lesson that a significant amount of trust must be afforded lower echelon decision makers to achieve operational and tactical goals. Higher echelons must take greater risk in freeing units to exploit the increase in situational awareness and fleeting advantage. The same lesson will apply to mission command for machines and will necessitate a gradual lessening of restrictions, through training for human supervisors and better and more-rapidly programmable machine decision-making code. As the British strategist J. F. C. Fuller noted, "The more mechanical become the weapons with which we fight, the less mechanical must be the spirit which controls them."[8]

The "teams" or relationships we form with machines will therefore be largely determined by environmental novelty—or in military terms, proximity to an adversary. The more our environment favors repetitive, manual tasks—such as base logistics—the greater opportunity for machine automation. Similarly, where analysis warrants the assessment of longer-term trends and activity, the better suited our analysis will be to machine intelligence. As we approach contact with an adversary and environmental novelty increases, we are in the realm of tacit knowledge and rapid environmental assessment. As a recent study by Oxford University and Citigroup noted on the implications of autonomy in the workplace, this is specifically the area where human interaction will hold preeminence.[9]

Human preeminence need not mean machine absence; indeed, this may be the greatest value of Deputy Secretary Work's emphasis on autonomy.

As in all technology endeavors, robotics and AI may provide significant advantage by augmenting or amplifying human activity. Rather than seeing the human–machine interaction as a zero-sum or an either-or relationship, we must find the synergy between the man and machine. Wearable technology and robot assistants, or "co-bots" (collaboration robots), offer the synthesis of the best of both worlds—the interaction of human intuition and tacit or social knowledge with machine intelligence and manual strength.[10] In this regime, the area of interest will be the nature of the interaction or relationship—just as in our use of animals to perform military tasks. It may well be, similar to an attack dog, the human commands the machine to act and employ its strength to the team's advantage. Alternatively, and more conceptually challenging, like the explosive-sniffing dog, the machine may lead the human to action. It is undoubtedly in the development of teams and co-bots that the benefits of autonomy will be decisive militarily. In doing so, we must be prepared to lead, to trust, and to follow.

Implications for the Third Offset

Clearly there are cultural, practical, and political challenges facing autonomy in enhancing military advantage. Conversely, the enormous benefits that come with pairing machine cognition with machine labor are apparent to the military practitioner. Indeed, it has been articulated by the deputy secretary as the single greatest advantage, in concert with an educated workforce, the United States can leverage against its likely adversaries. The current description, interestingly, seeks to differentiate between tasks by the manual-mental "output" that are **absent** unique-repetitive environmental complexity. Those differentiated tasks are depicted in figure 3 and explained below.[11]

- **Learning Machines or Systems** represent machine decision making on a network that allows machines to learn from and communicate with each other in order to counter machine attacks such as a cyber virus. Learning machines maximize machine task autonomy with minimal human supervision but perform a wholly cognitive and virtual function, such as Google's "Deep Mind" system. This concept also recognizes that cyber weapons may be employed at a speed too great for human response; machine defense may be essential to counter machine offense.

- **Human–Machine Collaboration** represents a situation in which machines benefit from huge databases to highlight patterns and trends to facilitate human decision making. This is a largely cognitive task that requires human action to translate data to an action. An example may be the development of a digital "air-operations planner" that monitors all air mission activity and battle damage assessment on operations and presents alternate courses of action to the combined force air component commander (CFACC) for the next day's air tasking order or dynamic solutions to an unfolding significant event.

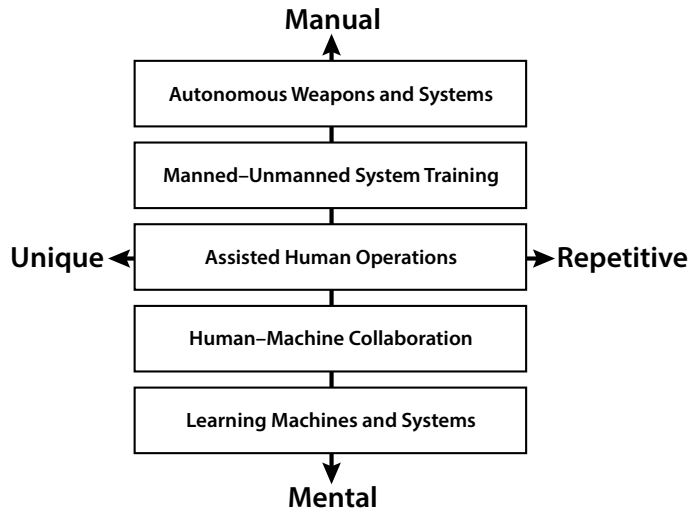

Figure 3. The "Big Five" using the framework for task classification

- **Assisted Human Operations** are tasks with similar output to human–machine collaboration but with a greater emphasis on deliverables or wearable hardware at the tactical level of war. As an excellent example, the Air Force Future Operating Concept (AFFOC) offers an aerial resupply port of the future, where networked supply chains in real time across an area of responsibility prioritize and palletize aircraft loads based upon evolving theater priorities.[12] The only science-fiction element to this vignette is its military application: this is a business practice widely employed by commerce giants such as Amazon and Walmart today.
- **Manned–Unmanned System Teaming or Human–Machine Combat Teaming** deals with tasks consisting of physically cooperating human and autonomous systems on the battlefield. Human interaction

and supervision is still necessary for mission success, albeit in a limited capacity. The clearest example for the USAF is the integration of autonomous wingmen into the combat air forces to enhance lethality or situational awareness. The AFFOC vignettes on a future close air support and air superiority mission invoke autonomous wingmen in concert with a manned combat platform, allowing man and machine to contribute their requisite strengths to the benefit of the overall mission—increasing payload, survivability, and the merits of disaggregated command and control (C2) to grasp fleeting changes in local conditions.

- **Autonomous Weapons and Systems** represent tasks that benefit from all four layers previously described to apply learning machines to advanced robotics and deliver a machine that is able to conduct its task against a reacting adversary without human input. While this may seem far-fetched for an air force that has engaged in 15 years of wide-area security operations, conducting high-tempo operations in a highly contested environment offers a very different operating concept. If the United States were able to embrace autonomous weapons in defense of currently vulnerable and distant operating bases, with much greater emphasis on early detection and engagement, the tyranny of distance might be repainted as an opportunity. With clear delineation between friend and foe, clear fire corridors for autonomous kinetic, cyber, and electronic-warfare weapons might offer a decimating form of defense against any potential aggressor.

The obvious takeaway from placing these five capabilities on a quad chart that shows the vulnerability to adversarial action is that there immediately are undoubtedly huge benefits to the military application of learning systems, human–machine collaboration, and assisted human operations. Indeed, during the last 15 years, many of these benefits are already being exploited in understanding enemy networks and their subsequent targeting. Furthermore, cyber defense already rests largely in learning systems and human–machine collaboration. Similarly, those who have worked on exchange tours with industry would recognize these five capabilities are widely used and see that the DOD could undoubtedly do more to employ such abilities. The advantage Deputy Secretary Work

seeks will be realized when this cognitive computational power can be reliably delivered into a machine that also performs the task at hand.

It is in autonomous weapons systems and manned–unmanned system teaming that the most benefit can be derived but the greatest military risk exists. Machines promise significant opportunities in delivering lethality and performance beyond that of the limited human physiology. However, their application is fraught with risk due to the question of outcome certainty and the necessity to monitor them. The niche for autonomous weapons systems does exist, but its fragility to adversary action or, conversely, the time and cost of development is significant. Thus, human creativity will continue to be essential in delivering battlefield success against reacting and intelligent adversaries. As the recent evaluation of Google's AlphaGo machine algorithm against a human expert demonstrated, learning machines come with significant advantages. Such machines are guaranteed to perform to expert levels when fielded and will continue to learn thereafter. However, in a crucial one-off engagement, like combat, they can be undermined by genius or confused by human error.[13]

The answer lies, as in most polemics, somewhere in the middle—in advancing the concept of manned–unmanned system teaming to determine where full mission autonomy might be granted, under specific rules of engagement (ROE) or circumstance, and where the final determination of action must rest with a "man in the loop" or on the spot. The emphasis must be upon teaming or the appropriate mix of interaction that generates the greatest military advantage.

The final critical deduction from a study of autonomy is the promise and challenge of disaggregated and dispersed operations. As a facet of the third offset, the necessity to operate in a highly-contested environment, using networks of platforms to defeat massed firepower, is a robust deduction. However, there are grave limitations between that mode of operating and our current C2 structure. A generation of leaders has lived in an operational environment where risk has been held at a fairly high level and decision making for the use of lethal force has been largely held with higher echelons. ROE do exist for tactical action, but they have been extremely constrained. Operating with greater emphasis on command, rather than control, will be challenging but not insurmountable. Significant capital must be expended in training and simulation to prepare commanders to grant their machinery more autonomy, and more importantly, this way of thinking must be inculcated into USAF

leaders such as CFACCs. If the adversaries we expect to face take the battlefield, the long screw driver will be consigned to history, and the strategic corporal and captain will own the day. This may well be as great a cultural challenge, in releasing the reins, as the simple introduction of the technology itself. The challenge we face is that in an Information Age war, the initial moves may be so debilitating that little time is available to adapt or react. Our drive to field centrally controlled, exquisite capabilities over networked, disaggregated, human–machine mission capacities may deny us a second chance and may be so cost prohibitive as to deter action. Being "not too wrong" necessitates a balanced capability mix to allow an opportunity to adapt rapidly to a threat environment.

Conclusion

As the venerated British general Graeme Lamb noted about leadership in complex environments, the solution to a future characterized by autonomy may be to operate "in command, but out of control."[14] When it comes to autonomy, the third offset is as much about software, or organizational culture and concepts, as it is equipment. Any discussion of autonomy must capture and leverage this insight. An important inference is that leaders, decision makers, and planners will lead *and* follow; they must become comfortable in both roles as humans guiding and following autonomous systems.

Autonomous machines, like people, offer greater potential with increased latitude in determining their own course of action. The challenge with men or machines is trusting their judgment in a complex and contested environment. In this final regard, we hold a significant advantage. Western militaries have a long history of devolved command responsibility. This autonomy for man and machine is an opportunity to adapt in contact and may well be our unique advantage against the most likely peer in an era of information age war. While a conversation on autonomy may drive the audience to the subject of hardware and equipment, it is clear that building trusting organizational constructs is as, or more, important. The ultimate irony may be that to get the most from our machines, we have to free our men and women. SSQ

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Book Reviews

To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction by Edward Kaplan. Cornell University Press, 2015, 260 pp., $39.95.

In *To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction*, Edward Kaplan skillfully examines the conceptual context behind an overlooked period of American strategic thought: the air–atomic age where the United States Air Force explored how to fight and win a nuclear war with the Soviet Union. A shocking concept today where nuclear war is assumed to be the end of civilization, Kaplan's study of air–atomic strategy traces the evolution of the ideas, technology, personalities, organizations, and policies from 1945–1963. In eight thematic chapters, Kaplan analyzes the evolution of strategic thought from early air power theory, the World War II bombing campaigns that forged the United States Air Force, the era of American atomic monopoly, and the fundamental changes generated by increasing nuclear stockpiles, growing Soviet threat, and altering perceptions where deterrence and stability replaced victory. Kaplan argues that air–atomic strategy (the term used in early Cold War planning documents) formed the core of Air Force thinking, organization, and identity: "Atomic weapons first enabled airpower and the Air Force and then enslaved them" (p. 3).

Although Kaplan resists the urge to paint legendary air leaders as Strangelovian stereotypes, he critiques their ironic vision of the Strategic Air Command (SAC), a finely tuned instrument for a blunt annihilation mission. Stressing SAC's pragmatism, the author explains the incremental changes to emergency war plans, initially based on atomic scarcity, eventually resulting in the Single Integrated Operational Plan (SIOP, p. 62), the penultimate overkill that shocked the Kennedy administration with its "go/no go" inflexibility and lack of policy options. In Kaplan's analysis, the Air Force focus on providing a war-winning force fit the policies of the Truman and Eisenhower administrations. SAC's goal of limiting American casualties by rapidly destroying Soviet industrial, and later nuclear, capability enhanced early concepts of deterrence. Conversely, fundamental changes in the strategic environment rendered the Air Force vision unacceptable, morally objectionable, and absurd to the realities faced by Pres. John F. Kennedy and Secretary of Defense Robert McNamara.

Strong in examining the policy and political rationale of early Cold War presidential administrations, Kaplan adds a nuanced look at the organizational dynamics of the US armed services competing for influence and budgets. He provides a fresh look at the "Revolt of the Admirals" over the B-36 and a fascinating chapter, "The Compression of Time," where SAC struggled with Soviet advances in atomic and missile technology: "By the end of the 1950s, SAC was well positioned to launch a first strike, but not to absorb one. Its efforts to overcome this dilemma led it to a razor edge of preparation and a policy which required politicians to be willing to destroy the world on a hair trigger" (p. 77). With its experienced-based, problem-solving mind-set, SAC focused

on specific technical challenges and missed the greater political and social implications of overkill. Kaplan shows SAC unable to respond conceptually to challenges raised by civilian theorists (Bernard Brodie, Herman Kahn, Henry Kissinger, and others), the Navy's finite deterrence embodied in the Polaris submarine-launched ballistic missile, and the Army's ideas of limited war voiced by Maxwell Taylor. Kaplan credits the McNamara and Kennedy team for recognizing a different world of the 1960s; he also credits Pres. Dwight Eisenhower's shrewd manipulation of the existing SAC deterrent for actual crises faced in the 1950s. Although not shy to point out flaws of logic and imagination, Kaplan concludes: "In the end the system worked. Between 1945 and 1963, Americans made rational decisions about nuclear forces which were well suited to their time and emerging trends. Responsible men made good decisions about hard issues" (p. 223).

To Kill Nations features superb research combining astute summaries of nuclear deterrence literature with extensive, pioneering primary sources drawn from the National Archives, the Library of Congress, the Air Force Historical Research Agency, and the Truman, Eisenhower, Kennedy, and Johnson presidential libraries. Edward Kaplan mines the personal and professional correspondence of Curtis LeMay, Thomas Powers, Nathan Twining, Robert McNamara, and other senior leaders to great effect. Balanced and fair, the author captures their perspectives and shows senior leaders capable of serious thought, if not always open to new paradigms. Carefully documented, useful footnotes aid the reader, but the publisher's decision to not provide an academic bibliography punishes the serious researcher.

Edward Kaplan's *To Kill Nations* is bold, thoughtful, and fills an important gap in strategic studies of the Cold War. It complements Lawrence Freedman's classic *The Evolution of Nuclear Strategy* and extends the fine work of Conrad Crane, Tami Davis Biddle, and Mark Clodfelter. Drawing upon his career as an Air Force intelligence officer and associate professor in the Department of History at the Air Force Academy, Kaplan achieves a rare balance of perspectives—civilian and military, academic and practitioner, and policy maker and commander. This book is a must read for the serious student of the Cold War, airpower history, military innovation, and interservice rivalries. Kaplan not only explains the thinking of a vital era of strategic history but also suggests parallels for today. To what extent does a version of air-atomic thinking pervade strategic thought in emerging nuclear powers?

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China Goes Global: The Partial Power by David Shambaugh. Oxford University Press, 2013, 410 pp., $17.00.

No one appears to doubt that China is becoming an important international actor; its investments seem to trickle down to every corner of the world, and its outreach has already started to shift established frameworks of global affairs. It is, therefore, unsurprising that there would be many contested explanations about the motivations backstopping Chinese policy making in what is nearly universally acknowledged to be

the "Asian century." Beijing's enhanced confidence and ability to fashion international relations seem to attest both to the transformations in and the transformative potential of Chinese foreign policy attitudes. The established purview is that it is the complex interaction between the very turbulence of the post–Cold War period and the ability to maintain consistent levels of economic growth that have allowed China to demonstrate its growing capacities to navigate the turbulent dynamics of world affairs. Such governance capacities seem to have provoked both interest and anxiety.

David Shambaugh, a professor of international affairs in the Elliott School of International Affairs at the George Washington University and an old China hand, is the perfect candidate to address many of the quandaries and uncertainties about what he calls "China going global." Shambaugh's proposition is that while China is indeed engaged either economically or politically (or both) in many countries and regions of the world, its impact is still far short of that of a global power. Instead, while "China is *present* and *active* in various parts of the globe and in various functional spheres, it is not (yet) *influencing* or shaping actions or events in various parts of the world" (p. 8). It is for this reason that Shambaugh coins the term "partial power," which appears in the subtitle to his book. According to him, partial power reflects both China's capacities and its self-understanding on the world stage. On the one hand, China has next to no leverage in many parts of the world or on major international issues, cannot "actively contribute to solving problems," and therefore "'punches way below its weight' in international diplomacy" (p. 309). In fact, Shambaugh goes as far as suggesting that China "may better be thought as a 'middle power' and a regional power like Australia, Brazil, Britain, France, India, Japan, or Russia" (p. 310).

On the other hand, Shambaugh argues that "China is not ready for global leadership"—not only because it lacks the toolbox of a global power but also because it does not have the ideational inclination to do so (p. 311). As he points out, it is "a very narrow-minded, self-interested, realist state, seeking only to maximize its own national interests and power. It cares little for global governance and enforcing global standards of behavior" (p. 310). As a result, China has "minimal soft power and a mixed-to-poor international image" (p. 207). Shambaugh therefore contends that China is "a lonely power, lacking close friends and possessing no allies. . . . In other words, China is in the community of nations but is in many ways not really *part* of the community; it is formally involved, but it is not normatively integrated" (p. 7). It is for these reasons that rather than China's rise, Shambaugh suggests that it is far better to speak about its spread. The necessary qualification is that these inferences should not be taken as an indication that China will not become a global power or that its influence will not be impacting the patterns of world affairs. Instead, what Shambaugh is arguing is that China is not there yet—it has yet to develop the mind-set for and skills of a global power; in fact, that is why he refers to it as a partial power.

While not uncontroversial, the book develops this argument cogently by looking in turn at China's nascent international identities, its diplomatic initiatives, its global governance contributions, its global economic outreach, its global cultural impact, and its global security presence. This comprehensive overview offers a thoughtful and rarely accessible consideration of China's emerging international agency. As Shambaugh ac-

knowledges in the preface, his efforts have been largely motivated by his "frustration with the academic China field" and, in particular, with its failure to offer a generalizable picture of "China's global emergence in its '*totality*'" (p. x). In this context, his analysis promotes a much broader and thorough understanding of China's global roles than the ones advanced in the existing literature. Not surprisingly, therefore, much of the criticism that Shambaugh's book will likely attract is going to target the very motivation and methods on which it relies for the explanation, understanding, and translation of China to its readers. It is also expected, that many will find problematic (to say the least) Shambaugh's proposition that China is a partial power. Indeed, China might not yet have the influence required by a global power; however, its impact is far greater than a mere presence. In fact, if one were to use Shambaugh's criteria and apply them to the United States (which provides the benchmark for a global power), it is doubtful whether it will actually meet them, and, perhaps, one might have to consider rebranding the United States as a partial power itself.

Yet, one is almost tempted to say that such provocation was what Shambaugh was after. It is this kind of contestation that is likely to produce extensive and comprehensive analyses of the kind that his book represents. For if one were indeed to offer a critical reading of Shambaugh's efforts, it will almost by default have to offer broad contextualizations that Shambaugh argues are wanting in the current academic literature. His account offers a stimulating framework for the discussion of the prospective trajectories of China's international interactions. At the same time, the book makes available ample evidence of the contested nature of China's rise to global prominence. What emerges is a framing of world affairs premised on the fusion of complex innovation and its creative contextualization within the idiosyncratic experience of China. In this respect, Shambaugh's analysis provides thoughtful reconsiderations of China's global roles and offers a wealth of solid knowledge on the evolution, patterns, and practices of China's external relations. Thus, to the buffs of China's international affairs, his book provides a superbly researched examination of the strategic underpinnings of Beijing's international agency. It is expected that the book will be welcomed by students and scholars alike. At the same time, Shambaugh's careful process tracing of this complex topic of current global politics provides a compelling perspective that is bound to attract policy makers and pundits interested in Chinese foreign policy.

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Deceit on the Road to War: Presidents, Politics, and American Democracy
by John M. Schuessler. Cornell University Press, 2015, 176 pp., $27.95.

In his book, *Deceit on the Road to War: Presidents, Politics, and American Democracy*, John Schuessler examines how democratic leaders can "exploit information and propaganda advantages to frame issues in misleading ways, cherry-pick supporting evidence, suppress damaging revelations, and otherwise skew the public debate in advantageous directions" (p. 117). By resorting to deception, leaders take what he calls a "calculated risk"—the outcome of which may impose public backlash to their credibility based

upon their actions and the outcome of war. With caution, he informs the reader that deception is hard to reveal and leaders rarely own up to deception.

The book is divided into three in-depth case studies—the first two focusing on deception through *blameshifting* involving Franklin Roosevelt (World War II, a "high-opposition, high-deception" case) and Lyndon Johnson (the Vietnam War, a "medium opposition, medium-deception" case). The third case study turns its attention to the manipulation of deception referred to as *overselling* with George W. Bush (the Iraq War, a "low-opposition, low-deception" case).

The central argument, "deception is a natural outgrowth of the democratic process when war is on the horizon," (p. 6) is supported through a well-conceived analysis of deception by democratic leaders with careful construction of the case study format. At first glance, three case studies may be seen as insufficient to support the overall argument; however, the author includes supplementary international relations literature as additional evidence, such as the United States and politicizing intelligence. Although not an easy read, a few noteworthy passages can be found while reading each case study. Most surprising is a 1940 election campaign statement by Roosevelt signifying deception by omission: "Your boys are not going to be sent into any foreign war"—deliberately leaving out "except in case of attack" (p. 40). In addition, readers will appreciate Schuessler's assessment of the Gulf of Tonkin naval incident that plays a major role in Johnson's "creeping form" of deception through stealth methods in order to escalate the war in Vietnam.

In his conclusion, Schuessler leaves the reader with a reflective question: "When does deception blur into self-deception?" To "successfully deceive others," he argues, "these leaders needed to deceive themselves, at least in some measure" (p. 125). If there is any truth in this, then perhaps future democratic leaders contemplating deception to gain public support for war should take to heart what French philosopher Jean-Jacque Rousseau wrote in the eighteenth century: "Nature never deceives us; it is always we who deceive ourselves."

Lastly, as a suggestion to the reader, it is recommended that each case study be read several times to grasp the overall picture of what is happening as it pertains to democratic leaders means of deception and again to ascertain and comprehend the specific issues that determine the outcome of their decisions towards war. *Deceit on the Road to War* is recommended for anyone interested in the executive branch, foreign policy, and national and international security.

Christopher L. Wright

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