Fostering Revolutionary Innovation

CENTER FOR STRATEGIC AND BUDGETARY ASSESSMENTS ...

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Seminar Report: Fostering Revolutionary Innovation

Center for Strategic and Budgetary Assessments (CSBA)

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CONTENTS

I. INTRODUCTION

The Center for Strategic and Budgetary Assessments (CSBA) conducted a seminar entitled "Fostering Revolutionary Innovation" at the Jefferson Hotel in Washington, DC, on February 11, 2000. The Office of Net Assessment in the Office of the Secretary of Defense sponsored the event.

Occasionally, the creative application of technology, innovative operational concepts, and new methods of organization have dramatically altered the character and conduct of military operations. These episodic historical discontinuities have variously been termed "military-technical revolutions" (MTR) or "revolutions in military affairs" (RMA).[1] Examples during the past two centuries include the *levee en masse* of the Napoleonic era; the application of the railroad, rifle, and telegraph to land warfare; the application of the all big-gun battleship and submarine to naval warfare; the German *blitzkrieg*; the development of carrier aviation; and the advent of the atomic bomb.

Many believe that we are in opening stages of another RMA, spawned by the ongoing information and biotechnology revolutions, and that those who take the initiative now in bringing it about and exploiting it will enjoy a major military advantage over competitors who fail to keep pace. The emerging RMA promises to usher in a new warfare "regime" that will render obsolete or subordinate many of the military capabilities that have been dominant since World War II such as short-range manned fighters, carrier battlegroups, and ground maneuver divisions.[2] Given the time it takes to field new weapon systems, develop new operational and organizational concepts, and "grow" new commanders, a major transformation of the U.S. military will likely take at least 20 to 30 years.[3] Thus, the transformation process must be initiated in the very near future in order to field an RMA force by 2025.

Accordingly, this seminar focused on actions that the current administration could take during President Bush's first term in office, 2001-2005, to "kick start" a transformation of the U.S. military. It was not our intention to craft a long-term, comprehensive transformation strategy, but rather to identify steps that could be taken almost immediately to induce discontinuous change of the U.S. military that anticipates emerging challenges and opportunities associated

[1] The term "revolution in military affairs" should be considered interchangeable with "military revolution" or "military-technical revolution."

[2] As it is used here, a "military regime" is defined as a set of military capabilities and strategic cultures that determine the dominant methods for the conduct of war over a given period of time.

[3] As Rosen notes "Because of the time necessary for young officers to be promoted to senior rank, the practical side of innovation typically took a generation to accomplish..." Stephen Peter Rosen, *Innovation and the Modern Military – Winning the Next War* (Ithaca, Cornell University Press, 1991), p. 58.

with the ongoing RMA.[4] The majority of the discussion during the seminar revolved around the following critical action items:

1) Developing and communicating a compelling vision of future warfare;

2) Selecting transformational leaders and creating a powerful, guiding coalition in support of discontinuous change;

3) Creating a sense of urgency regarding the need to transform;

4) Encouraging "competitive jointness" within and across each of the armed services;

5) Creating organizational slack within the armed services;

6) Increasing industry incentives for innovation;

7) Expanding and refocusing RDT&E funding and investing in rapid prototype development; and

8) Conducting RMA experimentation.

Seminar participants included: Dr. Eliot Cohen, Johns Hopkins SAIS; Dr. Owen Cote, Massachusetts Institute for Technology; Mr. Frank Finelli, The Carlyle Group; CAPT Karl Hasslinger, OSD Net Assessment; Dr. Pat Larkey, Carnegie-Mellon University; Mr. Andrew Marshall, OSD Net Assessment; Dr. Stephen Rosen, Harvard University; Dr. Marin Strmecki, Smith Richardson Foundation; CDR Jan Van Tol, Navy Staff; and Mr. Barry Watts, Northrop-Grumman Analysis Center. CSBA representatives included: Ms. Alane Kochems, Mr. Todd Lowery, Mr. Robert Martinage and Mr. Michael Vickers.

In the next chapter, the reasons for embarking upon a transformation of the U.S. military that is both anticipatory and discontinuous in nature are explored. Chapter III provides an explanation for why such transformation appears unlikely on our current path. Chapter IV discusses several strategies for beginning the process of transformational change of the U.S. military. The report concludes with a summary overview of the seminar, including a list of short-term action items that the Bush administration and the senior leadership of the Department of Defense (DoD) could implement to initiate the transformation process.

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[4] A full-length monograph outlining a complete transformation strategy for the U.S. military will be released by CSBA in October of 2001.

II. THE TRANSFORMATION IMPERATIVE

The ongoing RMA promises to usher in a fundamentally new warfare regime; one which will present the United States with an array of new challenges, as well as opportunities. At the moment, based upon any useful measure of military power, the U.S. military is clearly preeminent within the current warfare regime. The critical task for defense planning over the next several decades, therefore, is to preserve U.S. military superiority by adapting to emerging challenges and exploiting new opportunities before potential competitors. Failure to move through periods of revolutionary change in warfare ahead of competitors has historically been costly to the strategic position of leading powers. A shock resulting from the asymmetric exploitation of the RMA by potential adversaries could have strategic and political repercussions analogous to those associated with the loss of our nuclear monopoly in 1949 or the attack on Pearl Harbor. As will be elaborated upon below, to avoid this outcome, DoD should craft a strategy for anticipatory, discontinuous change of the U.S. military.

THE REVOLUTION IN MILITARY AFFAIRS

Military revolutions are periods of discontinuous change that render obsolete or subordinate existing means for conducting war. They are often linked with broader social, economic and scientific transformations, and are brought about by changes in militarily relevant technologies, concepts of operation, methods of organization, and/or resources available. Transformational change in aggregate military capabilities is a function of changes in the five core areas of firepower; mobility; protection; sustainment; and command, control, communications, and intelligence (C3I). Revolutionary change can result from an order of magnitude or greater increase in one of these functional areas (as was the case with the atomic bomb), or, more typically, from non-linear interaction of two or more of these areas. Military revolutions have historically advantaged the strategic/operational offense, and have thus provided a powerful impetus for major changes in strategic balances. Surprise is endemic. A defining battle is usually required before competitors become fully aware that a revolution has occurred.[5]

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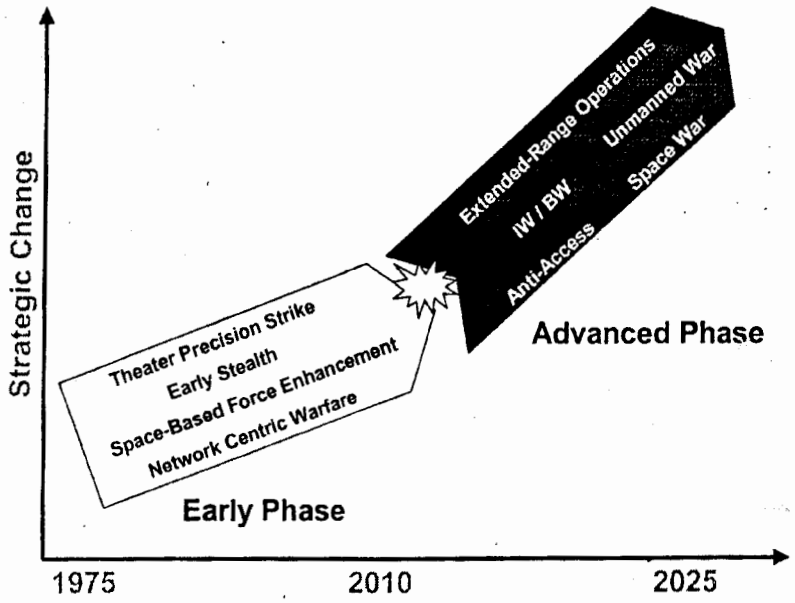
[5] See Michael G. Vickers, "The Structure of Military Revolutions," Ph.D. dissertation, The Johns Hopkins University, forthcoming. Depending upon the definitional and periodization criteria employed, the historical record provides evidence of about a dozen cases of revolutionary change in the conduct of war. The modern period in general, and the past two centuries in particular, has witnessed the greatest rate of change. Since the early fifteenth century, the conduct of war has been radically altered eight times. Six of these transformations have occurred within the past two hundred years, making the nineteenth and twentieth centuries in effect an Age of Military Revolutions. The eight cases of modern transformational change have several potentially important implications for a prospective revolution in military affairs. The artillery revolution of the fifteenth century and its naval counterpart, the guns and sails revolution, several decades later, were central developments underwriting the West's rise to global dominance. The Napoleonic revolution during the last decades of the eighteenth century and the first decade of the nineteenth and the railroad, rifle and telegraph revolution of the mid-nineteenth century were brought about in large measure by developments outside the military sphere. The dreadnought and submarine revolution at the turn of the twentieth century illuminates the problems of technological flux, self-obsolescence and non-hierarchical changes in power relationships. The interwar revolutions in armored warfare, air superiority and naval air power underscore how differences in concepts of operation and methods of organization can result in large disparities in military capability

An RMA based in large measure upon the burgeoning information revolution has been underway since at least the late 1970s, but only a glimpse of its potential revolutionary effects has been seen to date. Within the next 10-20 years, the RMA will likely begin to shift from a purely opportunity-based revolution for the U.S. military to one that portends significant threats (see Figure 2-1 below). The ability of the U.S. military to control the air, operate on the ocean's surface in littoral areas and conduct mobile armored warfare – the core of current U.S. power projection capabilities – could be severely challenged. For example, prospective adversaries could field robust "anti-access" capabilities that allow them to target in-theater ports, airfields, and other installations relied upon by U.S. forces, as well as high-signature aircraft, surface ships, and ground combat vehicles. New forms of regional power projection could complicate U.S. efforts to defend and reassure its allies. Other possible discontinuities include a dramatic rise in the prominence of unmanned combat systems, as well as the outbreak of war in space and the emergence of new forms of biological and information warfare.

Figure 2-1: Phases of the RMA



Between these two phases of the RMA, a tension will likely exist between the desire to optimize forces for fighting within the early regime (e.g., equipping legacy platforms with new sensors and munitions) versus the need to adopt new capabilities and platforms for fighting within the advanced RMA regime.

Advances in ten capability areas — i.e., awareness and connectivity, range and endurance, precision and miniaturization, speed and stealth, and automation and simulation — will likely be central to the emergence of an advanced RMA regime (see Figure 2-2 below). New classes of

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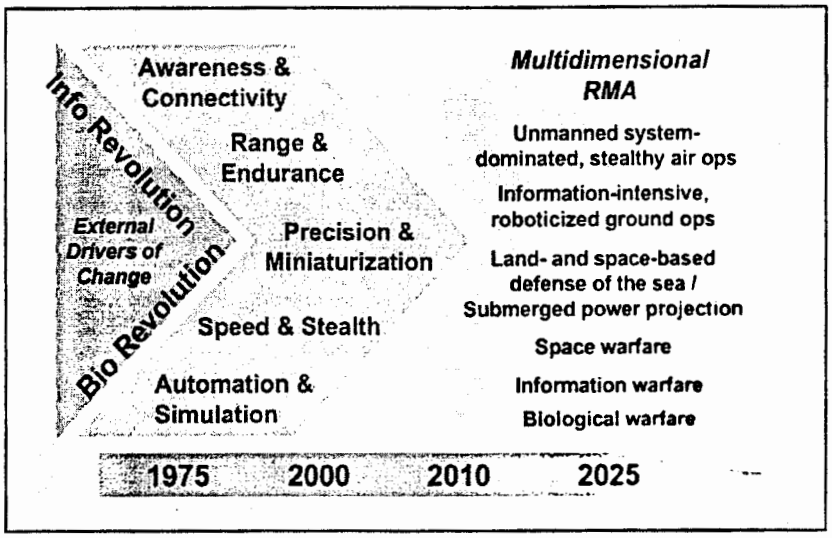
among similarly equipped adversaries. Finally, the bifurcation of warfare into nuclear and conventional regimes induced by the nuclear revolution could significantly limit the strategic scope of a prospective RMA.

commercial and military sensors could dramatically enhance the transparency of the battlespace. Meanwhile, space-based communication satellites (COMSATs), data packet networking capabilities, robust fiber optic grids, and widely available encryption technologies could dramatically enhance the command, control, and communications capabilities of military forces by providing them with secure, reliable, broadband communications.

The advanced phase of the RMA will likely be characterized by the rapid evolution and diffusion of precision-strike systems that are progressively more accurate and "brilliant." Given an increasingly transparent battlespace, these systems could dramatically reduce the survivability of high-signature platforms in the air, at sea, and on land. The networking of increasingly capable ISR systems with ever more lethal precision-strike weapons could result a future warfare environment in which, if you can be seen, you can be killed. This development would, of course, place a premium on stealth, speed, and information operations, including offensive IW and electronic warfare (e.g., jamming, radio-frequency warfare and deception operations).

Figure 2-2: Drivers of the Advanced Phase of the RMA



Operational endurance could be extended substantially as a result of new applications of nuclear power and other forms of high-density energy storage, increased reliance on unmanned systems unconstrained by human physiology, and the migration of additional capabilities to space. The range and speed of combat operations could continue to increase as militaries take greater advantage of missile-based, long-range, precision-strike capabilities and myriad applications of hypersonic and directed-energy technologies. Unmanned systems could increasingly substitute for manned systems across warfare dimensions. Progress in miniaturization could not only result in dramatically smaller versions of traditional platforms and munitions, but could also yield new capabilities such as bird-sized UAVs, insect-sized ground robots, disposable microsensors, and micro-satellites. Biotechnology could be exploited to create a broad range of novel biological

weapons that are more discriminate and lethal in their effects.[6] Advances in simulation could transform military planning and training.

In sum, by 2025, developments in these ten areas could lead to a transformation in the conduct of war on land, at sea, and in the air. New forms of warfare could emerge in near-earth space, the information domain, and biological realm. Although the United States stands to benefit enormously from this ongoing RMA, certain aspects of this change (e.g., the likely increasing strategic effectiveness of missile-based, long-range, precision-strike capabilities) could significantly advantage our potential competitors. There is substantial evidence, moreover, that potential competitors are highly aware of the ways in which ongoing trends could alter strategic balances in their favor.[7]

The ability of the DoD to forestall exploitation of this revolution by potential adversaries will likely be limited for a variety of reasons. Some of the key capabilities, ballistic and cruise missile technology, for example, are well understood and are accessible to potential adversaries. Others, such as rudimentary stealth, are not far behind. The dual-use nature of many RMA-related capabilities (e.g., commercial, space launch services) will exacerbate the control problem, as will the increasing military value of commercial or non-defense scientific capabilities such as space-based imaging, navigation and communications services; information technology; and biotechnology. Technology that may be considered obsolete by the United States might still substantially contribute to the development of hostile revolutionary capabilities. Moreover, future competitors will likely be much stronger economically than those we face today, so it could be more difficult for the United States to "buy" its way out of an emerging problem.

THE NEED FOR ANTICIPATORY, DISCONTINUOUS CHANGE

What type of change will be required for the U.S. military to exploit the opportunities and overcome the challenges likely to be engendered by the ongoing RMA? In answering this question, it is useful to draw upon the literature pertaining to how large, successful businesses adjust to major shifts in the marketplace.[8]

During periods of relatively stable consumer demand, well-understood competition, and measured technological change, companies typically engage in a "process of constant tinkering,

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[6] Vickers, *Warfare in 2020: A Primer* (Washington, DC: CSBA Monograph, October 1996), pp. 1-7.

[7] Historically, military organizations in the midst of revolutionary change in war have displayed widely varying degrees of awareness of the transformation process as it unfolds. Even the most successful military organizations were often less than fully aware of the character and extent of change that was underway. The current period, however, seems to be marked by higher than average levels of awareness of the prospects for revolutionary change, further bolstering the case for an anticipatory strategy.

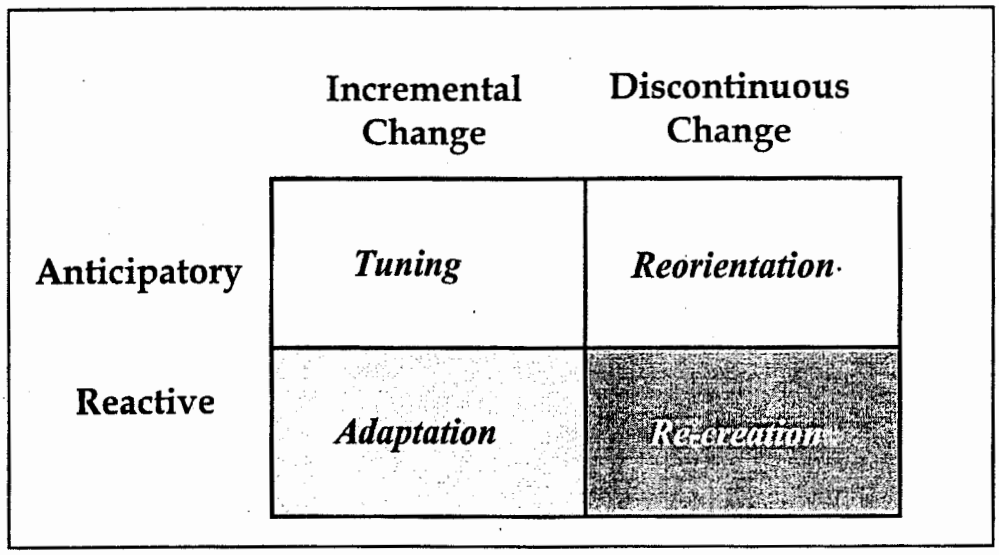
[8] The following section draws extensively from David A. Nadler and Michael C. Tushman, "Types of Organizational Changes: From Incremental Improvement to Discontinuous Transformation in David Nadler, Robert Shaw, and A. Elise Walton, *Discontinuous Change – Leading Organizational Transformation* (San Francisco: Jossey-Bass Publishers, 1995), pp. 22-28

adaptation, and modification" in order to improve efficiency and garner higher profit margins. This type of activity can be referred to as incremental change. However, when confronting a radically changing environment characterized by market innovations, rapid technological change, regulatory shifts, or other disruptive shocks, companies must break away from the past and reform themselves in order to compete effectively. Companies not only have to learn new ways of thinking, working, and acting, but may also need to "unlearn" the habits, orientations, assumptions, and routines that were previously effective. This type of restructuring can be termed discontinuous. As the distinguished business scholars David Nadler and Michel Tushman note:

> Discontinuous change is qualitatively different from incremental change. It requires a break with the past, perhaps even the deliberate destruction of certain elements of the current system. It raises fundamental issues of values and basic vision. It is frequently uncertain, incomplete, and headed toward a future that is unclear.[9]

Aside from the degree of continuity with the past associated with a given change, another factor to consider is its *timing*. Entities that are able to foresee a destabilizing event and change in advance of it engage in "anticipatory" change, while those that lacked the foresight and change only afterwards engage in "reactive" change (see Figure 2-3 below).

Figure 2-3: Types of Organizational Change[10]



[9] Ibid., p. 37.

[10] Ibid., p. 24.

Tuning occurs when an organization initiates *incremental* changes in *anticipation* of relatively small shifts in the environment or in search of improved efficiency or effectiveness. While these changes can be valuable, there is no immediate requirement to change and the company's survival is not at stake, at least over the short run. Companies that fail to make these relatively small changes early on, however, often find that they are eventually compelled to make even larger changes, and quickly, or suffer major negative consequences. This type of reactive change to gradual shift in the external environment is referred to as "adaptation."

Change that is discontinuous but initiated in advance of, or very early on in a period of disequilebrium is called "reorientation." This type of change "involves a fundamental redefinition of the enterprise—its identity, vision, strategy and even its values."[11] A critical aspect of reorientation is that it occurs before the change imperative hits. Often, however, business leaders are unable to foresee disruptive shocks to the system, or if they do, they fail to transform their strategy, organization, and operations soon enough. Having waited too long and now facing grave external pressures, the company must "re-create" itself in order to survive. The company no longer has sufficient time to design and implement a reorientation strategy, but instead must make fast and simultaneous changes throughout the organization. Under these circumstances, "the action must be swift, decisive, and all encompassing, and even then, the chances of success are low."[12]

Assuming that revolutionary changes in the future security environment are on the horizon, the relevant question is whether DoD will anticipate the necessary changes in a calm and deliberate manner, or be forced to recreate itself belatedly in a crisis atmosphere. Several "first mover" advantages are likely to accrue to those militaries that are first to re-orient R&D, system procurement, organizations, and concepts of operations in response to a discontinuous change in the conduct of war. By anticipating change rather than reacting to it, first movers into a new warfare regime would be rewarded with relatively more time to carry out their transformation and would likely enjoy the following benefits:[13]

- The opportunity to experiment *and* fail with new systems and concepts, and still have sufficient time to make second attempts.

- The luxury of undergoing relatively gradual change and "reshaping" their military forces without seriously damaging morale or threatening core values. In contrast, those militaries which do not adapt until late in the game are likely to encounter significantly more disruption and stress since the pace of change will, by necessity, be faster.

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[11] Ibid., p. 26.

[12] Ibid., p. 28.

[13] Similarly, companies that move early during a period of disequilebrium tend to be more successful than those that move later. See David A. Nadler and Michael C. Tushman, "Types of Organizational Changes: From Incremental Improvement to Discontinuous Transformation in David Nadler, Robert Shaw, and A. Elise Walton, *Discontinuous Change – Leading Organizational Transformation* (San Francisco: Jossey-Bass Publishers, 1995), p.21

- The chance to shape the future security environment by influencing the direction of arms control and diplomatic initiatives, as well as the technology development and acquisition strategies of emerging competitors.

- An increased opportunity to learn and develop the skills needed to function effectively in the new warfare environment, and then recruit and train soldiers with the desired skill sets.

As Stephen P. Rosen has observed, time is among the most important of transformation resources.[14] Fewer resources made available early on for development of, and experimentation with, new systems and capabilities may be more important to a successful transformation than more resources later. Anticipatory discontinuous change is not only likely to result in less strategic shock, but less institutional shock as well.[15] In the ideal case, anticipatory transformation would be revolutionary in result, but evolutionary in execution.[16]

The most important reason for pursuing an anticipatory strategy, however, is that failure to move through periods of revolutionary change in warfare ahead of potential competitors has historically been far more costly to the strategic position of leading powers than leading change. When a leading power (the Royal Navy, for example, at the turn of the twentieth century) is the first to make the leap to a new way of war, the result has usually been large strategic gains, or, at worst, a continuation of the strategic status quo. Conversely, when a would-be challenger (e.g., the Prussian Army during the mid-nineteenth century) has been the first to make the leap, transformations of war have typically led to dramatic shifts in power balances (see Figure 2-4).

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[14] Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military*, Ithaca, NY: Cornell University Press, 1991, pp. 252-253.

[15] Some advocate a policy of strategic agility that would rely on the U.S. military's ability to embrace change more rapidly and on a greater scale than its would-be competitors. Such a strategy, however, would likely carry significant risk. Agility-based strategies work only when intelligence is very good, competition is largely symmetrical, product life cycles are short, and first movers either lack the will, strategic focus or the scale advantage to capitalize on their temporary advantage. Few of these conditions are likely to obtain in the emerging strategic competition. The emerging RMA competition is likely to be asymmetrical, our potential adversaries are likely to benefit from a narrower strategic focus, and important RMA capabilities could easily remain concealed (e.g., information warfare, advanced biological capabilities, and means for space control) until they are used. "Wait and see" strategies, moreover, also run a high risk of failing to exploit important strategic opportunities (e.g., shaping competitors' future behavior in ways favorable to our interests).

[16] Gary Hamel and C.K. Prahalad, "Competing for the Future," *Harvard Business Review*, July-August 1994

Figure 2-4: Transformation and Power Balances

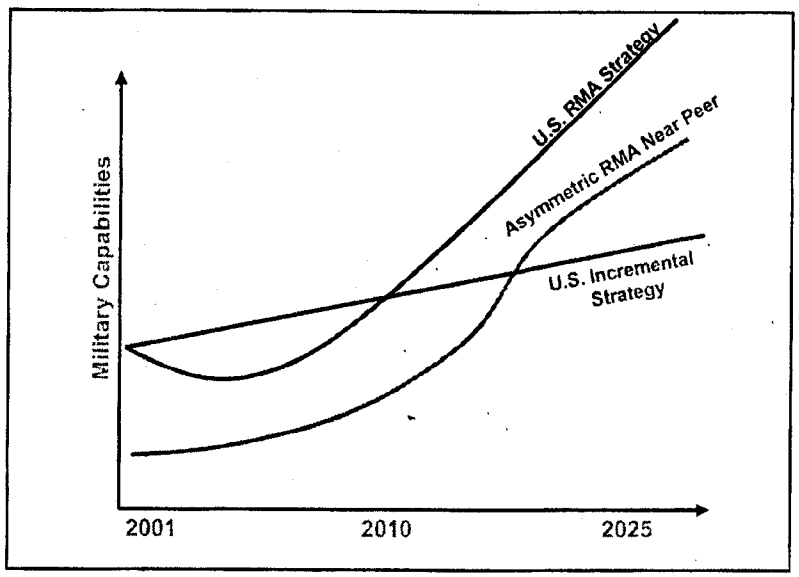
	Anticipatory Strategy	Reactive Strategy
Leading Power	*Large Strategic Gains Or Maintenance of Strategic Status Quo Under New Conditions*	*Large Strategic Losses Unless Scale Effects Dominate*

Transforming its military capabilities in advance of potential rivals could allow the United States to shape the emerging competition in important ways. If the United States transforms its military capabilities and its potential adversaries do not, the United States could enjoy a historically rare, revolutionary advantage, substantially enhancing the deterrent power of U.S. forces. Even if the United States does not enjoy a long-term monopoly on the RMA, early adoption of transformational capabilities may block or reduce the strategic gains available to potential competitors by making U.S. forces, the American homeland and U.S. allies less vulnerable to emerging threats.

Moreover, potential adversaries of the United States certainly have the incentive to "overthrow" the U.S.-dominated, current warfare regime. The strategic tradeoffs between incremental and discontinuous change in military capabilities during a period of revolutionary change can be represented graphically using "S" curve analysis. The emergence of a new military regime typically follows an "S" curve evolution, with new capabilities evolving slowly until a critical mass is reached, after which exponential increases in capability may be achieved for a period before diminishing returns set in. (See Figure 2-5.)

During periods of transformational change, incremental strategies can fail catastrophically. The Cold War and post–Cold War eras provide polar cases for the relative efficacy of evolutionary versus revolutionary change. When, as was the case during middle decades of the Cold War, the potential for discontinuous change in military capabilities is low, and near-term threats are great, an incremental approach to change is clearly preferred. The current strategic environment, on the other hand, in which the potential for discontinuous change in military capabilities is high and near-term competitive pressures are low, compared to potential long-term threats, is ideal for revolutionary strategy.

Figure 2-5: Transformation and Strategic Risk



Transforming the U.S. military will, depending on the degree of near- and mid-term risk assumed, necessarily involve a policy of self-obsolescence, as currently dominant capabilities are divested to make room for capabilities more suited to an emerging military regime. Among the areas of current U.S. dominance that might be partially divested under a policy of self-obsolescence are manned, short-range aviation, carrier warfare, and heavy ground forces.[17]

[17] Indeed, the capability differential between U.S. forces and their potential adversaries could even be greater in these "legacy" warfare areas than it is in emerging military competitions. While these warfare areas will not likely be central to the emerging military competition, some (e.g., amphibious capabilities) could make significant long-term contributions to full-spectrum dominance.

III. Why Discontinuous Change Is Unlikely On Our Current Path

During the course of the seminar, the participants discussed several reasons why discontinuous change seems unlikely on our current path. The reasons most frequently cited included:

- The absence of a future warfare vision that is clear, convincing, and broadly communicated;
- A low sense of urgency within the defense establishment for transforming what is already the world's premier military force;
- The paucity of innovative, transformational leaders within DoD that are willing to take risks; and
- Insufficient RDT&E funding focused on capabilities that will be in demand over the long term.

This chapter will discuss each of these obstacles to transformation in turn.

Absence of a Compelling Vision of Future Warfare

One of the critical enablers of transformation is a vision of the future that not only convinces others of the need for discontinuous change, but also provides them with guidance about how to proceed. John Kotter, who has studied many companies that have both succeeded and failed in transforming themselves, concludes:

> Vision plays a key role in producing useful change by helping to direct, align, and inspire actions on the part of large numbers of people. Without an appropriate vision, a transformation effort can easily dissolve into a list of confusing, incompatible, and time-consuming projects that go in the wrong direction or nowhere at all.[18]

Unfortunately, DoD currently lacks a vision appropriate for inspiring and guiding transformational change. Current joint and Service visions of the future are either not precise enough to provide meaningful guidance, do not address the full range of emerging challenges, or are extensions of the current status quo. The vision statement contained in *Joint Vision 2020*, for example, reads as follows: "Dedicated individuals and innovative organizations transforming the joint force for the 21st Century to achieve full spectrum dominance: persuasive in peace, decisive

[18] John P. Kotter, Leading Change (Boston, MA: Harvard Business School Press, 1996), p. 7.

in war, and preeminent in any form of conflict."[19] It explains further that "the overarching focus of this vision is full spectrum dominance—achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection."[20] While few would dispute the desirability of having full spectrum dominance, *Joint Vision 2020* provides almost no explanation for why change is necessary or how the lofty objectives it sets forth might be accomplished. As one seminar participant quipped, *Joint Vision 2020* does little more than attach superlative adjectives to core warfighting missions.

The Army's vision of a more deployable, information-intensive "Objective Force," while sensible in many respects, does not address the full range of challenges that the U.S. military will likely confront over the mid- to long term. For example, the Army has yet to explain how its Objective Force divisions could be deployed and sustained in future "anti-access" environments. Similarly, the Navy's vision of "network centric warfare" does not address the growing vulnerability of high-signature surface ships operating in littoral waters to long-range, stealthy, anti-ship cruise missiles; quiet submarines, potentially armed with wake-homing torpedoes; and large numbers of increasingly sophisticated mines. The Aerospace Expeditionary Force and Global-Reconnaissance Strike concepts espoused by the Air Force represent only modest extensions of the status quo, not a vision for discontinuous change.

A compelling vision of future warfare should focus upon operational or strategic challenges that seem likely to shape the competitive landscape as current trends play themselves out over the next two to three decades. These might include, for example:

- Power projection in an anti-access/area-denial environment
- Urban eviction and control,
- Assured space access and space control; and
- Homeland defense.

LOW SENSE OF URGENCY

The U.S. military faces no imminent challenges to its current preeminence. In the view of the seminar participants, DoD has become steadily more complacent since its lop-sided victory in the Gulf War over a decade ago. Recent victories (e.g., Operation Allied Force) and the U.S. military's relatively high operational tempo have contributed to a climate of extraordinary institutional resistance to change. As one participant observed, the dominant view within DoD is that "if it ain't broke, don't try to fix it." In the absence of a visible challenge to meet or threat to

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[19] General Henry Shelton, Chairman of the Joint Chiefs of Staff, Joint Vision 2020 (Washington, DC: GPO, 2000), inside front cover and p. 1.

[20] Ibid., p. 3

overcome, it is difficult to overcome the inertia of complacency and build momentum in support of discontinuous change. John Kotter has observed that:

> By far the biggest mistake people make when trying to change organizations is to plunge ahead without establishing a high enough sense of urgency in fellow managers and employees. This error is fatal because transformations always fail to achieve their objectives when complacency levels are high.[21]

He notes that without a sufficiently high sense of urgency, people will not make needed sacrifices and will instead "cling to the status quo and resist initiatives from above."[22]

The sense of urgency needed to kick start the transformation process could be generated by several different means. An analytically rigorous assessment of emerging threats that was credible, convincing, and widely distributed within the entire defense community (e.g., DoD, Capitol Hill, the Intelligence Community, and defense industry) could increase urgency levels. Or as one participant suggested, it might also be possible to "engineer a train wreck," by intentionally designing field exercises to highlight the growing vulnerabilities of legacy platforms. For example, as will be discussed in the next section of this report, a series of field exercises might test current Service warfighting concepts against an anti-access threat that is representative of what a major regional power could field between 2015-2025.

PAUCITY OF TRANSFORMATIONAL LEADERS

Visionary leaders are essential to military transformation. For example, the choice of General Hans von Seeckt, first as chief of the general staff and then as commander-in-chief of the Army, was crucial to the *Reichwehr's* development of *blitzkrieg*. Had Admiral Jackie Fisher not been First Sea Lord from 1904-10, it is doubtful that the Royal Navy would have moved so aggressively in divesting itself of over 150 ships of the passing military regime, while plunging forward with the revolutionary *HMS Dreadnought* and fast battle cruisers. As John Kotter notes in reference to corporate transformations:

> Only leadership can blast through the many sources of corporate inertia. Only leadership can motivate the actions needed to alter behavior in any significant way.[23]

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[21] Kotter identifies nine major sources of complacency, including: the absence of a major and visible crisis, too many visible resources, low overall performance standards, inappropriate measures of effectiveness, and insufficient performance feedback from external sources. See John P. Kotter, *Leading Change* (Boston, MA: Harvard Business School Press, 1996), p. 4 and pp. 38-42. Kotter also notes that "When the urgency rate is not pumped up enough, the transformation process cannot succeed and the long-term future of the organization in put into jeopardy." John P. Kotter, "Leading Change: Why Transformation Efforts Fail," *Harvard Business Review*, March-April 1995, pp. 60-61.

[22] Kotter, *Leading Change*, p. 4.

[23] Ibid., p. 30.

Unfortunately, in the view of the seminar participants, there is currently a paucity of leaders within DoD with a compelling vision of future warfare, as well as the "management savvy" and fortitude needed to implement a major transformation of the U.S. military. To the contrary, the Services are controlled by individuals who, for the most part, are powerful defenders of the status quo. Having worked their way up through the ranks over the last two to three decades, senior officers are intimately familiar, and therefore, comfortable with the established doctrine and warfighting methods of the current warfare regime. While this experience is invaluable for preparing the military to fight over the short-term, it is not necessarily conducive to preparing the military for fighting in a new warfare regime that could emerge over the longer term. In terms of promoting transformation, "experience is valuable only to the extent that the future is like the past," and when the competitive terrain in changing quickly, experience can become "irrelevant and even dangerous."[24] As one participant commented, one of the greatest obstacles to transformation of the U.S. military is that the senior leadership of DoD is "entrenched in the old regime" and unable to free themselves from "the tyranny of the short term."

Aside from the apparent shortage of transformation-minded individuals within DoD's senior leadership, those few military leaders that advocate transformation typically have short tenures in policymaking positions.[25] Senior officers shuttle from one position to the next, completing "touch-and-go" assignments often after only a year or two. Four years is the maximum time a senior officer can serve as a chief of Service or as chairman of the Joint Chiefs of Staff (JCS). Thus, they barely have enough time to enunciate a vision of transformation, let alone institutionalize a process for achieving it. Short tenures also have a way of promoting emphasis on near-term problems and solutions. Leaders are naturally concerned with things not going wrong on their watch. They also want to point to clear accomplishments when they depart their positions.

In contrast, major U.S. military innovations and transformations during this century were typically characterized by support from senior military leaders whose tenure was considerably longer. This makes intuitive sense, since innovation often takes considerable time, and military revolutions tend to occur over several decades. Admiral William Moffett, who headed up the Navy's Bureau of Aeronautics during the critical infant years of naval aviation, served in that position from 1921 to 1933. Admiral Hyman Rickover, father of the nuclear navy, led the Service's program for several decades. General Hamilton Howze, the leader in the effort to create the only new Army division in the last half century — the Airmobile (now Air Assault) Division — served in a series of positions directly related to air mobility for nearly a decade.

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[24] Gary Hamel, "Strategy as Revolution," *Harvard Business Review*, July-August 1996, p.74. Similarly, Kotter notes that: "Employees in large, older firms often have difficulty getting a transformation process started because of the lack of leadership coupled with arrogance, insularity, and bureaucracy. In those organizations, where a change program is likely to be overmanaged and underled, there is a lot more pushing than pulling. Someone puts together a plan, hands it to people, and then tries to hold them accountable. . .The problem with this approach is that it is enormously difficult to enact by sheer force the big changes often needed today to make organizations perform better. Transformation requires sacrifice, dedication, and creativity, none of which usually comes with coercion." See John P. Kotter, *Leading Change* (Boston, MA: Harvard Business School Press, 1996), pp. 29-30.

[25] The following section on short tenure draws from Andrew Krepinevich, "Why No Transformation?" CSBA paper, February 1999.

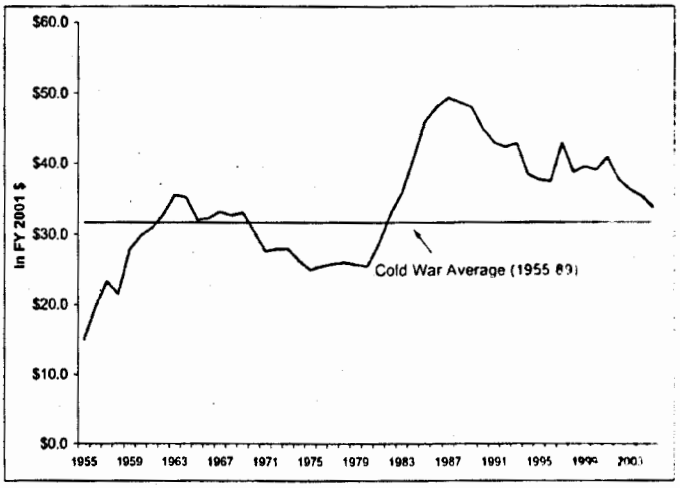
Similarly, Admiral Jackie Fisher, who was a powerful force behind Britain's investment in all-big-gun battleships (HMS Dreadnought), and later, fast battle cruisers and submarines, held key decision-making positions for the better part of a decade. General Hans von Seeckt, who was critical to the emergence of blitzkrieg warfare also had a long tenure.

ANACHRONISTIC RDT&E STRATEGY

Although the ongoing RMA could be based in part on the development of new operational and organizational concepts, they alone will almost certainly prove insufficient for bringing about discontinuous change. Given the postulated threat environment for 2020-2030, the military utility of most of today's legacy systems will likely depreciate significantly, regardless of the operational or organizational concepts employed. Consequently, it will be important to fund the creation of new capability options through a vigorous research, development, testing, and evaluation (RDT&E) program.

Over the past 45 years, DoD has spent an average of about $33 billion a year on RDT&E programs. For the past two decades—which correspond to the early phase of the RMA—RDT&E funding was substantially above this Cold War average. Just as the RMA is accelerating, however, RDT&E spending was projected to drop by nearly *20 percent* in real terms over the final Future Years Defense Program (from $41.3 billion in FY 2001 to $33 billion by FY 2005) submitted by the Clinton administration.[26] (See Figure 3-1.)

Figure 3-1: R&D Budget Trends over Time



A decline of this magnitude in RDT&E spending would make it exceedingly difficult for the U.S. military to keep pace with the rapid rate of technological change anticipated over the next

[26] In its FY 02 amended budget, the Bush administration requested an increase in RDT&E spending from $41.3 billion to $47.4 billion. A revised FYDP will not be submitted, however, until the administration releases its FY 03 budget. (See Steven Kosiak, *Analysis of the FY 2002 Defense Budget Request*, Washington, DC: Center for Strategic and Budgetary Assessments, August 2001., pp. 12-13.)

two decades. With insufficient resources to invest in an ever-broadening menu of potential "leap ahead" technologies, the capabilities available to the U.S. military could be seriously constrained between 2010-2025.

The defense RDT&E budget funds a wide array of activities ranging from basic research to full-scale development of operational military systems. For administrative purposes, the RDT&E budget is divided into seven categories: basic research, applied research, advanced technology development, demonstration and validation, engineering and manufacturing development, management support, and operational systems development. Within the DoD budget, the accounts associated with these RDT&E baskets are dubbed 6.1 through 6.7, respectively. For convenience, the basic research (6.1), applied research (6.2), and advanced technology development (6.3) accounts are often lumped together and referred to more simply as DoD's Science and Technology (S&T) program. Programs funded by accounts 6.4 through 6.7 are geared primarily toward late-stage development of new systems and short-term upgrades to existing weapons systems based on technology that is already well established. In contrast, the driving principle behind the S&T program is to discover new ways of accomplishing tasks of military value by pushing the technological envelope beyond the current state of the art. By exploring potential military applications of relatively immature technologies, the S&T program is necessarily focused upon capabilities that might not be possible to field for a decade or more (See Table 3-1 below).

Table 3-1: DoD RDT&E Budget by Category (in millions of dollars)[27]

	FY 1998	FY 1999	FY 2000	FY 2001
Basic Research (6.1)	1,012	1,064	1,161	1,326
Applied Research (6.2)	2,910	3,057	3,410	3,718
Advanced Technology Development (6.3)	3,790	3,453	3,826	4,018
Demonstration & Validation (6.4)	6,556	7,364	6,525	7,901
Engineering & Manufacturing Development (6.5)	8,284	7,646	8,679	8,753
Management Support (6.6)	3,516	3,553	2,552	2,418
Operational System Development (6.7)	11,115	11,967	12,137	12,999

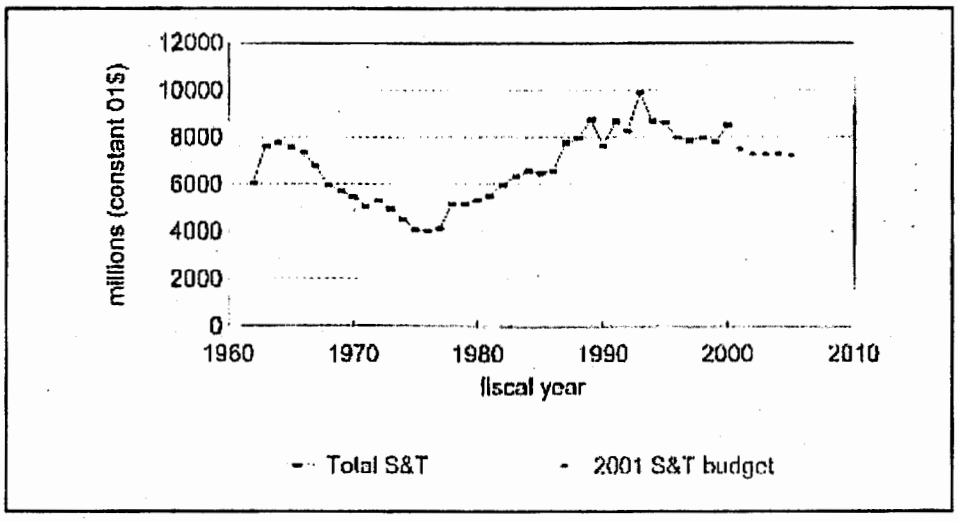
Of the $41-47 billion allocated to RDT&E for FY 2001, only about $9 billion is for S&T. Meanwhile, operational systems development (6.7) consumes nearly one-third of the budget. If

[27] Office of the Under Secretary of Defense (Comptroller), *RDT&E Programs (R-1) for Fiscal Year 2001* (Washington, DC: DoD, February 2000), p. III. The FY 1998 figures are taken from the 1999 R-1. Figures for FY 2001 are based upon data contained in U.S. House of Representatives, *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2001, and for Other Purposes -- Conference Report 106-754 to Accompany H.R. 4576* (Washington, DC: Government Printing Office, 2000), pp. 218-283.

the engineering and manufacturing development account (6.5) is included, the funding disparity increases to more than two to one. This imbalance has grown more pronounced over the last two decades.

An Air Force Association study chaired by retired Air Force General Lawrence Skantze assessed that: "Given a decade of declining S&T budgets, the most promising technologies, such as directed energy, miniaturized munitions, new electronic countermeasure techniques, unmanned combat aerial vehicles (UCAVs), and improved material for space power, may not be ready to be incorporated into Air Force systems to be fielded through 2020."[28] According to the Congressional Research Service, "whether one considers S&T funding since FY 1987 or FY 1993, the FY 2001 budget allows S&T funding to drop below FY 1987 levels in FY 2001 dollars" and it will drop even more by FY 2005 (see Figure 3-2).[29]

Figure 3-2 – Historical Trends in S&T Spending



During the Cold War when the prospect of war suddenly erupting was not improbable and a slight advantage in weapon system performance relative to the Soviet Union could have tipped the balance if conflict broke out, this type of emphasis was all too necessary. However, given that the current generation of U.S. weapons systems are qualitatively superior to nearly all others in the world and will likely remain so for the next decade, this technology strategy has become an anachronism, especially in light of the rapid pace of technological change engendered by the

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[28] Lawrence Skantze et al, *Shortchanging the Future* (Air Force Association: Washington, D.C., 2000). See also Stanley Kandebo and David Fulghum, "USAF, AFA at Odds Over R&D Funding," *Aviation Week & Space Technology*, January 24, 2000, pp. 26-27. Army Chief of Staff General Eric Shinseki has similarly asserted that the "S&T effort is the linchpin of Army transformation." Ann Roosevelt, "Army Science Efforts Leverage Past for Future," *Defense Week*, November 13, 2000, p. 5.)

[29] John D. Moteff, "Defenses Research: DoD's Research, Development, Test, and Evaluation Program," *CRS Issue Brief for Congress*, August 31, 2000, n.p. (electronic version).

information revolution. In commenting on DoD's technology strategy since the end of the Cold War, Secretary of Defense Donald Rumsfeld testified to Congress:

> We have under invested in dealing with future risks. We have failed to invest adequately in the advanced military technologies we will need to meet the emerging threats of the new century. Given the long lead-times in development and deployment of new capabilities, waiting further to invest in 21st Century capabilities will pose an unacceptable risk.[30]

To address these shortfalls, RDT&E resources, including both new and reprogrammed funds, should be shifted away from incremental modernization programs toward development of high-leverage capabilities that seem likely to be in demand ten or twenty years hence. A premium should also be placed upon technologies that could help solve emerging operational and strategic problems that may emerge in the next decade or so. For example, the proliferation of multidimensional "anti-access" capabilities could potentially upend the current U.S. approach to power projection within that timeframe.

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[30] Secretary of Defense Donald Rumsfeld, *Prepared Testimony to the Senate Armed Services Committee*, June 21, 2001, p. 7.

IV. Fostering Revolutionary Innovation In A Period Of Discontinuous Change

An organization's response to and preparation for periods of discontinuous change are constrained by an organization's resources, processes and values.[31] Resources include both tangible ones such as people and equipment, as well as intangibles such as leadership and institutional culture. Greater resources of the correct type increase the chances that an organization will be able to successfully navigate periods of change, but they are not the sole factor. Processes like good communication, coordination and decision-making procedures also contribute to an organization's ability to recognize and anticipate changing future conditions.

Given that backdrop, this chapter focuses on those actions that the Bush administration could take over the next few years to help "kick start" the transformation process. While discussion during the seminar digressed into a myriad of other transformation-related issues, the participants kept coming back to the following critical action items:

1) Developing and communicating a compelling vision of future warfare;

2) Selecting transformational leaders and creating a powerful, guiding coalition in support of discontinuous change;

3) Creating a sense of urgency regarding the need to transform;

4) Encouraging "competitive jointness" within and across each of the armed services;

5) Creating organizational slack within the armed services;

6) Increasing industry incentives for innovation;

7) Expanding and refocusing RDT&E funding and investing in rapid prototype development; and

8) Conducting RMA experimentation.

Based seminar discussions and additional CSBA research, this chapter explains each of these action items in some detail.

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[31] This discussion draws from Christensen, Clayton and Michael Overdorf, "Meeting the Challenge of Disruptive Change," *Harvard Business Review* March—April 2000, pp. 67-76.

DEVELOPING AND COMMUNICATING A COMPELLING VISION

Seminar participants emphasized the importance of replacing *Joint Vision 2020* with a more compelling future warfare vision that addresses key transformational challenges and opportunities. In their view, developing and communicating such a vision was a prerequisite for initiating transformational change of the U.S. military.

A more compelling vision would need to be based upon areas of interactive competition that seem likely to shape the transition to a new warfare regime, and, to a significant extent, could provide the major contours of the future geostrategic environment. In light of current R&D and military modernization plans, foreign military writings, global proliferation and technology diffusion patterns, and other relevant trends, it appears that the following six strategic and technological competitions could be central to the emerging future warfare regime:[32]

1. Evolving anti-access or area-denial capabilities versus current and new forms of power projection;

2. Strategies of preemption versus strategies of denial;

3. Hiders versus finders;

4. Space access versus space control;

5. Offense-defense competitions in the areas of missile attack versus missile defense, IW attack versus IW defense, and BW attack versus BW defense; and

6. Strategies of coercion versus strategies of deterrence and reassurance.

Although the outcome of these competitions is, of course, uncertain, they offer a useful prism for focusing defense investment and policy, as well as a simple framework for identifying important hedges to better manage strategic uncertainty. For example, the competition between anti-access/area denial strategies versus current and new forms of power projection should focus investment attention on power projection capabilities that might defeat or circumvent anti-access strategies. Among these are:

- Various forms of stealthy, long-range air power (e.g., stealthy, long-endurance, ISR UAVs; stealth bombers; stealthy, long-range UCAVs; and low-observable aerial refueling aircraft);

- Stealthy mobile ground forces (e.g., air-delivered, information-intensive, robotics-heavy forces) that can project substantial power in the absence of forward base access;

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[32] For an extended discussion of these competitions, see Vickers and Martinage, *Transforming the U.S. Military* (Washington, DC: CSBA, 2001).

- Capabilities for stealthy, undersea-based power projection (e.g., SSGNs and counter mine UUVs) and stealthy Streetfighter frigates that can operate in a denied littoral;

- Capabilities to assure access to space (e.g., satellite survivability and rapid space reconstitution) and provide space-based surveillance and target acquisition (e.g., space-based GMTI radar);

- Capabilities for information assurance (e.g., information warfare-defense); and

- Ballistic and cruise missile defenses.

Forms of power projection whose ability to operate in an anti-access environment is more doubtful (e.g., short-range tactical aircraft, carrier battle groups, and heavy ground forces) would face a greater investment burden. The competition between anti-access / area denial strategies and current and new forms of power projection could also be used to better frame policy choices regarding allied defense options. For example, a division of labor between the United States and Taiwan could assign a primary role to the latter for defensive counter-air operations and ground defense, with U.S. forces assuming primary responsibility for sea denial (e.g., undersea warfare) and power projection.[33] Under such a division of labor, emphasis might be placed on maintaining a favorable Taiwanese air balance (e.g., through qualitative superiority and hardened shelters) and distributed ground defenses at the expense of other capabilities.

The competition between strategies of preemption and strategies of denial could highlight the importance of survivable U.S. forward presence forces such as SSGNs and SSNs. This competition could also be used to highlight capabilities that may be needed to bolster allied defenses (e.g., theater missile defenses, sophisticated sensor networks, precision-strike weapons, SAMs, and anti-ship cruise missiles). The competition between strategies for coercion and strategies for reassurance could point to the value of similar capabilities and policies.

The hider-finder competition focuses investment attention on an area of military capabilities that is undergoing very rapid change, and one that will likely be central to future military operations. The hider-finder competition encompasses several sub-competitions (e.g., undersea warfare versus ASW, stealth versus counter-stealth, and decoys versus precision strike targeting fidelity and munitions inventories) and is central to other evolving strategic competitions (e.g., anti-access versus power projection and urban control versus eviction). It and the competition between information warfare and biological operations offense and defense are also perhaps the fullest four-sided strategic game among the key emerging competitions (e.g., two-sided investment by both competitors), and one that will likely be complicated by concealed capabilities. As the ability to "find" increases, the strategic value of hiding will also rise, quite possibly non-linearly and with an asymmetric payoff. For example, stealth could be strategically vital to U.S. power projection, but relatively costly to maintain. Operational responses, such as the mass employment of decoys and forcing an adversary to operate within a cluttered, civilian-

[33] Taiwan could also be equipped with air-independent propulsion diesel submarines to restore the undersea warfare balance in the Taiwan Strait.

military battlespace, on the other hand, could require little in the way of defense investment. Investments that combine both the ability to hide and find (e.g., stealthy, loitering UAVs and micro robots) might be particularly valuable. Using the hider-finder competition as a framework for defense investment could lead to new operational concepts, such as "information baiting" operations, as well as new technologies (e.g., false image generation to gain tactical overmatch).

The space access versus space control competition is as important for policy reasons as it is for technological choice. Some access to space by future adversaries may have to be accepted even though technological means for space denial might be feasible. Alternatively, the importance of U.S. capabilities for assured space reconstitution should also receive increased focus as a result of making this emerging competition a centerpiece of defense strategy. Prevailing in any future space control competition and assuring U.S. access to space even in the event of a space "Pearl Harbor" are U.S. vital interests.

SELECTING THE RIGHT LEADERS & CREATING A POWERFUL COALITION FOR CHANGE

> It is a love of comfort, not to say sluggishness, that characterizes those who protest against revolutionary innovations that happen to demand fresh efforts in the way of intellect, physical striving and resolution.[34]

Seminar participants asserted that along with crafting a compelling vision of future warfare, selecting transformation-minded leaders was one of the most important ingredients in the recipe for bringing about anticipatory, discontinuous change of the U.S. military. Moreover, they cautioned that a handful of individuals, regardless of how visionary or managerially skilled, would be very hard pressed to transform an organization as large as DoD. This judgement tracks well with the history of successful military transformations. For example, while General Hans von Seeckt was undoubtedly important, it is hard to imagine the emergence of the blitzkrieg without Heinz Guderian, Werner von Fritsch, Hermann Goering, and so on.[35] Similarly, while Admiral William Sims was unquestionably critical to the development of carrier aviation, so too were Army Air Corps General William "Billy" Mitchell, Rear Admiral William A. Moffett, and Captain Joseph Reeves.[36] In short, the participants emphasized the importance of creating a

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[34] Major General Heinz Guderian, *Achtung — Panzer!* Translated by Christopher Duffy (London: Arms and Armour Press, 1992), p. 24.

[35] See, for example, James S. Corum, The Roots of Blitzkrieg (Lawrence, KS: University of Kansas Press, 1992) and Robert M. Citino, The Evolution of Blitzkrieg Tactics: Germany Defends Itself Against Poland, 1918-1933 (New York: Greenwood Press, 1987)

[36] Clark G. Reynolds, *The Fast Carriers* (Annapolis, MD: Naval Institute Press, 1968), William F. Trimble, *Admiral William A. Moffett: Architect of Naval Aviation* (Washington: Smithsonian Institution Press, 1994); Geoffrey Till, "Adopting the Aircraft Carrier," in Williamson Murray and Allan R. Millett, *Military Innovation in the Interwar Period* (New York: Cambridge University Press, 1996)

critical mass of senior military leaders committed to discontinuous change, or what John Kotter terms a "powerful guiding coalition."[37]

To this end, the seminar participants suggested identifying the top 100 positions within the defense establishment charged with responsibilities critical to military transformation, which could be subsequently filled with advocates for discontinuous change. However, as one participant observed, even assuming these positions could be identified, it would still be extraordinarily difficult to find transformational leaders to fill them. He noted that "if potential candidates for high-ranking positions are asked whether or not they are innovative, out-of-the-box thinkers, everyone will raise their hand."

Transformational leadership requires what Clausewitz might have described as "transformational coup d'oeil"– the ability to see, almost at a glance, which methods of future warfare have the best chance of working well in the context of only dimly foreseen circumstances, and perhaps even more important, which methods do not. As Clausewitz also observed, however, intellect is not enough. Transformation decision makers must have "the courage to follow this faint light wherever it may lead."[38] Identifying individuals with this coup d'oeil will likely be a difficult and frustrating process, and many mistakes will undoubtedly be made along the way. Finding leaders with the "right stuff" to bring about a transformation of the U.S. military will almost certainly be more of an art than a science.[39]

Transformation is first and foremost a key Secretary and Deputy Secretary of Defense responsibility. Both must be completely committed to transformation, and be "tough-minded" activists. Key transformation areas that fall under the Secretary and Deputy Secretary's direct purview include redirection of defense investment, senior officer selection, supervision of transformation experiments to ensure that appropriate performance metrics are being used, and imparting strong, top-level support for promising fledgling programs. To some extent, their role can be likened to that of a CEO's in transforming a large corporation or "spinning out" new business units to meet emerging market challenges. And, while that analogy has its limits, it is certainly worth noting that the well-known business scholars, Clayton Christensen and Michael Overdorf, have cautioned:

> We have never seen a company succeed in addressing a change that disrupts its mainstream values without the personal, attentive oversight of the CEO. . . Only the CEO can ensure that the new

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[37] John P. Kotter, "Leading Change: Why Transformation Efforts Fail," *Harvard Business Review*, March-April 1995, pp. 62-63.

[38] The concept of transformational coup d'oeil is adapted from Harold R. Winton, "On Military Change," in Harold R. Winton and David R. Mets, *The Challenge of Change: Military Institutions and New Realities, 1918-1941*, Lincoln, NE: University of Nebraska Press, 2000, pp. xv-xvi.

[39] See Daniel Goleman, "What Makes A Leader," *Harvard Business Review*, November-December 1998, p93-102.

> organization gets the required resources and is free to create processes and values that are appropriate to the new challenge.[40]

Supporting the Secretary and Deputy Secretary with a staff of transformation-minded, senior civilian officials is likewise critical. Among the most important civilian positions within OSD from a transformation perspective are the:

- Under Secretary of Defense for Acquisition, Technology and Logistics;
- Assistant Secretary of Defense for Command, Control, Communications and Intelligence;
- Director, Defense Research and Engineering (DDR&E);
- Director, Defense Advanced Research Projects Agency;
- Under Secretary of Defense for Policy;
- Principal Deputy Under Secretary of Defense for Policy;
- Advisor to the Secretary of Defense for Net Assessment;
- Under Secretary of Defense (Comptroller); and
- Director, Office of Program Analysis and Evaluation (PA&E).

In addition to staffing as many of the above positions with transformation-minded individuals as possible, significant adjustment to the perspective, scope and stature of several positions is also warranted. Among those most needing adjustment are the Advisor to the Secretary of Defense for Net Assessment, the DDR&E, the Under Secretary of Defense (Comptroller) and the Director, PA&E. Strong consideration should also be given to creating a new senior civilian position, Assistant Secretary of Defense for Transformation, and, perhaps, new senior civilian positions for space and homeland defense.

Nearly banished from OSD by the 1997 Defense Reform Initiative, the focal point for thinking during the past decade about the RMA and the future security environment, the Office of Net Assessment (ONA), should be restored to its 1970's role and stature, when its director had direct access to the Secretary and Deputy Secretary.[41] ONA provides objective strategic assessment about emerging competitions, including identification of opportunities to strategically exploit

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[40] Clayton M. Christensen and Michael Overdorf, "Meeting the Challenge of Disruptive Change," *Harvard Business Review*, March-April 2000, p. 74.

[41] This appears to have been organizationally accomplished early in the Bush administration. The Director of the Office of Net Assessment, Andrew W. Marshall, was given responsibility for conducing the diagnostic phase of the administration's strategy review.

them for U.S. advantage. Additionally, ONA could make valuable contributions during a period of transformational change through its lesser-known role of strategy development.

Given the critical importance of "leap-ahead" technologies to transformational change, strong consideration should also be given to likewise reelevating the DDR&E to the stature and independence (e.g, under secretary rank) it enjoyed during the 1970s, when the early phase of the RMA began. Over time, the DDR&E's influence has been buried under the Under Secretary of Defense for Acquisition, Technology and Logistics. The Defense Advanced Research Projects Agency needs to be focused on military-unique, leap-ahead technologies that could lead to revolutionary changes in warfare.[42] During the early Clinton administration, DARPA was focused on dual-use technologies of dubious value.[43] There has also been a reluctance to abandon the Agency's historical role in being the "first developer" of leading-edge information technologies, a task the commercial, high technology sector has for the most part assumed.

The Comptroller must bring a "strategic" or long-term programming approach (e.g., spanning three-to-four "FYDPs") to transformational change. Reform of the Planning, Programming, and Budgeting System and Joint Warfare Capabilities Assessment process to make transformational investment more transparent is also required. The Office of Program Analysis and Evaluation needs to be reoriented toward "systemic" change in military capabilities as opposed to marginal analysis of incremental change within the boundaries of the current military regime. In addition to fundamental change in perspective, this will require investment in a new family of models and simulation tools.

Strong consideration should be given to creating a full time "transformation strategist"— an Assistant Secretary of Defense for Transformation — reporting directly to the Secretary and Deputy Secretary. Such a position could be created out of the current Assistant Secretary of Defense for International Security Policy (formerly the Assistant Secretary of Defense for Strategy and Threat Reduction) position by reassigning ISP's responsibilities to the Assistant Secretary of Defense for International Security Affairs. In addition to direct access to the Secretary and Deputy Secretary and the authority to cross OSD jurisdictional lines, the ASD for Transformation would need full access to special access (i.e., "black") programs and seats on the Joint Requirements Oversight Council and Defense Acquisition Board. The new ASD should also chair an invigorated RMA Council.

Consideration should also be given to creating an Assistant Secretary of Defense for Space. Such a position could be created out of the current position of Assistant Secretary of Defense for Command, Control, Communications and Intelligence. Consideration should also be given to creating an ASD position for Homeland Security. This new position could be created using the

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[42] DARPA's programs should generally meet the following three criteria: they should be central to the advanced phase of the RMA; they should push the technological "envelope;" and they should be technologies that only the military can be expected to develop during the time required for their maturation.

[43] Under its last director, Frank Fernandez, DARPA was refocused to a significant extent along the lines suggested here.

billet currently filled by the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict.[44]

Although their role has been diminished since the passage of the 1986 Goldwater-Nichols Act, the Service secretaries could also play an important role in fostering innovation. Incumbents of these positions, for example, can affect the promotion system at lower levels than can the secretary of defense. Accordingly, strong activists who share the secretary's vision should be selected for these positions. Given the difficult investment and divestment choices that will have to be made and the cultural obstacles that will have to be overcome to begin developing capabilities appropriate for the advanced phase of the RMA, it is vital that these officials view their role as implementing the vision of the Secretary of Defense, and not as their Department's agent in DoD budget battles.

On the uniformed side, a critical mass of senior leaders must be put in place to induce and sustain transformation. In addition to individuals who are well suited to lead transformation, the U.S. military will also continue to need many other kinds of senior leaders: warfighters, soldier-statesmen, technical specialists, resource managers, and educators. However, because we are in a period of transformational change, the ability to effect transformation consistent with the new future warfare vision should be a central criterion for selection as JCS Chairman, JCS Vice Chairman, Service Chief or Vice Service Chief, Commander-in-Chief, Joint Forces Command, and the Directors, of J-7 and J-8.[45] Given the short tenure of most senior leaders, consideration should also be given to retaining selected senior military officers who prove important to sustaining transformation in their current positions for two, or even three, consecutive tours.

Whether the current incumbents possess the necessary attributes to implement the secretary's vision is a key transformation issue. Early replacement of key military leaders could send a strong signal that transformation is a top priority. Indeed, several seminar participants asserted that "non-performing" leaders ought to be removed from transformation-related positions as expeditiously as possible. Additionally, while conceding that great transformational leaders could originate from "legacy" warfare specialties, they were in favor of selecting for these positions from within communities likely to be congruent with the new future warfare vision. This might mean, for example, choosing a submariner as Chief of Naval Operations, a bomber pilot or space warrior as Chief of Staff of the Air Force, and a robotics-minded officer or special operator as Chief of Staff of the Army.[46] They also discussed a "Trojan horse approach" to

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[44] The ASD SOLIC's functions overlap to a considerable extent with those of CINC, USSOCOM.

[45] The Director, J-7 has staff responsibility for the joint warfare vision, and the Director, J-8 controls the Joint Warfare Capability Assessment process.

[46] For example, of the seventeen, most senior Air Force officers (e.g., Chief of Staff, Vice Chief of Staff, Deputy Chiefs of the Air Staff, and Commanders of Major Commands) in February 2001, only one, General Charles Robertson of Air Mobility Command, had a significant bomber background. Ten of the top officers had fighter backgrounds, including the Chief of Staff, the Commanders of Air Combat Command, Air Force Space Command, Pacific Air Forces and U.S. Air Forces in Europe. For a discussion of the rise to dominance of Air Force fighter pilots, see R. Michael Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership*, Air University Press, 1998.

senior officer selection based upon the idea of "selecting someone acceptable to current Service bureaucracy, but who is willing to subvert it internally in the interests of transformational change."

Seminar participants strongly advocated the idea of including "genuine and useful innovativeness" as a specific, high-priority element in the fitness reports used by promotion boards.[47] They felt it would be essential to establish new career paths for emerging warfare specialties such as UAV and UCAV "pilots," information warriors, and space control specialists. To this end, several participants recommended reserving a number of promotion slots for new warfare area specialists.

Finally, legislative and public relations strategies will be needed to build support for transformational change. A strong effort should be made as well to develop a bipartisan "transformation caucus" in both houses of Congress.[48] Seminar participants suggested that DoD should develop and advance an "actionable agenda" for transformation on Capitol Hill each year. Congressional hearings that "showcase" the need for transformation should be also sought.

CREATING A SENSE OF URGENCY

The importance of establishing a sense of urgency has been identified as one of the key enablers of successful business transformation. John Kotter has argued, for example, that "when the urgency rate is not pumped up enough, the transformation process cannot succeed and the long-term future of the organization is put in jeopardy." He maintains that unless "about 75% of a company's management is honestly convinced that business-as-usual is totally unacceptable" then the transformation process is likely to face "very serious problems."[49] Emerging challenges facing the U.S. military (e.g., anti-access threats), while increasingly acknowledged rhetorically, still seem distant and uncertain to many, and have yet to have a discernible impact on the defense program.[50] Thus far, DoD's senior leadership has paid insufficient attention to answering the question: Why should the best military in the world transform itself?

In terms of military transformation, formulating and broadly disseminating a future warfare vision that highlights emerging challenges and competitions is one means of increasing the sense of urgency regarding the need for discontinuous change. In addition, seminar participants suggested the possibility of using field exercises to "engineer a train wreck" that vividly demonstrate the need to transform. Over the next decade, for instance, exercises could be

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[47] Interestingly, this finding was not only reached by participants in this seminar, but also in the 1996 Net Assessment Summer Study: Sustaining Military Innovation, chaired by David Chu.

[48] While obviously a prerogative of the legislature, the authorizing committees could be reorganized to provide more explicit oversight of transformation. The Senate Armed Services Committee recently established an Emerging Threats and Capabilities sub-committee, but it lacks jurisdiction over much of the scope of transformation strategy.

[49] John P. Kotter, "Leading Change: Why Transformation Efforts Fail," *Harvard Business Review*, March-April 1995, pp. 60-62

[50] See, for example, Andrew F. Krepinevich, Jr., "Why No Transformation?", *Joint Forces Quarterly*, Autumn/Winter 1999-2000.

intentionally designed to make obvious the potential decline of existing means of warfare, as well as to highlight possible discontinuities associated with the ongoing RMA. Such experiments could offer a graphic, compelling answer to the question cited above.

During the Interwar Period, the sinking of the former German battleship *Ostfriesland* in 1921 and simulated dive bomb attacks against a U.S. battle fleet steaming toward San Diego in 1926 provided a graphic illustration of an emerging threat to the battleship. Just as importantly, it also bolstered the bureaucratic standing of air power enthusiasts and helped solidify political support for their cause within Congress.[51] A more recent example would be the 1997 "Eligible Receiver" exercise that demonstrated the vulnerability of U.S. civilian and military C4ISR networks to computer network attack.[52]

Over the next several years, a series of field exercises might test current Service warfighting concepts against an anti-access threat that is representative of what a major regional power could field between 2015-2025.[53] Although some surrogates would be necessary, most of the requisite anti-access capabilities could be represented by systems that the U.S. military fields today or that could be readily purchased or leased on the world arms market.

For example, given a large enough exercise area, it might be possible to pit an aircraft carrier battlegroup (CVBG) or ARG operating in littoral waters against a multidimensional anti-navy architecture. The anti-access network controlled by the adversary or "Red team," might comprise the following: current U.S. C4ISR satellites augmented by products offered by commercial providers; long-endurance UAVs such as Global Hawk; over-the-horizon radar systems; stealthy UCAVs; leased foreign AIP diesel submarines or appropriate surrogates; ADS-like submerged sensor arrays; thousands of modern sea mines; hundreds of sea-, air- and ground-launched long-range ASCMs such as the Harpoon or advanced Russian designs;[54] and Patriot PAC-3, Avenger and SA-10-like air defenses. By exploiting commercially available fiber optic and radio-frequency communication technologies, all of these capabilities could be integrated into a common network.

Over the course of several months, a series of exercises might be run with different mixes of anti-navy assets, as well as varied CVBG or ARG compositions (e.g., additional mine

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[51] For example, after conducting board games at the Naval War College and witnessing maritime bombing tests off the Virginia Capes in 1921, Admiral William Sims, previously an ardent supporter of the battleship, concluded in March 1922 that, "The battleship is dead." Scot MacDonald, "Flattops in the War Games," *Naval Aviation News*, August 1962, p. 28.

[52] See Bob Drogin, "In Theory, Reality, U.S. Open to Cyber-Attack," *Los Angeles Times*, October 9, 1999, p. 16; Anne Plummer, "DoD Official Says Hackers Are More Sophisticated Since Solar Sunrise," *Defense Information and Electronics Report*, October 22, 1999, p. 1.

[53] Similar experiments could also be conducted in wargames or with computer modeling and simulation tools. Because field exercises would entail clashes between actual forces, they would almost certainly be perceived by the officer corps as more convincing.

[54] Russian ASCMs incorporated into the exercise might included the newly developed 3M55 Yakhont system with an effective range of nearly 250 kilometers or the 4K80 Bazalt with a range of over 500 kilometers.

countermeasure ships, ASW assets, SSNs, enhanced network connectivity, etc.). The goal of the Red Team in these exercises would, of course, be to find, track and conduct simulated strikes (using dummy warheads of various types) against U.S. vessels. If the Red Team proved successful in this regard, these exercises could provide a powerful impetus for migrating toward stealthier forms of naval power projection. The feasibility of deploying the Army's future Interim Brigade Combat Teams (IBCTs), which will each comprise about 3,500 troops and over three hundred 20-ton light armored vehicles, into ports or airfields under various anti-access conditions could also be assessed through a series of exercises.

As alluded to above, however, it would almost certainly be necessary to build an expansive, instrumented exercise and training facility in order to conduct these types of exercises. The exercise area itself, for instance, would need to be large enough to support the use of current and emerging long-range precision-strike weapons, or perhaps 1,000 kilometers wide by 1,000 kilometers deep. Accordingly, there are only a handful of places where it might be possible to establish such a facility. Two candidates would be Alaska's southern coast or Australia's Northern Territory. Building the necessary support infrastructure, installing the necessary instrumentation, and assembling a prototypical anti-access system of systems, comprising both real and virtual elements, would probably cost at least $10 billion and would take several years to accomplish.

Moreover, given the asymmetric nature of the threats, it would likely be necessary to create a standing opposition force (OPFOR), which would essentially be a scaled-up, joint version of the OPFOR used at the National Training Center. Such a force would be responsible for staying up-to-date on anti-access concepts espoused by potential adversaries. As a dedicated unit, the OPFOR could gain proficiency operating foreign anti-access systems and build valuable institutional knowledge over time. (Rotational OPFOR units, in contrast, would have little experience to draw upon in terms of operating foreign equipment or implementing anti-access concepts and tactics. Rather than learning progressively more over time like a standing OPFOR, each rotational unit to cycle through the facility would likely rediscover the same ideas as its predecessors.)

If the many economic and political hurdles to establishing such a facility could be overcome, it could make an invaluable contribution to military transformation. The Services could evaluate and refine promising operational and organizational concepts on a regular basis against a dynamic, thinking adversary equipped with an array of different anti-access capabilities. During the course of a given year, several small-scale exercises might focus upon relatively narrow issues (e.g., force insertion, sustainment, battlespace deconfliction, alternative C4ISR configurations, etc.). In some cases, these small-scale exercises might be limited to only a single Service. However, every year or so, a series of major joint exercises could be conducted to test linkages and interoperability between the Services, as well as to evaluate the pros and cons of their respective concepts. The operations and support costs associated with this type of vigorous transformation field exercise program would likely be at least $1 billion per year. A similar exercise program, including the creation of a dedicated exercise and training facility, might be undertaken with respect to developing and evaluating concepts for conducting urban operations.

In addition, it would also be valuable to conduct exercises focused on emerging space control and homeland defense challenges. Candidate exercises might include the following:

- Using microsatellites based on commercially available technology to conduct various types of proximity operations against U.S. satellites that are nearing the end of their service lives;

- Disrupting U.S. satellite uplinks and downlinks with UAVs equipped with jammers built with commonly available components;[55]

- Compromising the security features designed to protect critical U.S. infrastructures (e.g., civilian and military communication networks, energy distribution, transportation, and banking and financial services) with CNA and other offensive information warfare strikes; and

- Responding to simulated, but realistic, biological attack in major urban areas around the United States.

The last two candidate experiments would, of course, not be restricted to DOD. They would necessarily involve numerous federal, state and local entities.[56]

In the view of several seminar participants, without an all-out campaign to increase the sense of urgency for change, transformation will not even "get out of the blocks" until the defense community is shocked by an exogenous event of some kind. For example, a "Pearl Harbor" in space or the actual employment of "anti-access" capabilities against U.S. or allied forces attempting to intervene in a regional crisis. By that time, however, the U.S. military may no longer have the option of gradual change, but would need to "recreate" itself quickly, which be both more disruptive institutionally and uncertain in outcome.

ENCOURAGING "COMPETITIVE JOINTNESS"

While there are important reasons to have strong central control over the transformation process, competition for warfare primacy is a proven road to innovation.[57] Accordingly, intra- and

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[55] A team of U.S. Air Force engineers, dubbed the Space Aggressor Squadron, for instance, recently demonstrated how easy it would be for potential adversaries to design and build a powerful UHF jammer. They successfully assembled one from materials purchased from home improvement stores and at electronics fairs for a total cost of $7,500. Valuable information related to the construction of the jammer was widely available on the Internet. Paul Marks, "Wanna Jam It?," *New Scientist*, April 22, 2000, p. 11.

[56] For additional information on the roles that DoD might play in responding to a WMD incident in the United States, see: Fred Ikle, *Defending the U.S. Homeland – Strategic and Legal Issues for DoD and the Armed Services* (Washington, DC: CSIS, January 1999).

[57] To varying degrees, the transformation of individual Services will likely be dependent in fundamental ways on supporting change within other Services (for example, far greater future ground force reliance on remote fires and strategic mobility provided by other Services). The Services are also likely to differ from one another with respect to the pace and scope at which they pursue the transition to a new force posture. Significant change in the relative

interservice competition should be strongly encouraged, with the Secretary of Defense and his key advisors as referees. Interservice "crowding" into each other's battlespace in particular, if managed properly, could lead to a more robust future force.[58] As one seminar participant noted, "benign peer group competition within and across the Services would be very conducive to creativity." A competitive approach to joint operations would allow alternative concepts to vie for incorporation into regional CINC's war plans and DoD investment resources.

Encouraging competition within and among the Services does not mean that the Services should adopt a "go-it-alone" approach to warfighting. The intent of what might be called "competitive jointness" is to exploit the expertise inherent in divergent approaches, and to expand the range of warfighting options presented to current and joint force commanders. Each Service or primary warfighting branch would be encouraged to integrate the capabilities of other Services and branches to enhance its own capabilities and achieve theater objectives. For example, a near-term, air-dominant concept to halt/defeat an invading army in open terrain in scenarios in which access to forward bases is denied by weapons of mass destruction and non-stealthy aircraft were vulnerable to advanced surface-to-air missile systems might rely on TLAMs for strategic attack and interdiction, aerial refueled stealth fighters to establish air superiority and stealth bombers to destroy the invading forces. In more restricted terrain, the same concept might employ special operations forces to flush targets. Where access to forward bases is not denied, the preferred force might be a deep strike brigade, centered around land-based missile artillery, attack helicopters and medium endurance UAVs.

CREATING ORGANIZATIONAL SLACK

Organizational slack, defined as "the degree to which uncommitted resources are available to an organization," must also be created if innovation is to flourish.[59] Freeing up the necessary human resources will require critical looks at current approaches to overseas presence, existing war plans, and professional military education.

Conducting naval forward presence operations in new ways, for example, could result in the creation of substantial organizational slack. A key issue to consider in the future is the necessity of conducting naval forward presence with carrier battle groups. To sustain a full-time carrier presence in each of three regions requires a force of 15 CVBGs – six to sustain one carrier forward in the Mediterranean, eight to sustain one forward in the Persian Gulf, and one for sustained presence in the Western Pacific, due to the homeporting of a carrier battle group in

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capabilities of the Services as they transform has important ramifications for long-term defense strategy – affecting, for example, the kinds of military options the National Command Authority could have at its disposal at a given time. The key advances underwriting the revolution in warfare, moreover – in awareness, connectivity, range, endurance, precision, miniaturization, speed, stealth, automation and simulation – will increasingly allow the Services to crowd into each other's battlespace.

[58] Attempts to "rationalize" defense planning through a rigid partitioning of the future joint battlespace -- however appealing from an efficiency point of view -- should be resisted.

[59] See, for example, Richard M. Cyert and James G. March, *A Behavioral Theory of the Firm*, Englewood Cliffs, N.J., 1963, pp. 278-279.

Japan. A combination of land-based air and a surface action group could frequently provide a less expensive alternative to a forward CVBG. If the capabilities a CVBG provides are reduced to seizing control of the air and conducting air and missile strikes, a combination of land-based air and an SSGN, or alternatively, Streetfighter littoral combat ships, would be less expensive still. A single SSGN can provide about seventy percent of the Tomahawk delivery capability of an entire CVBG or Surface Action Group without the need for escort ships, thus resulting in substantial manpower savings.

Similarly, relying on a larger fleet of long-range, penetrating bombers (e.g., B-2s) for more of the air attack mission would be less expensive to operate, and would free scarce infrastructure, airlift and aerial refueling assets for those forces that must be based in or near the theater. By allowing reductions in the size of the strike fleet, a more bomber-centric attack force could also ease force management risk through reduced demand for attack pilots. A larger fleet of B-2s could also allow reductions (or shifting aircraft into the reserves) in other portions of the bomber fleet (e.g., the B-1B). ISR UAVs and UCAVs, similarly, could potentially enable future air occupation (i.e., enforcing no fly zones) to be conducted at reduced OPTEMPO and perhaps PERSTEMPO levels. Finally, the likely effectiveness of emerging PGMs, such as small diameter bombs, LOCAAS submunitions, and Tactical Tomahawks, may create substantial warfighting slack across the Services that could be factored into force sizing and shaping criteria.

The seminar participants also suggested that organizational slack could also be generated by using reserve component forces more effectively. They noted, for example, that reserve units could be specially trained and equipped for peacekeeping and homeland defense missions. When necessary, these reserve units could be activated, thereby freeing up active duty military units for other missions.

Experimental and intellectual slack must also be provided for. While provisional operational units would be capable of conducting operational experimentation, new units within the Services and new joint organizations may need to be stood up from time to time as test beds beyond those accounted for in war plans or rotational presence schedules. Over the next decade or so, this could include a UCAV squadron or an early Army Objective Force unit. Creating "offline" units (i.e., units that are withdrawn from presence rotations and war plans) for purposes of experimentation should be done judiciously, however. Air and naval forces, for the most part, should be capable of conducting field experiments while on deployment or in operational status.

Additional intellectual capital could be created by reorienting the higher military education system (staff and war colleges) toward emerging challenges and by expanding the number of staff positions that focus on future warfare. Seminar participants believed that a reoriented professional military education program could make a substantial contribution to military transformation. In their view, innovative thought and creative problem-solving would be fostered by "giving individuals sufficient time to think" and placing them in "an atmosphere in which they are freed from the psychological pressure of being ready to fight at a moment's notice and where the fear of failure is removed." Given the inherent multidimensionality of future warfare, several participants called for the creation of a "joint advanced warfighting school" that would take the place of current Service-focused programs such as the Air Force's School of Advanced Airpower Studies (SAAS) and the U.S. Army's School of Advanced Military Studies (SAMS).

INCREASING INDUSTRY INCENTIVES FOR INNOVATION

During the 1990s, the defense technology and industrial base became increasingly concentrated.[60] The effect of this post-Cold War consolidation has been to create new monopolies (e.g., in long-range cruise missiles), highly asymmetric duopolies and increased barriers to entry. Existing industry incentives, moreover, are strongly biased in favor of incremental change. A strategy of qualitative superiority demands a competitive technology and industrial base that has incentives to pursue revolutionary technologies and concepts. New policies are therefore essential. At a minimum, this should include:

- Increasing the incentives for and profitability of independently performed R&D (IR&D), including, perhaps, creation of a special IR&D fund of $1-2 billion per annum to stimulate non-DoD-directed innovation;[61]
- Increasing the profitability of DoD-directed R&D to make it equivalent to rates allowed for procurement;[62]
- Increasing the profitability on technologically risky projects relative to rates allowed for incremental improvement of mature systems;
- Reallocating contract R&D and procurement funds to redress competitive imbalances caused by size disparities resulting from mega-mergers;
- Increasing investment in prototypes to maintain/strengthen design teams in critical areas of military technology;

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[60] From 1990 to 1998, through mergers and decisions to exit the defense business, the defense industry witnessed the disappearance of Avondale, Bath Iron Works, Chrysler Technologies, E-Systems, Ford Aerospace, Grumman, Hughes, Logicon, Loral, Martin Marietta, McDonnell Douglas, Magnavox Defense, IBM Federal Systems, Rockwell, Texas Instruments Defense, Vought, and Westinghouse ESG, among others.

[61] IR&D refers to R&D that is neither sponsored by a grant, nor required in performing a contract, and which falls into one of the following four areas: basic research, applied research, development, and systems and other concept formulation studies. As Jacques Gansler, Undersecretary of Defense for Acquisition and Technology during the second Clinton administration, testified before the House Armed Services Committee, the IR&D system is broken and badly in need of repair: "Increasingly, we've forced industry to devote scarce independent research funds to projects that the Defense Department has specifically tailored. Industry therefore loses its independence, and by inference, its ability to develop innovative technologies on its own." (Paul Mann, "Profit Incentives Urged for Defense R&D," *Aviation Week & Space Technology*, March 6, 2000, p. 26.) Currently, only 4-6% of annual expenditures by U.S. defense companies is associated with R&D. Recent acquisition system changes have placed increased pressure on industry for cost sharing and have lowered profits – reducing industry incentive to spend "over ceiling" for IR&D. To make matters worse from a transformation perspective, the lion's share of industry R&D -- upwards of 90 percent in some sectors -- is devoted to short-term product development and process improvements – with a return on investment objective measured in months, or at best, a few years. (See Stanley Kandebo and David Fulghum, "USAF, AFA At Odds Over R&D Funding," *Aviation Week & Space Technology*, January 24, 2000, p. 27.)

[62] Industry profits on the development phase are typically only a third to a half (4-6%) of what they are during the procurement phase. A strategy based on future ability to exercise options on "leap-ahead" technologies and limited production runs of operational prototypes for experimentation requires that this disparity be rectified.

- Actively managing competitions for major subsystems; and

- Increasing incentives to attract new talent to the defense industry and reduce the age of the defense technology workforce.[63]

Management strategies for speeding up defense acquisition cycles should also be formulated. While acquisition reform has repeatedly failed, the rapid pace of technological change and uncertainty about the emerging strategic environment mandate a renewed effort. The Boeing 777, for example, only required five years to move from initial design to production, which is about one-third to one-half the time required for comparable military systems. Strategies for transformation must be realistic about the prospects for acquisition cycle acceleration (particularly with respect to large, complex systems that push the technological state-of-the-art and are subject to political scrutiny and budget fluctuations), but reform of the Federal Acquisition Regulations could still help. Among the most important are less reliance on detailed military specifications and increased emphasis upon "spiral development" to accelerate the fielding of complex new systems.[64] Abbreviated procurement processes should also be adopted for "novel" systems that will initially be purchased only in limited quantities.[65]

Seminar participants also identified the short tenure of typical acquisition management positions as a problem to be addressed. One of the reasons that military officers have traditionally been averse to long assignments in acquisition management positions is that they "see program-manager jobs as career dead-ends."[66] The armed services reward and promote people with operational experience, so an ambitious officer who becomes a program manager wants to "get back to the field" as quickly as possible. As a result, a weapon system is not unlikely to have four or five military officers as program managers, which is obviously inefficient. DoD should consider either attaching greater value to acquisition management programs as part of an officer's career track, or growing a cadre of individuals dedicated to overseeing new weapons system development efforts.

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[63] See James Roche, "The Anticipated Odeen Report and Competition in the Defense Industry," *Defense Daily International*, June 9, 2000, Tony Capaccio, "Pentagon To Offer Incentives To Boost Innovation," *Defense Week*, February 14, 2000, and Vago Muradian, "DSB Issues Long-Awaited Industrial Base Report, Calls For Broad Changes," *Defense Daily*, November 29, 2000.

[64] Spiral development focuses on getting a basic system into the field as soon as possible, with upgrades planned in from the beginning.

[65] "Novel" systems are those that embody new employment and design concepts and have uncertain outcomes, production runs and operational lives. (See John Birker et al, *An Acquisition Strategy, Process, and Organization for Innovative Systems*, RAND, 2000.)

[66] The following discussion draws in part from Jacques Gansler, *Affording Defense* (Cambridge: MIT Press, 1989), p. 211.

EXPANDING AND REFOCUSING RDT&E FUNDING AND INVESTING IN RAPID PROTOTYPE DEVELOPMENT

Developing revolutionary or "leap-ahead" military capabilities is at the heart of the transformation process. "Leap-ahead," as used in a transformation context, refers to capabilities that are compatible with an emerging military regime. Leap-ahead capabilities may or may not be more technologically advanced or complex than within-regime modernization. It is their superior fit with the emerging strategic environment in a period of discontinuous change that most distinguishes leap-ahead from incremental investment. Advances within an existing warfare regime, no matter how revolutionary (e.g., a stealth fighter that relies on forward base access) will usually fail to meet this test. Upgrades to existing systems, however desirable otherwise, will also seldom meet this test. "Skipping a generation," as used in a transformation context, is synonymous with leap-ahead, that is, it should refer to capabilities that allow one to "skip" into the next military regime.[67] Given the current uncertainty regarding which technologies will pan out over the mid- to long-term, DoD should develop a portfolio of "real options" that can be exercised as the RMA unfolds, thereby allowing the U.S. military to "reserve the right to play" in future areas of competition.[68]

Doing so will require significant and sustained increases in RDT&E funding and better leveraging of non-defense R&D. Moreover, RDT&E funding should be shifted away from incremental modernization programs toward development of high-leverage capabilities that seem likely to be in demand 10 to 25 years hence. Although there will almost certainly be an "efficiency" penalty associated with developing future capability options that are not all subsequently exercised, the potential gains in future effectiveness are well worth the added cost.

Even with substantially increased RDT&E funding, however, technology investment priorities will still need to be set.[69] RDT&E programs should explore potential leap-ahead technologies that address emerging challenges such as projecting power in an anti-access environment,

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[67] "Skipping a generation" often refers to something that follows "after next." The "Army After Next," for example, was intended to be a big leap over Army 21, and a greater leap in capabilities than Army 21 was over the current Army. Until Army transformation, however, there was no plan to skip the "next Army." In the business literature, the technology or factory after next is thought to be associated with fundamental change.

[68] The concept of real options is drawn from Timothy A. Luehrman, "Strategy as a Portfolio of Real Options," *Harvard Business Review*, September-October, 1998, pp. 89-99. See also Peter Coy, "Exploiting Uncertainty – The 'Real Option' Revolution in Decision Making," *Business Week*, June 7, 1999, pp. 118-124; Avinash K. Dixit and Robert Pindyck, "The Options Approach to Capital Investment," *Harvard Business Review*, May-June 1995, pp. 105-115; and Hugh Courtney, Jane Kirkland, and Patrick Viguerie, "Strategy under Uncertainty," *Harvard Business Review*, November-December 1997, pp. 67-79.

[69] R&D costs for the Navy's F/A-18 E/F *Super Hornet*, for example – an incremental improvement over the aircraft it replaces – totaled $6 billion. Another $25 billion in R&D has been spent to date on the Air Force's F-22 stealth fighter, and $21-24 billion more will be required if the Joint Strike Fighter is fully developed. (See Steven Kosiak, *Options for U.S. Fighter Modernization*, Washington, D.C.: Center for Strategic and Budgetary Assessments, September 1999, pp. 3-4.) The Army, conversely, suffers from an S&T program that is too focused. More than half of the Army S&T funding is currently devoted to its Future Combat System. (Paul J. Hoeper, Statement of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology before the Subcommittee on Emerging Threats and Capabilities of the U.S. Senate Committee on Armed Services, March 21, 2000, p. 4.)

controlling space, and defending the American homeland against new threats. Key technology areas that should be considered for increased investment would include:

- Advanced data processing and connectivity;
- Advanced sensors;
- High density power sources;
- Miniaturization of systems and components;
- Advanced robotics;
- Next generation stealth and other advanced information protection technologies (e.g., advanced EW and false image generation);
- Directed energy;
- Hypersonics; and
- Biotechnology.

Furthermore, DoD should adopt an investment approach that allows for the rapid development and deployment of emerging systems in prototype or limited operational quantities that can be used for transformation exercises and in operational contingencies. This approach of buying a wide range of emerging systems in limited quantities as soon as they are available in prototype form offers the greatest promise for maximizing opportunities for innovation while uncertainty remains high about which future capabilities will be most needed and in what quantities.

Admittedly, this approach is less efficient than buying large numbers of fewer systems, which would allow RDT&E costs to be spread over a greater number of units and could make economies of scale in manufacturing possible. However, the sacrificed efficiency would be more than offset by the value gained from the opportunity to experiment with a wide array of prototypes during a period of rapid technological change.

Although prototype systems might well be used operationally if the need arose, the primary purpose of fielding them would be to support RMA experimentation. Prototype systems would be rigorously evaluated in the field before deciding which ones should be procured in larger quantities. Based on their performance, design improvements could be fed back into the technology development process. In addition, by putting these emerging systems into the hands of military forces, they could gain valuable practical experience in the field, as well as develop new operational and organizational concepts that take advantage of these systems. Examples of operational prototypes that could be developed and fielded over the short to mid-term include:

sub-orbital, unmanned hypersonic vehicles; stealthy, networked Streetfighter frigates; stored undersea strike modules; long-range UUVs; and micro-aerial vehicles and microrobots.[70]

CONDUCTING RMA EXPERIMENTATION

Revolutionary advances in military capabilities often depend as much, or more, on the development of new operational and organizational concepts, as they do upon the fielding of new technologies. For example, although technological advances in mechanization, aviation and radio communications were necessary enablers, they alone were not sufficient to bring about the revolution in armored warfare in the period between the world wars. The intellectual innovation of using combined arms *Panzer* units and close air support to effect a deep penetration along a narrow front was no less critical to the realization of the German *blitzkrieg*. As the French military became all too aware in June 1940, although multiple operational concepts and organizational forms may be plausible to exploit the technologies underlying a given military regime, some will inevitably prove superior to others. Oftentimes, however, the nature of that superiority may not be evident until demonstrated in war.

Experimentation with innovative operational and organizational concepts that employ emerging military systems in new ways has historically been an essential ingredient to preserving, or gaining, an advantage in military capability. For example, the twenty-one large-scale fleet problems undertaken in the 1920s and 1930s were crucial to the US Navy's developing the principles, doctrine, trained personnel, defense industrial base, and systems mix that enabled the fast carrier task forces to supplant the battleship-dominated fleet during World War II. Similarly, the numerous field exercises conducted by the German military in the 1920s and 1930s were indispensable to developing the highly coordinated, mechanized air-land forces and operations of blitzkrieg that enabled the rapid conquest of France.

In conjunction with an expanded and redirected defense technology strategy, much greater emphasis should be placed on RMA experimentation, defined to include wargames, computer modeling and simulation, and field exercises. If employed properly and given the requisite investment in enabling capabilities (e.g., new computer simulation tools and development of prototype systems), these three experimentation tools could potentially play an important role in transforming the U.S. military over the next few decades. RMA experimentation could be harnessed, for example, to:

- Explore and develop innovative operational and organizational concepts for fighting across all dimensions of the future battlespace;
- Discriminate between promising technological opportunities and false starts (i.e., ideas that appear promising initially but are unlikely to pan out over the long run);

[70] For a description of these systems, see Vickers and Martinage, *Transforming the U.S. Military*, Chapter VI.

- Evaluate the relative merits of emerging systems that are competing for the same or similar missions;
- Surface and solve practical problems associated with operations in a new warfare regime;
- Determine the proper mix of various emerging and legacy systems in the future force;
- Ascertain and validate measures of effectiveness (MOEs) consistent with a new warfare regime; and
- Build institutional momentum for transformational change.

Wargaming, simulation, and transformation exercises have different strengths with respect to these roles. Wargaming, for example, can be very useful for developing innovative operational and organizational concepts, especially early on in the transformation process when physical prototypes of emerging capabilities are likely to be either limited (in both quantity and variety) or altogether absent. Computerized simulations provide the analytic rigor needed to evaluate the capability tradeoffs between emerging weapons systems and various force mix options, as well as a means for visualizing and experimenting with novel operational and organizational concepts in a virtual world. The best use of field exercises is arguably in surfacing and rectifying unforeseen practical problems associated with the use of new military capabilities and the actual implementation of new operational and organizational concepts. Although the fidelity of simulations is steadily improving, they will likely never be able to substitute completely for trying out new systems and concepts in the field. As mentioned earlier, field exercises can also provide an effective means of building institutional momentum for transformational change.

This is not to suggest, however, that the utility of these tools is strictly limited to the specific areas suggested above. At least at the conceptual level, for instance, wargaming can be used to discriminate between promising technological opportunities and false starts, as well as assess force mix alternatives. Simulations can be used to formulate and refine innovative operational and organizational concepts. And by incorporating surrogates for nonexistent capabilities, field exercises can inform the concept development process and provide military officers with a glimpse of what the future battlefield might look like.

Wargaming, simulation and field exercises should be viewed as inter-linked, synergistic tools that can play a variety of roles in the development of revolutionary capabilities over time. RMA experimentation is most effective when the findings gleaned from each type of activity are continually fed into the others. For example, an operational concept developed as a thought experiment in a seminar-style wargame might subsequently be modeled, visualized and evaluated in a computer simulation. Assuming it still appeared promising, it could be assessed in a series of field exercises as soon as prototype systems, or adequate surrogates for them, became available.

RMA experimentation generally falls into two categories: discovery and validation (See Table 4-1 below).

Table 4-1: Discovery and Validation Experiments

Discovery	Validation
Devise Novel Operational & Organizational Concepts	Test a Specific Operational Hypothesis
Emphasis on Creativity & Imagination	Emphasis on Repeatability / Technical Evaluation
Solution Space Relatively Unbounded	Experiment Variables Carefully Controlled

Discovery experiments focus on devising novel ways of conducting military operations. They place a premium on creativity and imagination, and depend to a large degree, on chance. For example, an RMA wargame in which the players are asked to solve a problem with a given set of capabilities would be considered a discovery experiment. Except for the constraints imposed by the scenario and the postulated capabilities, the solution space is completely unbounded. In contrast, validation experiments are designed to test a specific hypothesis by following the scientific method.

Validation experiments aspire to control as many variables as possible. In theory, a well-crafted validation experiment could be repeated over and over, producing similar outcomes each time, subject to the limits imposed by the inherent complexity and unpredictability of military operations and war. For example, a field exercise that tests the hypothesis that ISR UAVs could enable ships at sea to engage mobile ground targets with cruise missiles would be considered a validation experiment. The goal is simply to confirm or disprove the initial hypothesis, and ideally, to identify which variables drove the outcome.

Assuming DoD ramps up and redirects RDT&E spending relatively soon, prototype systems could start becoming available within the next several years. Even though these prototypes will only be available in limited numbers at first, field exercises could begin to focus on validation initiatives that test specific hypotheses related to their use, as well as unbounded discovery experiments that strive to develop novel ways of using these prototypes. These exercises could also be invaluable to the technology development process by surfacing and recommending possible solutions to problems associated with the fielding of specific weapons systems.

The experiments conducted with the *USS Langley* in 1926 under the command of Captain Joseph Reeves provide a good example of how early experiments can contribute to the transformation process. Armed with wargaming-derived insights about the pulsed nature of carrier air strikes and the consequent need to get as many aircraft aloft as possible, Reeves rejected existing operational techniques and fitted the Langley with arresting gear and a crash barrier to determine if it might be possible to increase the aircraft cycle rate. By August, the ship's crew could launch an aircraft every 15 seconds and recover one every 90 seconds.[71] Only three years later in 1929, Rear Admiral Reeves, now in command of the newly built Saratoga, was authorized to execute a

[71] Norman Friedman, "The Aircraft Carrier," in *The Eclipse of the Big Gun: The Warship, 1906–1945*, p. 39; and Clark G. Reynolds, *Admiral John H. Towers* (Annapolis, MD: Naval Institute Press, 1991), p. 205

high-speed run toward the Panama Canal as part of the Navy's Fleet Problem IX experiment. From a distance of some 145 miles away, Reeves launched a simulated attack on the canal with a 70-plane strike force.[72] By illuminating the potential of the aircraft carrier as an offensive strike platform independent of the battleship, these early exercises imparted considerable institutional momentum to the development of carrier aviation.[73]

Discovery and validation experiments — especially credible computer simulations and fairly umpired field exercises — could also provide a very useful opportunity for creating "short-term wins" that impart momentum to transformation process by:[74]

- Providing evidence that the sacrifices associated with transformation are worth it;
- Offering positive feedback to involved military officers, which often improves their morale and deepens their motivation; and
- Undermining cynics and self-serving resisters that might otherwise be better positioned to block or impede discontinuous change.

In terms of realizing revolutionary capabilities, it is also essential that lessons learned from RMA experimentation be institutionalized within the military. In addition, the findings gleaned from experiments must affect technology development, procurement and force structure decisions. One notable historical example of such synergy was the relationship between the wargaming conducted at the Naval War College, technology development overseen by the Bureau of Aeronautics (BurAer), and Navy fleet experiments during the Interwar Period.[75]

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[72] The possibility of this type of attack was foreshadowed six years earlier in Fleet Problem I when a single plane, representing an air group, launched from the battleship-carrier Oklahoma bombed the Canal's spillway with ten miniature bombs. While the offensive striking potential of carrier-based aircraft was demonstrated during the Fleet Problem IX exercise, the vulnerability of the carrier itself was also displayed. Over the course of the exercise, officials ruled that the Saratoga probably would have been sunk three different times by the enemy fleet. On the first occasion she accidentally encountered three enemy battleships, which then opened fire on her from close range; on the second, she was "sunk" by torpedoes launched by an enemy submarine; and on the third, while her aircraft were landing from a successful raid, she was attacked by aircraft launched from her sister ship the Lexington. MacDonald, "Flattops in the War Games," pp. 28-33.

[73] "Systematically planning for and creating short-term wins" is also a critical ingredient for the successful transformation of business organizations. Kotter notes that "Most people won't go on in the long march unless they see compelling evidence within 12 to 24 months that the journey is producing expected results. Without short-term wins, too many people give up or actively join the ranks of those people who have been resisting change." Kotter, "Leading Change: Why Transformation Efforts Fail," pp. 65-66.

[74] The following draws from John Kotter, *Leading Change* (Boston, MA: Harvard Business School Press, 1996), pp. 122-124.

[75] This section draws extensively from Andrew Krepinevich, *Revolution At Sea: The U.S. Navy and Carrier Aviation* (Washington, DC: CSBA, 2000), pp. 9-22. See also: Geoffrey Till, "Adopting the Aircraft Carrier," (eds.) *Military Innovation in the Interwar Period,* ed. Williamson Murray and Allan Millett (New York: Cambridge University

In 1919 Admiral William S. Sims, then the president of the Naval War College, established wargaming procedures designed to facilitate a systematic and rigorous examination of how air power might influence war at sea.[76] These wargames provided important insights for Navy theorists, planners and practitioners. They also demonstrated that Lanchester's n-squared law—which sought to replicate the attrition that occurs when two enemy battle lines are engaged—did not apply to carrier air strikes, which are delivered as a pulse of combat power, as opposed to a stream.[77] The wargames exerted a strong influence on Navy decisions with respect to carrier design, as well as carrier aircraft type and mix.[78] The games showed that it was critical to maximize the number of aircraft the fleet could operate. This led to efforts to both maximize the number of aircraft on carriers and to compress the operating cycle for launching and recovering aircraft.[79] Between 1919 and 1941, a total of 318 wargames were played at the U.S. Naval War College.[80]

BurAer was a powerful institutional advocate for R&D focused on naval aircraft. Owing in no small measure to an intense lobbying effort spearheaded by Admiral William A. Moffett, in 1926, Congress authorized the procurement of 1,000 aircraft over the course of five years. The Navy emphasized procurement of gunfire spotters and fighters, reflecting its belief in the current dominance of the battle line. However, given the relatively high number of aircraft authorized, the Navy was free to tryout a range of specialized aircraft types that Moffett and his subordinates at the BurAer wanted for experimentation.

Fleet experiments both contributed to the wargaming effort at the Naval War College and BurAer's technology development and acquisition program, and benefited from them. The Naval War College tapped into BurAer for projections of future aviation capabilities and employed these projections in its wargames. The results of the college's wargames were funneled into the Fleet Problems, whose results were studied by BurAer and the War College. This process, which continued from the early 1920s well into the 1930s, proved immensely beneficial to progress in naval aviation.

In the coming decade, RMA experimentation should be used to inform the defense R&D program, evaluate prototype systems, and explore new operational and organizational concepts.

Press, 1996), pp. 191-226; Jan M. Van Tol, "Military Innovation and Carrier Aviation," *Joint Forces Quarterly*, Summer 1997, pp. 77-87.

[76] Norman Friedman, Thomas C. Hone, and Mark D. Mandeles, *The Introduction of Carrier Aviation into the U.S. Navy and Royal Navy: Military-Technical Revolutions, Organizations, and the Problems of Decision* (Unpublished paper, May 12, 1994), p. 22.

[77] For a discussion of Lanchester's n-squared law (and its limitations), see John W.R. Leppingwell, "The Laws of Combat," *International Security* (Summer 1987).

[78] Ibid., pp. 72-73, 87.

[79] Robert Gardiner (ed.), *The Eclipse of the Big Gun: The Warship, 1906-45* (Annapolis, MD: Naval Institute Press), p. 39.

[80] Of these, 136 were played at the strategic level, and all but nine of them anticipated a trans-Pacific naval clash with Japan. See Michael Vlahos, *The Blue Sword: The Naval War College and the American Mission, 1919-1941* (Newport, RI: Naval War College Press, 1980), pp. 131-178.

Experimentation could not only contribute to the development of innovative concepts for employing future forces, but could also provide an opportunity for creating near-term wins that could inspire enthusiasm for, and impart momentum to, transformational change of the U.S. military.

V. CONCLUSION

The strategic review conducted during the first several months of the Bush administration provided an ideal opportunity to begin transforming the U.S. military to meet mid- and long-term challenges and exploit emerging strategic opportunities. While it is unclear how that review will turn out, it is clear that the 1990s, from the perspective of mid- and long-term transformation, were essentially a "lost" decade.

Among the most important issues raised during this seminar is the need to begin the process of transformation now. Several potential discontinuities loom on the strategic horizon, and with them, the prospect for significant change in strategic balances if the U.S. military fails to transform in time. It is vital for DoD to begin reallocating the resources and adopting the strategies necessary to make discontinuous, anticipatory change a reality. The capabilities the U.S. military will have a decade from now will, for the most part, be determined in the next few budget cycles.

Implementing a transformation strategy, however, will not be easy. In the view of the seminar participants, the most significant obstacles that will need to be overcome are the following:

- The absence of a future warfare vision that is clear, convincing, informative, and broadly communicated;
- The low sense of urgency, and resulting complacency, surrounding the need to transform, which has generated extraordinary institutional resistance to changing what is currently the world's preeminent military force;
- The paucity of innovative, transformational leaders within DoD that are willing to take risks and who possess the requisite bureaucratic acumen;
- The short-tenure of those relatively few transformation-minded leaders in decision-making positions; and
- Insufficient RDT&E funding focused on developing capabilities that will be in demand over the long term.

As discussed in the main body of this report, the Bush administration and the senior leadership of DoD should implement the following eight action items to overcome the inertia of complacency and impart momentum to the transformation process:

1. Develop and communicate a compelling vision of future warfare that is shaped by emerging strategic and technological competitions;
2. Select transformational leaders and create a powerful, guiding coalition in support of discontinuous change throughout the DoD bureaucracy;

3. Create a sense of urgency regarding the need to change through analysis of emerging challenges, credible computer simulation of future conflicts, and honestly umpired field exercises that graphically illustrate the potential decline of existing means of warfare;

4. Encourage "competitive jointness" within and across each of the armed services by allowing alternative concepts to vie for incorporation into regional CINC's war plans and DoD investment resources;

5. Create organizational slack within the armed services by exploring new approaches to overseas presence and existing war plans, as well as by adjusting reserve component missions, creating provisional operational units and "off-line" units dedicated to RMA experimentation, and reorienting the higher military education system;

6. Increase industry incentives for innovation by increasing the profitability of IR&D, DoD-directed R&D, and technologically risky projects, as well as by increasing investment in prototypes, actively managing competitions for major subsystems, and creating new incentives for attracting new talent to the defense industry;

7. Expand and refocus RDT&E funding toward the S&T program and invest in rapid prototype development; and

8. Conduct wargames, computer simulations, and field exercises focused on the challenges and opportunities likely to be associated with an advanced RMA regime.

Participants and Agenda A

FOSTERING REVOLUTIONARY INNOVATION

FRIDAY, FEBRUARY 11, 2000

PARTICIPANTS

Eliot Cohen
Johns Hopkins SAIS

Owen Cote
Massachusetts Institute for Technology

Frank Finelli
The Carlyle Group

Karl Hasslinger
OSD Net Assessment

Pat Larkey
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Navy Staff

Barry Watts
Northrop-Grumman Analysis Center

Robert Work
Office of the Secretary of the Navy

FOSTERING REVOLUTIONARY INNOVATION

AGENDA

FRIDAY, FEBRUARY 11

TIME	ACTIVITY	SPEAKER
8:00-8:30	Jefferson Hotel Registration & Cont. Breakfast	--
8:30-9:30	Opening remarks / Fostering Revolutionary Innovation	Michael Vickers
9:30-10:30	Session #1 Selecting the Right Leaders	Seminar Group
10:30-10:45	Morning Break	
10:45-11:15	Session #1, cont. Selecting the Right Leaders	Seminar Group
11:15-12:15	Session #2 Imparting Institutional and Technological Momentum	Seminar Group
12:15-1:15	Lunch	
1:15-2:15	Session #2, cont. Imparting Institutional and Technological Momentum	Seminar Group
2:15-2:30	Mid-Afternoon Break	
2:30-4:00	Session #3 Creating Organizational Slack	Seminar Group
4:00-4:15	Workshop Wrap-up	Michael Vickers

Seminar In-Brief: Fostering Revolutionary Innovation B

Fostering Revolutionary Innovation

February 11, 2000
Jefferson Hotel, Washington, DC

Michael Vickers
Director of Strategic Studies
Center for Strategic & Budgetary Assessments

Presentation Overview

- ✳Seminar Objective
- ✳The Emerging RMA
- ✳The Challenge of Discontinuous Change

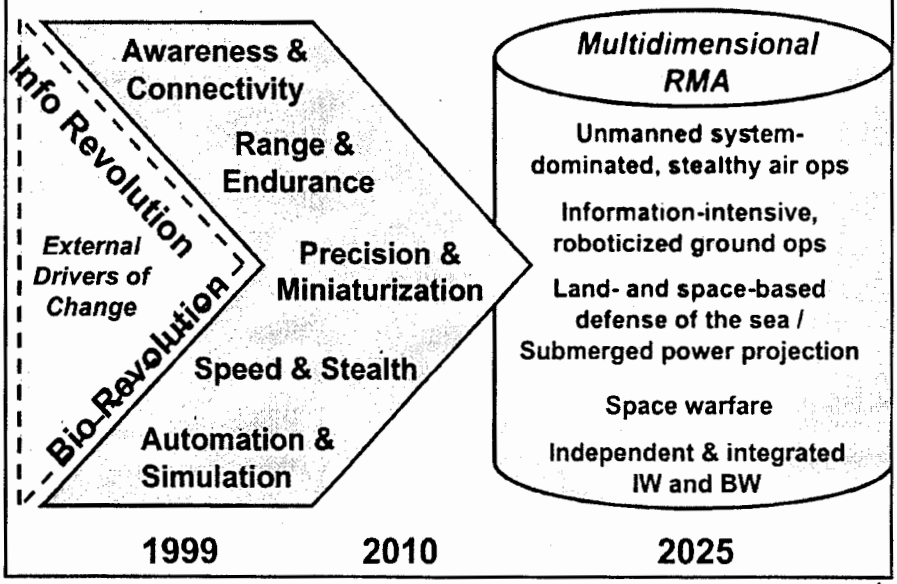
2

Seminar Objective

Identify key actions the next administration should take to foster anticipatory, discontinuous change of the U.S. military

3

The Multidimensional RMA: Transformation & Emergence



The Challenge of Discontinuous Change

	Incremental Change	Discontinuous Change
Anticipatory	Tuning	Reorientation
Reactive	Adaptation	

*from Nadler, et al., *Discontinuous Change: Leading Organizational Transformation*

5

DoD and Transformation

- Transformation =
  - Aerospace Expeditionary Forces
  - Medium-Weight Brigades
  - DD-21
  - V-22; Urban Warfare
- New "transformation" institutions (JROC, JFCOM) have had no discernable impact

RMA largely equated to application of information technology to existing platforms rather than a fundamental change in the way we project power

6

Selecting the Right Leaders

- Early replacement of existing leaders?
- New leader selection
  - Based solely on assessed ability to effect transformational change?
  - From among those who possess expertise in emerging warfare areas?
  - Deep select?
- Institutionalize transformational leadership by:
  - Ensuring succession or extending tenure?
  - Reorienting senior professional military education toward revolutionary innovation?
  - Establishing career paths for emerging warfare specialties?

7

Imparting Institutional & Technological Momentum

- Focus transformation effort by replacing JV 2010 with a future warfare vision that addresses key transformational challenges and opportunities
- Exploit transformation strategy hearings
- Develop & rapidly field prototypes of emerging weapon systems
- Divest legacy systems

8

Imparting Institutional & Technological Momentum (II)

- ✳ Use RMA experiments to create consensus for change
- ✳ Encourage intra- and inter-service competition
- ✳ Incentivize defense industry

9

Creating Organizational Slack

- ✳ **Resource slack:**
  - ➢ Non-CVBG-based forward presence?
  - ➢ Long-range strike-based war plans?
- ✳ **Innovation slack:**
  - ➢ Standing "RMA" experimentation units?
  - ➢ Innovation fellowships?
  - ➢ Fenced off innovation funds?

10

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