

MILITARY EXPERIMENTATION

Time to Get Serious

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In January 1929, the U.S. Navy undertook a major exercise known as Fleet Problem IX, part of a series of exercises conducted by the service between the two world wars. Despite the isolationist mood of America at the time, compounded by tight budgets and arms control constraints, the Navy persisted in conducting these exercises as, among other things, a means for determining the influence upon sea power of continuing rapid advances in aviation technology.¹

Fleet Problem IX took place off the coast of Panama. Present for the first time in these fleet problems were two ships of radically new design—the aircraft carriers USS *Lexington* (CV 2) and USS *Saratoga* (CV 3). During the exercise, Vice Admiral William V. Pratt, commanding the attacking force, authorized Rear Admiral Joseph Reeves, commanding the *Saratoga* and a

light cruiser, to execute a high-speed run toward the Panama Canal. Reeves then “attacked” the canal with a seventy-plane strike force launched 140 miles from the target.

Following Fleet Problem IX, Admiral Pratt observed, “I believe that when we learn more of the possibilities of the carrier we will come to an acceptance of Admiral Reeves’ plan which provides for a very powerful and mobile force . . . the nucleus of which is the carrier.”² The following year, upon becoming Chief of Naval Operations, Pratt directed that carriers be placed in offensive roles in war games and fleet exercises. In such exercises,

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involving experimentation with new kinds of equipment, doctrine, and formations, were sown seeds that brought forth the fast carrier task forces that enabled the U.S. Navy to defeat the Imperial Japanese Navy during World War II.

Eight years after Fleet Problem IX, on the north German plain, a new and very different formation appeared in exercises conducted by the German army: the panzer division. The panzer division was a combined-arms formation possessing large numbers of fast tanks with extended ranges; it was centered on a doctrine that called for rapid, deep penetration as a means to achieve quick victory. This represented a dramatic departure from Germany's World War I experience against its principal enemy, France. That conflict had been dominated by slow-moving forces employing heavy firepower and waging a war of gradual attrition.

In the 1937 German maneuvers, after a sixty-mile approach march, the panzer division went into the attack, forcing the enemy to commit its reserves. The following day the panzer division not only broke through the enemy front but penetrated deep into its rear. The enemy position quickly became untenable, and the issue was essentially decided only four days into what had been planned as a seven-day exercise. General Franz Halder, who witnessed the spectacle (and who would become chief of the General Staff a year later), was stunned by the "fluid mobility" of the panzer operations.³

Many other exercises were conducted during the 1920s and 1930s by the German military. They included experiments not only in mechanized warfare but with radio communications schemes and the use of aircraft to provide reconnaissance and close air support for rapidly moving ground forces. These exercises were indispensable in enabling the German high command to develop a devastating new form of land warfare known as *blitzkrieg*—lightning war.

Today, the U.S. military finds itself in a circumstance somewhat similar to those that confronted the two military services mentioned above. As in the interwar era, rapidly progressing technologies have emerged, creating a military revolution ("revolution in military affairs," in Pentagonspeak) that will produce dramatic changes in the instruments of war and how military operations are conducted. But as with naval aviation and mechanized ground operations seventy years ago, it is not yet clear how this revolution will play out.

THE RISK OF STAYING ON OUR CURRENT PATH: POWER PROJECTION

Despite all the uncertainties the U.S. military must confront in preparing for the future, two things seem certain. First, the incentive is high for would-be adversaries to present the American military with challenges very different from those

that confronted U.S. forces during the 1991 Gulf War. Second, the diffusion of military technologies and the rapid progression of military-related technologies will offer such adversaries the means to achieve this goal. Their prospects are particularly good with respect to traditional power-projection operations, which form the core of the current U.S. two “major theater war” defense posture.

This “two war” posture is founded on the nation’s ability to project power rapidly and decisively to threatened regions around the globe. The Defense Department’s last Quadrennial Defense Review, conducted in 1997, concluded that “it is imperative that the United States now and for the foreseeable future be able to deter and defeat large-scale, cross-border aggression in two distant theaters in overlapping time frames.”⁴ Along these lines, the Joint Chiefs of Staff’s vision statement, *Joint Vision 2010*, declared that “power projection . . . will likely remain the fundamental strategic concept of our future force.”⁵

However, the U.S. military’s accustomed method of deploying and sustaining air and ground forces at or through ports and airfields is almost certain to be jeopardized by the growing proliferation of national and commercial satellite services and of missile technology. Growing access to satellite services will allow even rogue states to monitor U.S. deployments into forward bases and (unless one makes heroic assumptions regarding the effectiveness of missile defenses) hold them at risk through the employment of large numbers of ballistic and cruise missiles. Senior U.S. military leaders have already voiced strong concern over the nation’s ability to deal with such a contingency. General Ronald Fogleman, when Air Force Chief of Staff, observed that

saturation ballistic missile attacks against littoral forces, ports, airfields, storage facilities, and staging areas could make it extremely costly to project U.S. forces into a disputed theater, much less carry out operations to defeat a well-armed aggressor.

Simply the threat of such enemy missile attacks might deter U.S. and coalition partners from responding to aggression in the first instance.⁶

As Chief of Naval Operations, Admiral Jay Johnson expressed very similar concerns when he declared,

Over the past ten years, it has become evident that proliferating weapon and information technologies will enable our foes to attack the ports and airfields needed for the forward deployment of our land-based forces.

I anticipate that the next century will see those foes striving to target concentrations of troops and materiel ashore and attack our forces at sea and in the air. This is more than a sea-denial threat or a Navy problem. It is an area-denial threat whose

defeat or negation will become the single most crucial element in projecting and sustaining U.S. military power where it is needed.⁷

Perhaps most revealing, however, are the comments of a retired Indian brigadier general who observed that future access to forward bases

is by far the trickiest part of the American operational problem. This is the proverbial “Achilles’ heel.” India needs to study the vulnerabilities and create covert bodies to develop plans and execute operations to degrade these facilities in the run up to and after commencement of hostilities. Scope exists for low cost options to significantly reduce the combat potential of forces operating from these facilities.⁸

According to a recent Defense Science Board Study, development by a regional power of this kind of anti-access capability by 2010 is certainly plausible, even given the relatively severe resource constraints under which many third-world militaries must operate.⁹ A commander in chief of U.S. forces in Korea has declared that the problem of forward base access is not a problem for the U.S. military of 2010 but one that exists in embryonic form in Korea *today* and will only worsen over time.

As potential adversaries look for ways to deal with U.S. military preponderance, they seem to have little inclination to create their own versions of the Iraqi military as it existed at the time of the Gulf War. Iran, for example, seems far more interested in fielding anti-access systems—such as ballistic and cruise missiles, antiship cruise missiles, submarines, and advanced antiship mines—than such military systems as tanks and combat aircraft that proved largely ineffective for the Iraqis in 1991.

Assessing the emerging threats to U.S. power-projection forces, the National Defense Panel unanimously agreed upon the need to “radically alter the way in which we project power.”¹⁰ The panel concluded that the U.S. military must develop the capability to execute the following missions (among others) within the next decade: inserting and extracting forces in the absence of forward bases; resupplying forward forces through airlift and sealift operations when access to forward ports and airfields is at risk; seizing and controlling key terrain (including urban areas) if friendly ground forces must operate dispersed; and achieving air superiority against an enemy’s missile force.¹¹

MILITARY EXPERIMENTATION: PAST AS PROLOGUE

In the coming years the U.S. military will likely encounter challenges very different from those it has faced in the past. There is enormous uncertainty, however, with respect to how it should position itself to deal with them. What military systems, both existing and potential, will be needed? What prospective operational concepts will prove effective, and which will not? Will new forms of

military organization be required, analogous to the fast carrier task forces and panzer divisions that transformed warfare in World War II? Will different kinds of people possessing different skill sets than those in today's force be needed? These and other such questions require answers if America's military is to play its role in extending the post-Cold War era into a Long Peace.

Unfortunately, the answers to these questions are difficult to come by. Moreover, barring a dramatic increase in projected defense budgets, the Defense Department will have to prepare for these challenges with roughly the resources

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that it has today, and perhaps less. Simply put, the Pentagon cannot afford to "think rich" about preparing for emerging challenges; instead, it must "think smart." It cannot build a military for every prospective threat, nor can it afford

to proceed with a modernization program that is oriented to meeting today's challenges but will prove ineffective against those that are emerging.

Yet the Pentagon may be doing precisely that when it undertakes large-scale production of a new armored combat system, aircraft, or class of ships without a good understanding of how the new weapon will compete against tomorrow's threats. For example, with respect to power projection, how does the Air Force plan to deploy its new F-22 fighters to forward bases against the kind of theater-denial forces described by General Fogleman, or to employ the fighter to achieve air superiority against an enemy's missile force? How does the Army plan to deploy and sustain its heavy, digitized divisions in the absence of forward-base access? How does the Navy plan to move its carrier battle groups safely through narrow straits so as to influence the battle ashore, given that the range of the F/A-18E/F carrier-based aircraft it is buying is inferior to that of the A-6 attack aircraft being replaced? Or does the U.S. military need to begin fielding very different kinds of systems, emphasizing different performance characteristics (such as extended-range, precision, and stealth), as outlined in the report of the National Defense Panel?¹² Experimentation—at both the joint and service level—provides an indispensable means for answering these questions and, in so doing, for determining the mix of new and legacy (that is, existing) systems required to operate effectively against future threats.

Military experimentation is one of the keys to defense planning in an era of high uncertainty and rapid technological change. Experimentation with innovative operational concepts that employ emerging military systems and radically new force structures has historically been an essential ingredient to preserving, or gaining, advantages in military capability. For example, the twenty-one large-scale fleet problems undertaken in the 1920s and 1930s were crucial to

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 that same time frame were indispensable prerequisites to the highly coordinated, mechanized air-land forces and operations that achieved the rapid conquest of France.

THE NEED FOR MILITARY EXPERIMENTATION

Military experimentation at the operational level (at which military campaigns are waged) confers several critical benefits, both for defense planners and for those concerned with fiscal accountability.

Reducing Uncertainty as to How Best to Meet Emerging Threats. Take the problem of projecting power in the absence of forward bases. Joint experimentation would permit military leaders to try out different operational concepts for deploying forces into a theater, conducting extended-range precision strikes, determining whether achieving secured access to forward bases is feasible, and deciding how to sustain the operation for a period sufficient to accomplish its objectives. Through such experiments commanders can develop a far superior feel for what operational concepts might succeed in such a threat environment, and for the force mix and systems needed to support such operations. Equally important, experimentation enables military leaders to identify force elements and modernization plans that are likely to diminish in value over time. This proved to be the case with the blitzkrieg; experimentation enabled the German military to work through the coordination problems associated with fast-moving mechanized formations, other ground formations, and supporting air units.

Determining the Proper Mix of Emerging and Legacy Systems. Experimentation also assists military organizations in determining what new systems and capabilities will be required, what legacy systems and capabilities should be sustained, and what combination of the two should be established. The Germans, for instance, used a series of exercises to experiment with different panzer-division designs. They found their initial organization was far too “tank heavy” in proportion to the other elements, such as artillery and engineers; consequently, the number of tanks was reduced by 50 percent, and the proportion of certain supporting forces (such as engineers) was increased. Finally, many supporting elements were motorized to enable them to support the tanks’ rapid advances better. In short, these exercises proved critical to the Germans’ ability to determine the proper mix of new (panzer, airborne, radio communications, reconnaissance and attack aircraft) and existing (artillery, engineers, logistics) capabilities.

Creating Options for the Future. Experimentation that identifies new forms of military operations and new force elements can permit the military to exercise those options quickly when the threat emerges. For example, in the early 1960s the U.S. Army conducted extensive experiments to assess the potential of air-mobile and air-assault operations. These experiments gave the Army an important option when, in the summer of 1965, it was ordered to send large forces to Vietnam. The first division selected for deployment was the newly formed 1st Cavalry Division (Airmobile). Similarly, the U.S. Navy that entered World II was, first and foremost, a battleship navy. However, through its Fleet Problems the Navy created the option of carrier-based operations, a capability that it pursued quickly following Pearl Harbor.

Complicating the Planning of Would-Be Enemies. Importantly, experimentation that enables the U.S. military to “buy options” can also complicate the planning of potential adversaries. For example, in the 1930s the Imperial Japanese Navy had to plan counters against a U.S. Navy that was exploring a range of options for naval aviation, including both large (*Saratoga* and *Lexington*) and small (USS *Ranger* [CV 4]) carriers, the use of seaplanes, airships, and land-based aircraft, and proposals for a class of “flying-deck” (partial flight-deck) cruisers. By compelling a would-be adversary to stretch resources thin in order to cover all possible options, or to concede that there are options for which it cannot prepare a counter, experimentation can play an important role in dissuading other militaries from entering into a competition in the first place.

Avoiding Legacy-Force Lock-In. Experimentation through war games, simulations, and field exercises provides a means of avoiding the purchase of large numbers of legacy systems under the assumption that since they are important today, they will remain so for the foreseeable future. For example, German military exercises led many senior leaders to conclude that horse cavalry had a very limited future.

Avoiding False Starts. Experiments can help military organizations avoid “buying in” too early during a period of transformational change in military capabilities. The U.S. Navy’s first carrier designed from the keel up, the *Ranger*, was commissioned in 1934. Although some Navy leaders had pressed for construction of five *Ranger*-class carriers, game analysis and fleet problems soon indicated that the *Ranger*, at roughly fourteen thousand tons, was far too small to meet many of the demands of future fleet operations. As it turned out, the *Essex*-class ships that formed the backbone of the Navy’s fast carrier task forces in World War II displaced nearly twice as much tonnage.

Avoiding Dead Ends. Military systems or capabilities that appear promising, even revolutionary, sometimes fail to live up to their promise. In this case, the issue is not to avoid “buying in” too early; rather, it is to avoid buying in at all. Again, the experience of the U.S. Navy during the development of naval aviation in the interwar period provides an example of how rigorous experimentation and operational exercises can help avoid accumulating military capabilities that lead not to transformation but to dead ends. In 1930 the Navy’s Bureau of Aeronautics proposed the construction of eight ten-thousand-ton flying-deck cruisers. The ships—half cruiser and half flight deck—were subjected to war game experiments at the Naval War College and to some experiments with surrogates in the fleet. The results painted a distinctly unfavorable picture of the hybrid ship, and it sank beneath the Navy’s programmatic waves, never to be heard from again.

Identifying and Solving Practical Problems. Planning exercises and war games can go only so far in identifying new forms of operations and system requirements. As with many things, the devil is in the details. For example, war games conducted at the Naval War College in the early 1920s indicated the importance of maximizing the aircraft complements and sortie rates of carriers.¹³ It was not, however, until a prototype, the USS *Langley* (CV 1), was available that the Navy could determine precisely *how* this goal was to be achieved. Under then-Captain Reeves, the *Langley* conducted a series of experiments that led to such innovations as crash barriers and the deck park, which enabled the ship to more than double its aircraft complement and dramatically increase its sortie rate. Similarly, the German army’s field exercises and operations in the late 1930s enabled it to solve critical issues with respect to fuel and spare parts for its panzer formations and to determine how the German air force, the Luftwaffe, could provide highly mobile reconnaissance and fire (close air) support. Experiments like these were essential to both militaries’ efforts to transform to dominate emerging conflict environments.

EXPERIMENTATION: TIME TO GET SERIOUS

How well is the Defense Department doing in its efforts to secure the benefits of experimentation to support its transformation efforts? To answer this, we must assess how well the Pentagon’s efforts match the characteristics of successful experimentation efforts in earlier periods of military transformation. To succeed, a Defense Department experimentation initiative must reflect the following characteristics.

Vigorous

Experiments must be conducted on a frequent basis, and funding, forces, and equipment (including prototype equipment and surrogates) must be made available to support them. Unfortunately, the Defense Department leadership's rhetoric asserting the need for military transformation and experimentation has not been matched by the requisite urgency or resources.

For example, the establishment of Joint Forces Command for the purpose of undertaking joint experimentation was not a Defense Department initiative. Rather, it was the consequence of congressional leadership and the recommendations of an independent panel of experts.¹⁴ The Pentagon's budget for Joint Forces Command's experimentation efforts stands at a meager forty-one million dollars for fiscal year 2000. The Clinton administration's request for FY 2001 was for forty-nine million. Such funding levels are at least an order of magnitude lower than what is required to conduct vigorous and sustained field experiments at the operational level. In 1999, for example, *one* service, the Air Force, spent more than sixty million dollars—over 50 percent more than the Joint Forces Command's *entire budget* for joint experimentation—on *one* exercise. According to the general in charge of JFC's experimentation efforts, the command is able, owing to funding shortages, to explore only half the warfighting concepts it has identified.¹⁵ The first major exercise, or “major joint integrating experiment,” is not scheduled to occur until 2004, some six years after the command was charged with the responsibility for joint experimentation.

This is not to say that a vigorous program of experimentation would necessarily involve enormous sums of money. To be sure, it would probably involve an investment of several billion dollars a year. However, the investment would be relatively modest—less than 1 percent of the defense budget—while the payoff, in terms of improved military effectiveness and efficiency, through avoiding such funding sinkholes noted above as premature lock-in, false starts, and dead ends, promises to more than justify it.

In any event, the current Defense approach to experimentation stands in stark contrast to the sense of urgency that has historically characterized successful military revitalization. Consequently, it is difficult to conclude the department's effort to date represents a serious intention to exploit the potential of experimentation to support and inform military transformation.

Enduring

Experimentation must be an enduring element of what the U.S. military does, as thoroughly institutionalized as forward-presence operations and training activities. Here certain services deserve credit for attempting to develop long-term approaches to experimentation. The Marine Corps, for example, has sustained a

series of exercises and experiments under the rubric of SEA DRAGON, which includes HUNTER WARRIOR, URBAN WARRIOR, and CAPABLE WARRIOR. The Marines apparently intend to pursue these experiments on an enduring basis, as a means for preparing to meet emerging challenges while looking for ways to exploit advances in technology to support future operations.

The Marines also have explored innovative ways to surmount the lack of emphasis and resources accorded to such enterprises by senior Defense Department leadership. For example, they have identified urban control and eviction operations as being key elements of the post-transformation operational environment. They immediately confronted the fact that the “combat towns” on U.S. bases, while excellent for training small units in basic tactics, do not offer the complexity or the communications interferences that real cities do. The National Defense Panel recommended that a Joint Urban Warfare Center be established for training and experimentation in an urban environment, but the Defense Department declined to act. Absent such a facility, the Marines have tried to conduct small-scale exercises in actual urban areas. One of their more innovative efforts addresses the problem of close air support. In the absence of a true urban-warfare training facility, the Marines commissioned the construction of an Urban Close Air Support Facility at their air station in Yuma, Arizona, comprising 167 buildings constructed from shipping and cluster-bomb containers. The buildings of this jerry-rigged urban landscape range in size from one to five stories and are configured in various shapes. In cases such as this, it appears that experimentation is being sustained almost in spite of senior Defense Department levels.

Comprehensive

Experimentation must take place at all levels (tactical, operational, and strategic) of warfare, and also among all principal organizations involved, to include all the services and, where appropriate, other governmental and nongovernmental elements. As asserted above, such experimentation implies a level of effort on the part of the Defense Department that simply does not as yet exist. To date, experimentation has been heavily weighted toward the tactical level of warfare. While such experimentation is desirable, it must be informed by how military organizations believe they will have to act at the operational level.

For example, a recent Joint Forces Command simulation involved attacks on critical mobile targets, such as self-propelled ballistic and cruise missile launchers. However, the specifics of how the military might accomplish this task are greatly influenced by considerations at the operational (and strategic) level. Consider, for example, how the experiment’s conduct would change under the

assumption that forward bases were either unavailable or had been placed at unacceptable risk (perhaps by the very missile forces that were the target of U.S. operations). In sum, experimentation that focuses on the tactical level of warfare without the context of the situation at the operational level risks arriving at irrelevant or impractical solutions.

Focused

Experimentation must be aimed squarely at the post-transformation challenges and opportunities at the operational level of warfare. While experimentation must be comprehensive, history indicates that its principal focus should be

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meeting challenges—or exploiting opportunities—at the campaign level. Furthermore, experimentation must be directed at preparing for the next war, not at becoming more

proficient at waging the last. As we have argued, if these factors are not taken into consideration, experimentation, no matter how vigorous, well funded, and enduring, may arrive at some very good solutions to the wrong problems. This is all too often the case with current experimentation.

Again, consider the recent simulation conducted by Joint Forces Command on engaging critical mobile targets. It assumed the availability of forward bases to support such operations, as was the case during the “Great Scud Hunt” of the Gulf War. Similarly, the Air Force’s Joint Expeditionary Force Experiment 99 involved the rapid forward deployment of an Air Expeditionary Force (AEF) to fixed forward bases. This was done despite a growing chorus of military leaders—including an Air Force Chief of Staff—and blue-ribbon expert advisory groups cautioning that operating out of such bases will be a risky proposition until enemy missile forces have been neutralized. Similarly, the Army, with its emphasis on deploying a brigade to a forward base within ninety-six hours, may, like the Air Force, find that its vision serves only to get itself to the enemy missile ambush point (that is, a fixed forward base) more quickly.

On a brighter note, the Marines, through experiments like HUNTER WARRIOR, are attempting in a small way to confront post-transformation challenges at the operational level: “How do we sustain our forces in a world that will feature fewer and fewer overseas land bases and where a large build-up of supplies and equipment ashore may be impractical because of geographical, political, or threat conditions?”¹⁶ The Navy’s Fleet Battle Experiment “Foxtrot,” which explored maritime operational concepts in an area-denial threat environment, is a significant step in the right direction. The Air Force has taken some positive, albeit small, initiatives as well. In 1995–96 it sent three specially created AEFs to unimproved airfields in

Bahrain, Jordan, and Qatar. For its part, the Army has war-gamed the forward-basing problem (although it has not yet conducted experiments based on the insights its games produced regarding the anti-access challenge). These are modest steps, to be sure, but ones that could be encouraged by a comprehensive Defense Department effort to exploit experimentation in support of transformation.

Both Service-Level and Joint

The U.S. military plans to fight as a joint force, one that draws upon all the services' capabilities. This makes sense, as modern technology has enabled each of the services to operate far outside its traditional battlespace—and into the battlespaces of the other services. Joint experimentation should therefore encourage a spirited, though friendly, competition among the services to determine the proper mix of capabilities. To its credit, the Army has sought to expand the major exercise on urban operations it planned for September 2000—now known as the Joint Contingency Force Advanced Warfighting Experiment, or MILLENNIUM FORCE 2000—to include participation from the other three services as well as the staff of Joint Forces Command. Once again, this represents a bottom-up approach by the services, as opposed to top-down encouragement from senior Defense Department leaders.

Certainly, there are operations or campaigns that one service may dominate, such as antisubmarine warfare, long-range precision strike, and space control. Here, service experimentation might assume primacy over joint experimentation. However, given current and projected technology trends, such cases at the operational level will likely become increasingly rare.

Exploited in Developing Future Requirements

It goes almost without saying that the insights and lessons derived from experimentation must be harvested if innovation and transformation are to succeed. Focusing on post-transformation challenges and opportunities helps to ensure that the military is addressing the right questions with respect to future warfare and thus can get the right answers with respect to emerging requirements. These insights mean little, however, unless they actually influence the way requirements are determined, budgets are shaped, resources are allocated, institutions are adapted, and forces are developed.

At present it is unclear how this is to be accomplished. Even if one assumes a robust level of service and joint experimentation focused on emerging challenges, it is not clear how the insights will be translated into new requirements. As one senior general officer has put it, “You fund these things and do an experiment and you find out great things, but then [do] you have to wait another two years or so before you get it into the normal budget process?”¹⁷

Indeed, in recent years both the Defense Department's Planning, Programming and Budgeting System and the Joint Chiefs' Joint Requirements Oversight Council (with its "joint warfighting capabilities assessments" approach) have seemed incapable of effecting significant changes in service budget shares or in program focus, despite the declared determination of Secretary of Defense William S. Cohen to transform the U.S. military.¹⁸ Promising new capabilities or force elements—such as unmanned combat aerial vehicles, moving-target-indicator satellites (such as Discoverer II), the arsenal ship, Strike Force, the Deep-Strike Brigade, the STREETFIGHTER littoral operational concept, and the Trident SSBN conversion to conventional missile carriers—have been terminated, delayed, or jeopardized. Yet support for such programs as modernizing tactical air and heavy divisions continues unabated, even though it is far from clear these would fare well in an anti-access power-projection environment.

If the Defense Department is to meet emerging challenges in such a way as to preserve the current level of national security, it will have to effect significant changes in its approach to military experimentation; specifically, it will have to increase dramatically the priority accorded to experimentation. At present, the department's effort is poorly focused and severely underfunded. The potential gains to be expected from a properly directed and funded experimentation effort are clear. To see the payoff of successful military transformation, and, by extension, the importance of a well-designed program of experimentation, one has only to look at how the blitzkrieg upset the military balance in Europe and how the U.S. Navy's fast carrier task forces turned the tide in the Pacific during World War II. The potential costs of continuing along the current path are clear as well. They include investing in false starts and dead ends, arriving at the right solutions to the wrong threats, and perhaps ultimately paying a price in jeopardized security interests, national treasure wasted, and the lost lives of young American men and women in uniform.

NOTES

1. The Washington Naval Treaty of 1922, among other things, banned the construction of battleships and limited carrier tonnage among the major naval powers. In addition, in 1928 the United States signed the Kellogg-Briand Pact renouncing war. p. 17; and "Remarks by Commander Black Fleet, W. V. Pratt," *Fleet Problem IX*, "Report of the CINC, U.S. Fleet," National Archives Publication M964, cited in Robert L. O'Connell, *Sacred Vessels: The Cult of the Battleship and the Rise of the U.S. Navy* (Boulder, Colo.: Westview, 1991), p. 285. Pratt flew his flag from the *Saratoga* on the return cruise, "partly as a badge of distinction, but most
2. Clark G. Reynolds, *The Fast Carriers* (Annapolis, Md.: Naval Institute Press, 1968),

- because I want to know what makes the aircraft squadrons tick.”
3. Robert M. Citino, *Path to Blitzkrieg* (Boulder, Colo.: Lynne Rienner, 1999), p. 241.
 4. *Report of the Quadrennial Defense Review* (Washington, D.C.: Department of Defense, May 1997), p. 12.
 5. U.S. Joint Chiefs of Staff, *Joint Vision 2010* (Washington, D.C.: Department of Defense, n.d.), p. 4.
 6. Bill Gertz, “The Air Force and Missile Defense,” *Air Force Magazine*, February 1996, p. 72.
 7. Jay Johnson [Adm., USN], “Anytime, Anywhere: A Navy for the 21st Century,” U.S. Naval Institute *Proceedings*, November 1997, p. 49.
 8. V. K. Nair [Brigadier, Indian Army], *War in the Gulf: Lessons for the Third World* (New Delhi: Lancer International, n.d.), p. 230.
 9. Defense Science Board, *Final Report of the Defense Science Board Task Force on Globalization and Security* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition and Technology, December 1999), p. vi.
 10. The National Defense Panel, *Transforming Defense: National Security in the 21st Century* (Washington, D.C.: n.d., December 1997), p. 33.
 11. *Ibid.*, p. 35.
 12. *Ibid.*, pp. 44–8.
 13. A sortie is one mission flown by one aircraft.
 14. National Defense Panel, pp. 68–72.
 15. William H. McMichael, “Joint Experiment in Expeditionary Force,” *Air Force Magazine*, January 2000, pp. 46–50.
 16. Senate Armed Services Committee, Emerging Threats and Capabilities Subcommittee, statement of John E. Rhodes [Lt. Gen., USMC], “Concerning Marine Corps Experimentation Efforts,” 20 October 1999.
 17. McMichael, pp. 46–50.
 18. See M. Thomas Davis, *Managing Defense after the Cold War* (Washington, D.C.: Center for Strategic and Budgetary Assessments, 1997).