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The Coming Military Revolution: Opportunities and Risks

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There seems to be growing consensus that rapidly evolving technologies will result in a profound change in the character of warfare in the coming decades—likely culminating in what has come to be known as a Revolution in Military Affairs or “RMA.”¹ Operation Desert Storm served to highlight some of the remarkable capabilities that technology has brought to the high intensity battlefield since World War II. Advanced sensors and communications now provide much greater information about the enemy as well as a higher degree of operational control over our own forces. Stealth and precision-guided warheads have reduced significantly the number of platforms and amount of ordnance necessary to destroy individual targets. Conventional weapon lethality has increased, while attrition and collateral damage have been significantly reduced. These developments portend perhaps an entirely new regime of high-technology warfare in the early 21st century.

All of the military services generally accept the idea that we are in a period of profound change, but none has yet formally articulated what will specifically characterize the possible “end states” of this ongoing RMA. In other words, looking back from a vantage point 50 years in the future, what qualities of military capability would cause us to conclude that a military revolution has indeed occurred in the intervening decades? Although this theoretical bridge has not been crossed, both service doctrine and the application of advanced technology to military systems have begun to focus on one battlefield goal that may indeed have revolutionary implications: *tempo of operations*.²

It is commonly accepted that future information technologies will allow the commander to know a lot more about the battlefield—to have greater situational awareness of both his own and enemy forces. However, real combat

leverage derives not simply from knowing more, but from *knowing more faster—and from having the ability to act on that information very rapidly*. The idea that higher relative tempo equates to increased military leverage is not new. What *is* new is that emerging information technologies now hold out the real prospect of increasing maneuver and strike tempo by orders of magnitude compared with past capabilities. Future command cycles may be reduced from weeks or days down to hours or minutes. Geographic massing of forces and fires may give way to temporal massing for simultaneous attacks against an enemy's tactical, operational, and strategic targets. The ability to identify and destroy a significant portion of an enemy's critical system vulnerabilities faster than he can move, hide, or react may lead to a new theory of victory: that of forcing the enemy's recognition of defeat not through sequential attrition, but rather by inducing massive systemic shock on his operating and control systems.³ Indeed, Jeffrey Cooper suggests that a conceptual end state of the RMA may be the reduction of a protracted war to a "*coup de main* executed in a single main-force engagement."⁴

Achievement of this capability against the full range of our future enemies would undoubtedly signify a new regime of warfare—and the culmination of a military revolution. It is a compelling vision that is well-suited to our national strategy of forward engagement, and to our national values, which favor short, decisive conflicts, with minimal cost and risk. At the very least, such high-tempo operations would virtually eliminate another nation's ability to project significant power across its own border. At best, this ability may help us to achieve the goal of universal strategic leverage—compelling any adversary to accede to our will, be that unconditional surrender or some lesser requirement. Moreover, an enemy's belief in our ability to execute this type of operation should provide a high level of non-nuclear strategic deterrence. In essence, the achievement of this end state will allow us to make the wholesale trade of force quantity for force quality in our 21st-century military.

Yet while this military goal of strategic leverage through vastly increased operational tempo is undoubtedly enticing, there may be significant costs and risks associated with it that have not been fully explored. As we continue to move down this path toward a new regime of warfare, it is time that we begin asking questions about the feasibility of achieving this goal, and, more important, about how well this end state will truly serve our national interests.

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Challenges of the Revolution

Inflicting “massive systemic shock” on the enemy has conceptual utility down to the tactical level of military operations. However, the real essence of the military revolution—of this new regime of warfare—derives from our ability to forestall an enemy’s effective reaction to our operations, his mobilization of additional forces, or his escalation of the conflict. Pursuit of “shock” warfare will, by necessity, be characterized by parallel strikes against critical targets across all levels of warfare—from tactical units up through the national decisionmaking process. In this new regime, all warfare becomes strategic warfare.⁵

Despite predictions of what will happen in the coming decades, the prospect of executing high-tempo strategic warfare depends upon our finding solutions to a number of critical problems.

- *Can we know enough about our enemy?*

Inducing massive systemic shock depends upon the rapid destruction of that set of critical vulnerabilities upon which the enemy’s key military, political, and economic systems depend. The concept seems as theoretically sound today as it did when first postulated during World War I—yet it has never been successfully demonstrated in wartime. Although the technical problems of precision strike may have been solved, we nevertheless need to know a lot more about how national systems operate than we have been able to discern in the past. Advanced computer modeling and simulation will undoubtedly offer us significantly greater insight, but collapsing the enemy’s will may depend more on our ability to understand more about individual human values of a very different culture than the physical operation of systems. Target sets will vary greatly in both number and type with each adversary, and even then will be constantly changing over time. Despite our best analytical efforts, the effectiveness of our conclusions can never be tested outside of war, and thus confidence in our ultimate success will never be more than a probability based upon assumption.⁶

- *Can we become fast enough?*

Revolutionary leverage emanates not just from identifying critical targets, but from doing so very rapidly—faster than the enemy can move, hide, or adjust. The number of targets per hour that must be struck to “shock” an enemy system will undoubtedly vary with the adversary and our objectives, but an action cycle approaching real time—target identification-to-destruction in hours if not minutes—has emerged as the conceptual goal.⁷ For a large, highly complex adversary this will doubtless require the synergy of an integrated reconnaissance-strike system to achieve near simultaneous identification and targeting of thousands of critical vulnerabilities.⁸ Far more than the single sensor-to-shooter links demonstrated to date, such a system will have

to integrate large numbers of theater sensors and weapons in real time—a data fusion problem of tremendous proportions, and one perhaps requiring as yet unforeseen breakthroughs in automatic target recognition technology and artificial intelligence. Moreover, our quest for speed must not result in an information and control system so centralized, standardized, and rigid that it offers critical vulnerabilities for enemy exploitation.

- *How good can we afford to be?*

Although the cost of microprocessing continues to drop, it is not evident that this trend will extend to commensurate reductions in the price of targeting data and precision-guided munitions (indeed, we need them to be cheap, but not so cheap that everyone in the world can acquire this capability). Unsophisticated and inexpensive countertargeting techniques may always keep offensive forces on the wrong side of the cost/exchange ratio, rendering it much less expensive for an adversary to deny timely information than for us to gather it. Whether we can achieve a revolutionary effect with information before a clever adversary makes that information too costly may be the most critical future technical challenge. To be sure, ambiguity in targeting data can be overcome by a willingness to expend large numbers of smart munitions. However, a key aspect of this RMA end state is that of moving beyond attrition warfare to the discrete application of force—and achieving economy by substituting quality for quantity. An added cost consideration is that our arsenal of smart weapons must not only be large enough to deal with the contingency at hand, but we must have enough left over so that we have not “demodernized” ourselves relative to our *next* opponent.⁹

Beyond the issues of technical capability and cost, the most daunting challenge will likely be that of the profound organizational change needed to exploit fully revolutionary advances in information processing. The most critical drag on high-tempo system performance is the cognitive limit of the human mind, the rate at which an individual can assimilate information and act. An information-intensive battle space may work to our advantage only if humans can be largely removed from the command loop. The need for speed will likely force today’s hierarchical command structures to become very flat, with automated analysis and decisionmaking largely replacing time-consuming and error-prone human deliberation. More profoundly, technical limitations of communications and data fusion may mean that humans will have to forego a traditional “picture” of the battle space. The question then becomes whether future US military commanders can accept a continuing reduction in their real-time battle information as the price of an increasing pace of activity. In a broader sense, the issue is whether we as a military can readily adapt not only to revolutionary changes in command relationships, but to changes in specialties, basic skills, and perhaps even professional values that are dictated by new technologies.¹⁰

Being Careful What We Ask For

If our faith in technology is rewarded and we can achieve this end state, then the issue becomes whether our nation can accommodate the strategic consequences of a continuously accelerating tempo of military operations. Indeed, nonnuclear strategic warfare may confront us with many of the same dilemmas of nuclear stalemate that we are seeking to leave behind.

- *Can warfare become too fast?*

As the world's military leader, the United States is now setting the pace in force capabilities and military measures of effectiveness. Other nations will undoubtedly follow our lead in acquiring integrated systems of advanced sensors and smart weapons. The result will be a competitive race for command cycle dominance not only in strike and maneuver, but in information superiority. This future battlefield in which all warfare is strategic could lead to a mutual perception that any relative delay in initiating military operations will invariably result in rapid and catastrophic national defeat.¹¹ The issue is whether our deliberative political process can accommodate a military system that is dependent upon strategic decisions of war and peace being made within hours or even minutes. Indeed, our future national security may come to depend upon our political willingness to initiate preemptive military strikes, an option that this nation has historically conceded to foreign "aggressors."

- *Will we be backed into the kinds of wars that we don't want?*

Unable to replicate our high-technology conventional forces, future adversaries may try to exploit our different cultural values by attempting to counter our non-nuclear strategic capability with weapons of mass destruction.¹² An oft-repeated lesson of the Gulf War by a retired Indian Army Chief of Staff—"don't fight the Americans without nuclear weapons"—may be indicative of a growing attitude about the need for RMA "deterrence."¹³ Likewise, the Russian military doctrine of 1993 eliminated the traditional Soviet "no first use" pledge for nuclear weapons, implicitly because of the "nuclear effects" demonstrated by the US conventional arsenal in the 1991 war.¹⁴ Thus our achievement of nonnuclear strategic leverage may, at some level of perceived capability, elicit the type of dirty warfare that we are explicitly seeking to avoid.¹⁵

- *Can our nation become psychologically dependent upon lightning victory?*

A major justification for our pursuit of a highly compressed war is the growing conviction within the military that the American public lacks the will to fight and win a protracted conflict.¹⁶ Although this is a useful position to justify trading force quantity for quality, such an argument, if repeated long enough, can become a self-fulfilling prophecy. Certainly doctrinal statements of America's lack of resolve are not lost on potential adversaries who may hope to attain future strategic victory (or at least avoid strategic defeat) simply by outlasting our attempted *coup de main*. The question then becomes

whether—having expended our high-tech arsenal to insufficient effect—this nation can suddenly reverse a psychological conviction that it lacks the will to fight on, even if our “vital” interests are at stake.

- *Will our strategic national interests become slaved to our military capability?*

A limited high-tech arsenal offering only one or two strategic engagements may become unusable—always being saved for the potentially more vital problem just over the horizon—or used too late in an enemy’s mobilization and force deployment to have the desired effect. Conversely, if this capability lives up to the promise of near infinite leverage at minimal cost, it will be useful everywhere. Thus the argument that our vital national interests are “those interests for which the United States is willing to fight” becomes truly circular; since we can fight for anything, everything becomes a vital interest that must be fought for.¹⁷ How then do we come to decide when *not* to intervene, and to justify our non-intervention? This need to define our national interests in terms of our national values may be the toughest challenge of all.

Conclusion: Military Means and Strategic Ends

The course of history should leave little doubt that the ongoing pace of technological change will culminate at some point in another military revolution. By definition, our failure to innovate and adapt successfully to this new regime of warfare will have potentially catastrophic consequences on some future battlefield. Our military will be facing some significant changes in the coming decades. We must be careful not to deter ourselves from profound innovation because of what might appear to be serious problems or challenges.

Nevertheless, the characteristics of the future battlefield are not predestined, but rather will depend upon specific choices that we and other nations will be making from an expanding array of technological, operational, and organizational options. Our pursuit of an increasing tempo of combat operations is not necessarily a bad choice, but at present it is being driven more by opportunity than necessity.¹⁸ What is important for us to remember is that the ultimate value of any innovation is measured by its success on the battlefield relative to the enemy, and many seemingly brilliant conceptions have failed miserably in that test. More important, as the German blitzkrieg revealed, the “goodness” of a military capability is ultimately determined by its contribution to the nation’s strategic goals and the success of the strategic outcome. That is indeed the criterion by which our exploitation of the ongoing military revolution must be measured.

NOTES

1. For recent discussions of the RMA, see for example Paul Bracken, “The Military After Next,” *The Washington Quarterly* (Autumn 1993); Jeffrey Cooper, *Another View of the Revolution in Military Affairs* (US Army War College, Strategic Studies Institute, 15 July 1994); James R. FitzSimonds and Jan M. van Tol, “Revolutions in Military Affairs,” *Joint Force Quarterly* (Spring 1994); and Andrew F. Krepinevich, Jr., “Keeping Pace with the Military Technical Revolution,” *Issues in Science and Technology* (Summer 1994).

2. General Gordon R. Sullivan has called tempo the "key" to battle command ("A New Force for a New Century," *Army* (May 1994)). The importance of battlefield tempo is central to all service doctrine. See for example TRADOC Pamphlet 525-5, Force XXI Operations, 1 August 1994, pp. 3-3 and 3-9; Air Force Manual 1-1, Vol II., *Basic Aerospace Doctrine of the United States Air Force*, March 1992, p. 149; and Naval Doctrine Publication 1, *Naval Warfare*, 18 March 1994, p. 35. Decisive action based upon nearly perfect, real-time knowledge is a formal goal of the *Defense Science and Technology Strategy* (DOD: Director, Defense Research and Engineering, September 1994) and programs such as the Integrated Airborne Reconnaissance Strategy of the Defense Airborne Reconnaissance Office (DARO) and the Advanced Research Projects Agency's (ARPA) War Breaker.

3. See TRADOC Pamphlet 525-5, p. 3-21, and Cooper, p. 30.

4. Cooper, p. 30.

5. The idea that increasing battlefield tempo will serve to merge the traditional levels of warfare has been noted by other analysts of the RMA. See Michael J. Mazarr, *The Military Technical Revolution: A Structural Framework* (Washington: CSIS, March 1993), p. 27; and Douglas A. MacGregor, "Future Battle: The Merging Levels of War," *Parameters*, 22 (Winter 1992-93), 42.

6. It is significant to note that the Air Force's *Gulf War Air Power Survey* questioned whether the problem of attaining strategic leverage by attacks on critical systems is even amenable to a technological solution. Eliot A. Cohen, director, *Gulf War Air Power Survey*, Vol. II, *Operations, and Effects and Effectiveness* (Washington: GPO, 1993), p. 370.

7. There is, as observers have pointed out, a critical difference between striking a target a day for a thousand days and striking one thousand targets in a day. The specific rate of attack necessary to "shock" an enemy system has never been clearly articulated. The first of the five Future Joint Warfighting Capabilities most needed by the US Combatant Commands is to "maintain near perfect real-time knowledge of the enemy and communicate that to all forces in near-real time" (*Defense Science and Technology Strategy*, p. 3). How near to real time we must be able to strike all enemy targets is not delineated. General Gordon Sullivan predicts a future decision cycle marked by action in "an hour or less" ("War in the Information Age," *Military Review* [April 1994], p. 47).

8. The number of critical targets that encompass a nation's strategic vulnerabilities continues to be a matter of speculation, and probably cannot be confirmed outside of wartime. Target estimates for even the same country vary by orders of magnitude.

9. A sobering lesson is offered by the "demodernization" of the German blitzkrieg on the Eastern Front in World War II. See Omer Bartov, *Hitler's Army* (New York: Oxford Univ. Press, 1992).

10. For example, the decreasing differentiation between military and civilian information technologies could make victory in a future war dependent upon "soldiers" like computer counterhacker Clifford Stoll in his self-described "uniform" of "grubby shirt, faded jeans, long hair, and cheap sneakers." Clifford Stoll, *The Cuckoo's Egg* (New York: Doubleday, 1989), p. 4.

11. The Army's Force XXI doctrine states that we must expect enemy preemptive strikes as a means to thwart our own high-tempo operations (TRADOC Pamphlet 525-5, p. 3-19).

12. There are those who maintain that any future RMA will not be a true revolution in warfare unless it specifically solves existing problems with weapons of mass destruction, terrorism, attrition warfare, etc. The position of this paper is that an RMA creates a new regime of warfare which may or may not offer solutions to existing military problems.

13. Patrick J. Garrity, *Why the Gulf War Still Matters: Foreign Perspectives on the War and the Future of International Security* (Los Alamos National Laboratory: Center for National Security Studies, July 1993), p. xiv.

14. The initial 1992 draft of the doctrine stated explicitly that conventional attack could elicit a nuclear response. See Charles Dick, "The Military Doctrine of the Russian Federation," *Jane's Intelligence Review*, Special Report No. 1, January 1994.

15. For a broader treatment of this issue, and the ultimate "disutility" of individual weapons, see Thomas J. Welch, "Technology Change and Security," *The Washington Quarterly* (Spring 1990).

16. Navy doctrine, for example, states that "rapid conclusion of hostilities is a key goal" because "protracted war can cause high casualties and unwanted political and economic consequences." (Naval Doctrine Publication 1, p. 35). The Air Force believes that we are entering an era in which "the American people will have low tolerance for prolonged combat operations and mounting casualties" (*The Air Force and U.S. National Security: Global Reach—Global Power*, A White Paper, June 1990).

17. For this definition of "vital" interests, see John H. Dalton, Admiral Jeremy M. Boorda, and General Carl E. Mundy, Jr., "Forward . . . From the Sea," Naval Institute *Proceedings* (December 1994), p. 46.

18. No high-technology threat presently requires an immediate US response. Moreover, the idea that we must acquire new capabilities to reduce both casualties and risk in future military action may stem more from folklore than fact. See Benjamin C. Schwarz, *Casualties, Public Opinion, and U.S. Military Intervention: Implications for U.S. Regional Deterrence Strategies* (Santa Monica, Calif.: RAND, 1994). Eliot Cohen is probably right in concluding that military officers are far more sensitive to casualties than is the American public ("What To Do About National Defense," *Commentary* [November 1994], p. 22.)