The New Military Revolution: Post-Industrial Change

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In a lecture delivered at Queen's University in Belfast in 1955, historian Michael Roberts argued that in the hundred years between 1560 and 1660, a number of critical changes and innovations had occurred in tactics, strategy, army size, and sociopolitical institutions, which taken together amounted to a "military revolution" in Early Modern Europe.[1] Roberts held that Gustavus Adolphus's combination of linear formations and improved firepower had revolutionized tactics, which in turn created fresh strategic possibilities. The broader range of strategic options then led to the need for large standing armies, which ultimately forced states to develop political and social institutions to oversee and supply them. Together, these changes wrought a revolution in the Early Modern style of waging war.

With its publication three years later, Roberts' lecture captured the interest of the historical community and excited further research into the nature and effect of military change in the 16th and 17th centuries.[2] Over the years a number of historians of Europe's Early Modern period, notably Geoffrey Parker and J. R. Hale, have modified and added to Roberts' original thesis.[3] Despite these changes, however, Roberts' basic argument has stood the test of time.[4]

In a similar manner, contemporary soldiers and scholars are struggling to appreciate the significance of the Persian Gulf War in terms of its critical tactical, strategic, and sociopolitical aspects and its impact on future wars. Simply put, the question has become whether the Gulf War represents a new style or form of warfare and, if so, what effect this new style of warfare is likely to have on future warfighting. At the heart of this question lies, once again, the issue of military change.

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Given all the baggage associated with the term "new," it is not surprising that military professionals have become divided over the question of the Gulf War's newness. If one claims, for example, that the Gulf War was new, the issue quickly becomes: New in what sense? Radically new? New in kind, or merely new in degree? Even a cursory glance at the wars of the industrial age—World War II, Korea, the 1948-1973 Arab-Israeli wars, and the Iran-Iraq War—reveals many changes in military capability: precision-guided munitions, near real-time battle management, vastly more steel on target in shorter times, and the critical role of space satellites, to mention just a few. To be sure, a new historical era—whether it is called the "Post-Industrial Age," the "Space Age," the "Computer Age," or the "Age of the Electronic Revolution"—has begun to replace the low-cost, mass-production-oriented industrial age which influenced warfighting up to the 1960s and early 1970s.[5] But the question remains, in what sense have these changes affected current warfighting?

On the one hand, proponents of the view that "the Gulf War equals New War," cite the dramatic effectiveness of new technology introduced by the US-led Coalition forces which greatly enhanced the speed, accuracy, and intelligence of military operations in the Gulf. This, they claim, was the decisive element in the Gulf War and has radically altered the course of future warfighting.[6]

On the other hand, much of the technology applied in the Gulf War was, in fact, *not* new: M113 armored personnel carriers and M60A3 tanks dating from the 1960s and 1970s complemented 1980s-vintage M2 Bradleys and M1A1 Abrams; 1950s-era B-52Gs and F-4G "Wild Weasels" (1960s-vintage airframes packed with 1980s electronics) abetted the latest F-117As. No one can deny that the older technology (especially in the case of the B-52Gs and F-4Gs) made vital contributions to the Coalition victory. Furthermore, the newer technology had significant problems: intelligence estimates and bomb damage assessment, despite the numbers of high-tech machines involved, left a lot to be desired. Likewise, relatively primitive SCUD launchers avoided detection by advanced systems and created a number of embarrassing situations for the Coalition leadership. Perhaps, then, the effect of this

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new technology, while not insignificant, has been exaggerated by the skewed arguments of post-industrial technocrats.

But criticism of the New War thesis does not stop with the issue of overlapping or over-hyped technology. Desert Storm's plan of maneuver does not greatly differ in spirit or concept from that used by Robert E. Lee in turning Joseph Hooker's flank at Chancellorsville in 1863. In both cases the victor distracted the loser by encouraging him to continue believing what he already wanted to believe, and then knocked him out with a left hook. New weapons and technology may be available to fight wars, but have they really changed the *way* we fight?

We believe they have. The inevitable overlap between old and new weaponry, the identification of bugs in experimental weapon systems and operating procedures, and the persistence of old maneuver schemes in military thought, particularly when new approaches are still maturing, do not weaken the case for a new style in warfighting. Military change, like most change, occurs in increments or stages rather than all at once—old and new tactics and technologies coexist for indefinite periods until the sea change from one to the other is complete. Pinpointing when that sea change occurs is much like searching for the proverbial needle in the haystack—difficult and unproductive; thus, we will not attempt to do that.

We believe that modern warfighting is, and has been, undergoing a revolution which, in its nature and impact, parallels that described by Michael Roberts in his 1955 lecture. The groundwork for this current revolution existed before the end of the industrial age, dating back to the union of science and military thought in the form of operational research during World War II. While soldiers have long sought to apply scientific advances to military problems, it was not until the war against Germany, Italy, and Japan that the scientific approach to problem-solving became standard.[7]

The categories of the Roberts thesis—tactics, strategy, army size and composition, and sociopolitical impact—provide the necessary framework for assessing the newness and significance of military change in this, the post-industrial age. In using this framework, however, we do not mean to suggest that a one-to-one correlation exists between the military terminology of Gustavus's day (particularly the definition of strategy) and our own. Our purpose is merely to show that dramatic changes in the field of technology and tactics have spiraled upward, forcing significant, even revolutionary, changes at all levels of warfighting.

Technical and Tactical Innovations

The Early Modern military revolution began with the military reforms inaugurated by Maurice of Nassau during the 1590s. Maurice developed a system of linear formations, discipline, drill, and volley fire based on classical

Roman methods which made his army more efficient and his command and control more effective.[8] Since Maurice never won great battles, however, Michael Roberts concluded merely that while his reforms "were great innovations, [they] were a revolution that stopped half-way. . . . It was left to Gustavus Adolphus to remedy most of the defects of Maurice's system."[9]

Gustavus's numerous technical and tactical innovations during the Thirty Years War—the union of pike and musket; the perfection of the salvo; the development of lighter, more maneuverable field artillery; and the use of smoke and suppression in the attack—constitute the second aspect of Roberts' military revolution in tactics. These tactical and technical innovations brought the Swedish king a number of hallmark battlefield victories, notably those of Breitenfeld and Lützen, where he combined "firepower and shock as nobody had been able to do since firearms replaced bows."[10]

Similarly, the precision targeting capability of post-industrial weapon systems like the M1A1 tank, and precision-guided munitions like the Tomahawk, the Copperhead, and the numerous variations of glide bombs, combined with the expanded volume of delivery possible with weapons like the Army Tactical Missile System (ATACMS) and the Multiple Launch Rocket System (MLRS) with their Dual-Purpose Improved Conventional Munitions warheads, have pushed firepower beyond anything imaginable in the industrial age, excepting nuclear weapons. Add to this the greater lateral and vertical mobility now possible with aerial troop insertions, the increased speed and mobility of ground and air units, and the enhanced capability to direct and control fires across the breadth, depth, and height of the modern battlefield, and one can see that shock, too, has clearly surpassed the limitations of industrial-era technology. This is particularly true of the ability to attack the enemy's brain and central nervous system—his command, control, and communications network—which has the effect of paralyzing him and rendering his numbers irrelevant. The impact of post-industrial technology on tactics means, therefore, that one can now attack throughout the depth of the battlefield simultaneously, with ever-increasing precision and enhanced lethality.[11]

Yet, dramatic as they are, these technical and tactical innovations do not in themselves herald the arrival of a new style or method of warfighting. To meet the criteria for a Roberts-style military revolution, these innovations must affect the strategic, force structure, and sociopolitical realms of warfighting as well.

Strategy

According to Roberts, Gustavus's technical and tactical innovations brought "battle again into favour . . . and with it strategy aiming at battle."[12] The concept of strategy began to expand gradually from the relative myopia prevalent in the limited punitive wars of feudal princes to a grander view,

encompassing any number of larger armies using all of central Europe as a theater of operations. Within this broader vision of strategy, Gustavus succeeded in combining two relatively independent strategic forms which complemented his technical and tactical innovations: (1) "a resolute offensive strategy designed to annihilate the enemy in battle—the product of confidence in the superiority of the new Swedish tactics"; and (2) "a wholly new gradualist strategy, designed to conquer Germany by the occupation and methodical consolidation of successive base-areas."[13] The impetus which Gustavus provided to strategic thinking thus enabled strategy to evolve into a dual form, combining an enemy-oriented approach, designed to defeat the enemy's armed forces, with a terrain-oriented one, having the aim of capturing key regions within the enemy's area of influence.

Similarly, post-industrial technology has opened new horizons for strategic thinking. Our strategic repertoire now includes the ability to execute spontaneous, rapid, and highly synchronized power-projection missions virtually anywhere in the world. Smaller yet highly lethal force packages may now converge on a single point from any number of cardinal directions, thereby effecting an extraordinarily potent global envelopment.[14] While the impact of post-industrial technology on tactics, especially regarding precision-guided munitions, was widely recognized in the late 1970s and early 1980s, the impact on strategy was not.[15] Thanks to the increased shock effect, precision, and lethality of post-industrial weaponry, punitive wars—the air strike against Libya, the invasions of Grenada and Panama, and the recent war against Iraq—offer high-intensity, short-duration response alternatives to political and military decisionmakers.[16]

This heightened degree of accuracy and swiftness of execution means that policymakers have more flexibility in terms of the specific military responses available in crisis situations—they are less constrained because collateral damage promises to be minimal and conflict duration promises to be short. For instance, a punitive strike against a country's infrastructure—bridges, pipelines, telecommunications centers, or power facilities—while keeping civilian and friendly casualties minimal, is now a possibility. Thus a third strategic form—an infrastructural strike—now augments the previous two: annihilation of the enemy and occupation of his terrain. In short, the greater speed, knowledge, and precision possible with post-industrial technology have enlarged the array of responses available to strategic thinkers as well as revolutionizing the means of carrying them out.

Army Size and Composition

The technical and tactical innovations of the 16th and 17th centuries, combined with a broadening concept of strategy, led to a marked increase in the size and composition of the armies needed to wage war. Again quoting

Roberts, "Men, no less than money, became in the seventeenth century the sinews of war."[17] With the need for larger armies, states looked for alternatives to the costly and unreliable mercenary forces already at their disposal. Despite the fact that militias were generally considered incapable of mastering the more involved military techniques of the day, Gustavus's victories proved that conscript national militias were not only "better than any mercenaries; they were also incomparably cheaper."[18]

In contrast to the industrial age, however, size is less important in the post-industrial era than army composition and quality. Post-industrial armies require more specialization among all branches of the armed forces—in sophisticated weapon systems, higher soldier skill levels, and more intellectually demanding tasks—than their industrial-age counterparts. Thus, post-industrial force structure will reflect a more technologically elite, more professional, and more expensive army than that of the industrial age. True, as the Viet Cong and Afghan mujaheddin have shown, ill-equipped and poorly trained forces can still give fits to modern armies in certain contexts. But in conventional war, the trendlines validate the post-industrial concept of a sophisticated force.

Over the centuries, military thinkers have searched for ways to reduce the chance, fog, and friction of war—to maximize those elements which contribute to victory and minimize those which confound it. Computer technology, with its unlimited capacity for data processing and comparative analysis, promises to reduce the chance and uncertainty in war. In short, computer analysis seeks to replace Caesar's augury, Montecuccoli's blend of science and mysticism, Von Bülow's enlightenment formulas, Clausewitz's *coup d'oeil*, and Von Mellenthin's *Fingerspitzengefühl*.[19] But despite our efforts to reduce war to a science, the enduring elements of chance, friction, and fog will likely conspire to keep it from becoming that. We must retain the military art to help us fill in those gaps not addressable by science and technology.

Additionally, post-industrial computer technology has revolutionized how armies train and practice for war, allowing operational and tactical situations to be developed and tested more rapidly than ever before. War game simulations steadily reflect greater realism, including simultaneous actions and the logistical constraints which keep the exercise grounded in empirical reality. Furthermore, computers can now create realistic training environments (like those of the Army's Conduct-of-Fire-Trainers, or better still, the computer graphics systems which allowed Desert Storm pilots to "fly" their attack missions before suiting up for combat). Such training advances, peculiar to the post-industrial era, enable us to explore an infinite number of "What if?" scenarios simultaneously so that we may commit our expensive personnel and equipment only at the appropriate place and time.

In the post-industrial era, special military units and organizations (the combined training centers at Forts Irwin and Chaffee and at Hohenfels,

Germany, and the Concepts Analysis Agency, for example) exist solely for the purpose of developing and operating such war-gaming products as the National and Joint Readiness Training Centers, the Army Training Battle Automation Simulation System, and the Battle Command Training Program. Such additions to training methodology are here to stay. Post-industrial armies require a larger pool of on-hand, performance-oriented, high-IQ soldiers; future military leadership will need a greater awareness of the role and importance of ever more demanding training at the cutting edge. But such changes also have a far-reaching sociopolitical effect on the US military's Total Force amalgam of active and reserve components. Because of the frequent parallels between civilian work and military duties, combat support and service support units will have fewer problems staying trained-up on their skills. However, given the amount of training necessary to become and remain proficient at current warfighting standards, the part-time (though dedicated and first-rate) training of the combat arms components of the National Guard and Reserve may prove insufficient. The "Johnny get your gun" era—with its implication that there will be time for training after the troops are assembled—is virtually over, and the age of come-as-you-are war is now upon us.

Sociopolitical Impact

The revolutionary tactical, strategic, and force structure transformations which occurred during the 16th and 17th centuries also left a profound mark on the sociopolitical institutions of that era. By the 17th century, war had changed from the occupation of a privileged class to—with little exaggeration—"the livelihood of the masses."[20] Warfighting offered economic prospects to all social classes—more people participated in it, either directly as combatants or indirectly as secretaries, administrators, financiers, entrepreneurs, or speculators. War had become a business. Entrepreneurs and financiers, who controlled the economic assets necessary to wage war, posed a threat to states who had to traffic with these intermediaries (and pay exorbitant fees) to secure uniforms, arms, and equipment. The final aspect of the Roberts' style military revolution, then, was the creation of sociopolitical institutions that effectively wrested control of economic assets away from war profiteers and placed them in the hands of the state. In short, by the end of the Early Modern military revolution, the state had achieved greater control over the ways and means of waging war.

But with the advent of post-industrial technology, this relationship may be in doubt. While post-industrial contributions to warfighting have made it more complex, threatening to return war to the occupation of a privileged few, its contributions in non-military spheres have provided civilian populations with constant and near real-time access to war information (or disinformation). Thus, while direct participation in war is limited, indirect participation as a

result of the global communications network, the spread of fax machines, cellular telephones, modems, portable video cameras, satellite uplinks, continuous-news broadcasts, and the seemingly inescapable barrage of video images, is inescapable. In contrast, civilian populations of the industrial era received news from the front via letters, daily newspapers, weekly or biweekly newsreels, or evening radio broadcasts. In that era governments could rely on their censors and on the slow speed of communications to control access to information, which made political decisions "history" by the time citizens learned of them. That's no longer so. Indeed, it is likely that future viewing audiences around the world will be able to bypass censors entirely and quickly see the results of policy decisions. Thus governments can no longer assume their activities will remain hidden.

In the Clausewitzian "Trinity" (the state, the people, and the armed forces), the state has traditionally held the initiative and provided leadership to the whole, directing the use of force while seeking to retain popular support. Now, with the people often getting information as fast as the decisionmakers, it is becoming more difficult for political leaders to lead their constituencies. Policies and government, especially in fast-breaking situations, become reactive, following the course of events rather than directing them. In short, further developments in the global-news network are likely to result in a corresponding loss of concealment and reaction time for policymakers as the contents of "secret" meetings and treaties (not to mention battlefield results) are brought out into the open. In addition, information seems addictive: the effect of modern communications technology on civilian populations is to make them more eager, not less, for information.

Likewise, the proliferation of space-based sensors, such as the French SPOT imaging satellite, means that all states will eventually be able to observe what potential or actual enemies are up to. (Israel and India have orbited satellites in recent years, while the European Space Agency's facility in South America is available for launching other nations' cargos into space.) Consider the possible outcome of the Falklands conflict had Argentina been able to track the British task force steaming south, or of the 1967 Arab-Israeli War if Egypt had had real-time imagery of Israeli airbases as early as 1 June 1967. Granted, real-time imagery avails little without the means to attack the targets disclosed, but lack of concealment nonetheless undermines the element of surprise.

Since concealment at all levels is becoming more difficult to achieve, deception and disinformation will naturally become more important. For the military planner and leader, this means that accurate intelligence will assume a greater priority than it already holds: having a faster cycle within which to reach and implement decisions is useless if one's actions are based upon false or insufficient information. It may be time to make the need for serviceable intelligence one of the US Army's Principles of War.

A Cautionary Note

As the industrial age's reliance on mass armies gives way to the increased specialization and precision of the new era, the Achilles' heel of post-industrial warfare will remain "the people's war." As briefly noted earlier, the strategy employed by Mao Tse-tung and Ho Chi Minh raises a difficult question: How does a high-tech army win against a "people's" army? If individuals are willing to fight to the death in a people's or holy war, professional armies face a prolonged contest of wills in which sophisticated equipment and better training may not be enough for victory. Douglas Pike summed up this problem concisely: "No democratic society . . . can fight a fifty-year war."[21] Current American defense strategy as well as US Army doctrine must address the issue of waging a limited war, or undertaking a power-projection mission, against an enemy willing and able to fight a total war.

There are other problems incident to this new style of warfighting. Perhaps the most serious is that war as an instrument of policy might come to be seen as something other than the last resort it should remain. The greater precision of weapons, the wider array of options available, and the swiftness with which they can be implemented may tempt leaders to choose war when some other option might also be workable (if harder). The greater control and precision afforded by post-industrial technology may, therefore, be a two-edged sword, ultimately injurious to both military and political aims.

Future wars will no doubt differ from the Gulf War: nuclear, biological, or chemical weapons can always enter the picture; further technical and tactical advances will occur; different geographic, social, and political circumstances will come into play. New and old warfighting styles and weaponry will continue to overlap. But the technologies which have increased the precision and speed with which war is waged, as well as the expertise required to wage it, are here to stay. Our ability to capitalize on our head start in the current military revolution will continue to be limited by cost and by the fact that military revolutions spread rapidly and follow unexpected trajectories. At some point, we will inevitably confront on the battlefield our own technological and doctrinal innovations. What will we have learned by then? What additional improvements will we have made in our own style of warfighting? Whatever future benefits the new era of warfighting holds, the luxuries of complacency and self-sufficiency are not among them.

NOTES

1. Michael Roberts, "The Military Revolution 1560-1660," *An Inaugural Lecture delivered before the Queen's University of Belfast* (Belfast: M. Boyd, 1956).

2. The lecture was printed in G. N. Clark, *War and Society in the Seventeenth Century* (Cambridge, Eng.: Cambridge Univ. Press, 1958).

3. Geoffrey Parker, "The Military Revolution, 1550-1660—A Myth?" *Journal of Modern History*, 47 (1976), 195-314; Michael Duffy, ed., *The Military Revolution and the State 1500-1800* (Exeter: Univ. of

Exeter, 1980); J. R. Hale, *War and Society in Renaissance Europe 1450-1620* (New York: St Martin's Press, 1985).

4. Geoffrey Parker's most recent contribution to the subject, which compares the military revolution in the West with that in the East, acknowledges his debt to Michael Roberts. See his *The Military Revolution: Military Innovation and the Rise of the West, 1500-1800* (Cambridge, Eng.: Cambridge Univ. Press, 1989).

5. We use the term post-industrial to encompass the variety of technologies based upon the microprocessor, whether space, computer, or electronically oriented, which have emerged since World War II.

6. See, for example, Alvin and Heidi Toffler's seminal article, "War, Wealth, and a New Era in History," *World Monitor*, May 1991, pp. 46-52, which provided the inspiration for this essay. The Tofflers link history's changing forms of warfare with contemporaneous changes in economic structures. While this approach is fundamentally sound, it fails to address transitional forms of warfare and omits conceptual changes in warfighting introduced by Gustavus Adolphus, Napoleon Bonaparte, and others.

7. Indicative of this trend was British professor P. M. S. Blackett's comment during World War II on the value of operational research: "Relatively too much scientific effort has been expended hitherto in the *production* of new devices and too little in the proper *use* of what we have got." Quoted in Samuel Morison, *The Two Ocean War* (Boston: Little, Brown, 1963), p. 125.

8. For a discussion of the role and significance of the Roman example and its influence on Maurice of Nassau, see Hans Delbrück, *The History of the Art of War, Volume IV: The Dawn of Modern Warfare*, trans. Walter J. Renfroe, Jr. (Lincoln: Univ. of Nebraska Press, 1985), pp. 155-68.

9. Roberts, pp. 7-8. But see Maury D. Feld, *Structure of Violence: Armed Forces as Social Systems* (London: Sage Publications, 1977), p. 19, and Gunther E. Rothenberg "Maurice of Nassau, Gustavus Adolphus, Raimondo Montecuccoli, and the 'Military Revolution of the Seventeenth Century,'" in *Makers of Modern Strategy: From Machiavelli to the Modern Age*, ed. Peter Paret with Gordon Craig and Felix Gilbert (Princeton, N.J.: Princeton Univ. Press, 1986), pp. 32-63.

10. Roberts, p. 8.

11. Throughout most of history, the political effects of battle had to percolate upwards from the tactical to the national strategic level. Moreover, these effects were not always decisive. Marlborough won a major victory at Blenheim in 1704, for example, but France fought on for nine more years. Now we can strike simultaneously at the tactical, operational, and strategic levels; and while decisiveness is still determined by a number of factors outside of battle, this revolutionary increase in capability across the spectrum of war makes a quick decision more likely.

12. Roberts, p. 13.

13. Ibid.

14. Carl E. Vuono, "National Strategy and the Army of the 1990s," *Parameters*, 21 (Summer 1991), 2-12.

15. One who foresaw the tactical significance of PGMs was Freeman Dyson, whose comments regarding PGMs as an alternative to tactical nuclear weapons holds equally well for their impact at the strategic level: "The computer revolution is chipping away at the supremacy of nuclear weapons, providing the technological foundations for a world in which weapons of human scale and purpose take the place of weapons of mass destruction." Freeman Dyson, *Weapons and Hope* (New York: Harper and Row, 1984), p. 51.

16. Bomb accuracies are revealing. In 1941, Britain's Bomber Command dropped only 20 percent of its bombs within five miles of their target during night attacks; in 1991 US F-117A fighters amazed the world by their pinpoint deliveries in the dark, as in a videotape of a bomb entering the Iraqi air headquarters ventilation shaft. On the ever-increasing accuracy of weapons, see Alfred Price, *Battle over the Reich* (New York: Scribner, 1973), p. 97; Anthony Verrier, *The Bomber Offensive* (New York: Macmillan, 1968), pp. 195, 285, 321; James F. Dunnigan and Austin Bay, *From Shield to Storm: High-Tech Weapons, Military Strategy, and Coalition Warfare in the Persian Gulf War* (New York: William Morrow, 1992), p. 180; Norman Friedman, *Desert Victory: The War for Kuwait* (Annapolis, Md.: Naval Institute Press, 1991), pp. 324-39; and, Anthony Cordesman and Abraham Wagner, *The Lessons of Modern War, Volume I: The Arab-Israeli Conflicts, 1973-1989* (Boulder, Colo.: Westview Press, 1990), particularly pp. 350-55.

17. Roberts, p. 15.

18. Ibid., p. 18.

19. On the development of military thought up to Clausewitz, see Azar Gat, *The Origins of Military Thought from the Enlightenment to Clausewitz* (Oxford, Eng.: Clarendon Press, 1989). For further details on Von Mellenthin's *Fingerspitzengefühl*, see "Generals Balck and von Mellenthin on Tactics: Implications for NATO Military Doctrine," Technical Report, *Defense Nuclear Agency*, 19 December 1980 (Alexandria, Va.), p. 21.

20. Roberts, p. 23.

21. Douglas Pike, *PAVN: People's Army of Vietnam* (Novato, Calif.: Presidio Press, 1986), p. 252.