CHAPTER ONE

Introduction

In the second half of the twentieth century, high technology became the defining characteristic of the American way of war. It is certain to remain central to U.S. defense policy in the twenty-first century as well. American military personnel are also outstanding. But it is their juxtaposition with the world's best defense technology that has created the finest military force in history.

High technology has not always been such a central ingredient in U.S. defense strategy. In the world wars, it was less the caliber of U.S. military technology than its sheer quantity that provided the raw material for victory. To be sure, that quantity was itself a function of American technological supremacy in the form of mass-production industry. But after World War II, U.S. defense strategists placed primary emphasis on ensuring that American military equipment would be of superior quality.

This transformation occurred gradually. In Vietnam, U.S. forces benefited from a wide array of new defense systems, ranging from helicopters to satellites to high-performance jets to laser-guided bombs. But the emphasis remained on massing weaponry and firepower. Not until the invasion of Panama in 1989 and Operation Desert Storm in 1991 was the transition to a high-tech American military truly complete.

In a broader sense, however, no such transition can ever be considered complete. Technology is constantly advancing—particularly in a world that is systematically organized to conduct scientific and engineering research on a large scale. The armed forces of a country, such as the United States, that depends heavily on technology must innovate constantly in order to stay ahead. In addition, as has been underscored by the tragic U.S. experi-

ence in Somalia in 1993, inconclusive aerial attacks against Iraq in 1998, the human cost for Kosovar Albanians of the long—if ultimately successful—NATO air war against Serbia in 1999, and the vulnerabilities of modern societies to missile and terrorist attack, our technological edge has its limitations even today.

With these historical trends and future policy challenges in mind, many American defense analysts have recently posited that a revolution in military affairs (RMA) is either under way or within reach and that the United States needs to be aggressive about pursuing it. Likening this time in geopolitics and military history to the 1930s or early 1940s, they see great potential for radically new military hardware and operational concepts—as well as great dangers if another country transforms its forces and realizes the revolution's promise before we do.

As discussed further in chapter 2, there are many different visions of what a contemporary revolution in military affairs should entail and how the United States should try to usher it in. It would be wrong to imply that all those who promote the RMA concept have the same idea of what it means today. Nonetheless, a common definition of the purported RMA is emerging, based in large part on how the Pentagon—now an official convert to the RMA concept—has chosen to define the term. Former chairman of the Joint Chiefs of Staff John Shalikashvili's *Joint Vision 2010* report and the subsequent 1997 Quadrennial Defense Review conducted under Defense Secretary William Cohen have figured prominently in the effort to define a contemporary RMA. Most notable are the goals these documents set out for U.S. military forces a decade into the twenty-first century: that they possess "dominant battlefield knowledge," "full-dimensional protection," "dominant maneuver," and "precision strike" ability from long distances. But what do these terms really mean? My understanding of the *Joint Vision 2010* RMA hypothesis, and those of similar schools of thought, is that they accept the following specific technological premises:

—First, improvements in computers and electronics will make possible major advances in weapons and warfare—most notably in areas such as information processing and information networks but also in communications, robotics, advanced munitions, and other technologies.

—Second, sensors will become radically more capable, in effect making the battlefield "transparent."

—Third, land vehicles, ships, rockets, and aircraft will become drastically lighter, more fuel efficient, faster, and more stealthy, making combat forces far more rapidly deployable and lethal once deployed.

—Fourth, new types of weaponry—such as space weapons, directed energy beams, and advanced biological agents—will be developed and widely deployed.

They also posit two sweeping conclusions:

—First, if properly exploited and integrated into military organizations, tactics, and concepts of operations, these technical trends can soon add up to a revolution in military affairs that will constitute the greatest advances in warfare since the advent of blitzkrieg and aircraft carriers in the 1930s and nuclear weapons in the 1940s.

—Second, U.S. adversaries, even if considerably less technologically sophisticated and wealthy than the United States, will also benefit from this contemporary RMA. Notably, they will acquire and learn to make good use of advanced precision missiles, satellites, antisatellite weapons, advanced mines, weapons of mass destruction, and computer viruses—and thus be able to challenge U.S. operations much more than Iraq did in Operation Desert Storm or Serbia did in Operation Allied Force. They are particularly likely to exploit the U.S. military's dependence on large bases, ships, and other vulnerable assets when projecting power overseas, as well as Americans' aversion to suffering casualties. As a result, the United States needs to seek radically new military concepts to overcome these challenges to its military supremacy and indeed its basic security.

A major contention of this book is that, while the first technological premise of the RMA hypothesis is essentially correct, the second and third are incorrect or at least badly overstated by their proponents. The fourth premise is less easily evaluated at this point, but there are ample grounds for skepticism.

Most mechanical technologies that are central to military systems have not been changing as fast as electronic and computational technologies; nor are they likely to do so in the first couple decades of the twenty-first century. In addition, although some types of sensors will improve substantially through a variety of engineering advances, their potential will generally remain limited by basic laws of physics and by an enemy's ability to take advantage of countermeasures as well as the cover provided by natural and civilian backgrounds.

As for the broad conclusions, these technological realities and trends suggest that any contemporary revolution in military affairs, should one prove possible, would have to be driven by developments in a fairly narrow subset of major defense technologies. One cannot rule out an RMA on these grounds alone. But they do suggest that the likelihood of an RMA

is less, and the probable speed and scope of any near-term revolution less sweeping, than proponents commonly admit—particularly for the types of conflicts that seem most likely to involve the United States in coming decades.

The second conclusion is more persuasive, if only because the history of warfare is about enemies trying to bypass each other's strengths and exploit each other's vulnerabilities. It is only natural that potential and actual U.S. adversaries will try to make widespread use of new technology themselves, and that—given their (generally inferior) means—they will do so in asymmetric ways, attempting to exploit specific U.S. vulnerabilities rather than defeat the American armed forces head-on in combat. However, enemies of the United States will not be able to achieve these asymmetric capabilities as easily as some RMA believers suggest. Nor will the best U.S. response to such enemy capabilities always require radically new high technology, as RMA believers tend to argue. Nor will radically new technologies always be achievable, even if the United States tries to develop them.

This book is not only an assessment of the contemporary RMA hypothesis. It is also intended as a more specific analysis of how the American military should acquire defense technology in the years ahead. Whether one believes a revolution is under way—and hence whether one believes the basic structure, equipment, and operational concepts of the U.S. armed forces must be radically overhauled soon—it is true that future decisions about weaponry and warfighting are of major importance for American security. The country must determine how much to spend on defense, how many resources to put into weapons modernization, and how to apportion those modernization resources between technological research and development (R&D) on the one hand and weapons procurement on the other.

When the issue is put in these terms—which are more pragmatic and less heady than RMA proponents generally prefer—it becomes very clear how important it is to determine which of the four RMA technological premises are correct. If, as I contend, the technologies undergirding most types of military vehicles and major weapons platforms are not advancing at revolutionary rates, it does not make sense to rapidly replace or transform these vehicles and platforms wholesale. Defense modernization can instead focus largely on R&D, war gaming and experimentation, and a targeted and relatively economical procurement strategy. Moreover, this modernization effort can probably be afforded, even at current defense budget levels, without reducing U.S. military operations in Korea, the Persian Gulf region, Bosnia, Kosovo, and the vicinity of the Taiwan Strait.

If there is indeed to be a contemporary revolution in military affairs, a great number of new technologies, warfighting concepts, and organizational innovations are still required to make it possible. A radical transformation may ultimately be appropriate, but it is too soon to know this—and certainly too soon to carry it out by radically reshaping the military and reequipping it essentially from scratch. The early years of the twenty-first century are thus more akin to the 1920s than the 1930s, to echo Pentagon Director of Net Assessment Andrew Marshall and Commandant of the Marine Corps James Jones.[1] In fact, the first decade or two of the twenty-first century might be most akin to the last five of the twentieth century, when the United States systematically pursued defense innovation and a gradual, yet very real, military transformation without adopting a strategy for doing so urgently.

This study's primary focus is the sphere of traditional warfighting. Subjects such as homeland defense and strategic information warfare are touched upon as well; however, this book emphasizes the arena of combat in which countries attempt to defeat each other's main military forces—and most notably each other's conventional military forces. That said, it is not only about large-scale combat that features heavy weapons, but also about urban and forest warfare, humanitarian intervention, peace operations, and other missions that may play less directly to U.S. military strengths.

This book begins with an overview of the RMA hypothesis and a brief historical sketch of past revolutions in military affairs. The rest of the book falls into three main substantive sections.

Chapters 3 and 4 survey trends in key areas of military technology. Not only computers and communications equipment, but also various types of sensors as well as military vehicles and weapons are considered. RMA literature to date has generally failed to provide such a systematic assessment of where defense technology is headed; instead, it has based its reasoning largely on anecdotes or selective use of statistics on computer and modern electronics systems advancements. This section provides the basis for evaluating the validity of the four RMA technological premises.

Some will object to my technology-oriented methodology, claiming that revolutions in military affairs are less accidents of invention than the pur-

1. See Jay Winik, "Secret Weapon," *Washingtonian,* vol. 34 (April 1999), p. 48; J. L. Jones, Marine Corps Operations Deputy to the Joint Chiefs of Staff, "Memorandum for the Director of the Joint Staff: Evaluation of Service RMA Activities," PLN MCODM 001-97, January 13, 1997.

poseful creations of military establishments. Although they are largely right on the latter point, technology has been an essential ingredient in most RMAs. For example, at least one major development in weaponry contributed centrally to each of the ten major military revolutions since 1300, as identified by Andrew Krepinevich.[2] Moreover, most who argue that an RMA is afoot or within reach today begin their case with reference to recent radical leaps in the power of computers and electronics, often claiming to be able to extrapolate those trends to other areas of defense technology.

In chapter 5 (the second section), the technological prognostications of chapters 3 and 4 are integrated to examine the implications of future military technology for various types of warfighting scenarios. This chapter also puts forth a broad verdict on the RMA hypothesis, accepting parts of it but disputing others, and arguing against the most sweeping policy prescriptions of its proponents.

Chapters 6 and 7 (the third and final section) consider the policy implications of evolving defense technology. They consider security issues such as U.S. requirements for overseas military bases in the early twenty-first century and the future of multinational military operations. They also offer prescriptions for Pentagon budgeting. I argue that near-term defense investment can be discriminating and patient, emphasizing systems that make particularly high use of electronics, computers, and advanced communications systems rather than major weapons platforms and vehicles. Scientific progress is most rapid in the spheres of electronics and computers. RMA proponents are right about the remarkable trends in these areas, even if they are often wrong to suggest that other areas of defense technology are advancing almost as fast. Therefore, with this investment strategy, the Pentagon can achieve considerable improvements in military capability at modest cost, allowing the nation to keep defense spending at current levels without having to sacrifice current military operations or skimp on research aimed at the future.

The Pentagon should sustain vigorous R&D and experimentation activities. Someday those activities, and the technologies and new warfighting concepts they produce, may convincingly argue for a major overhaul of the U.S. military. We cannot yet know if that will be the case. But we can be confident that there is not a compelling case for immediate and wholesale transformation at the turn of the century.

2. Andrew Krepinevich Jr., "Cavalry to Computer: The Pattern of Military Revolutions," *National Interest,* no. 37 (Fall 1994), pp. 30–42.