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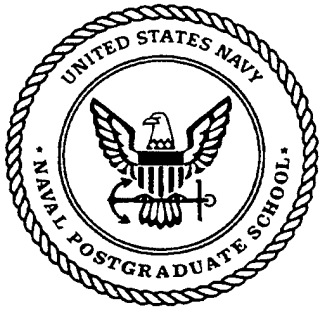

THESIS

NUCLEAR WEAPONS AND THE REVOLUTION IN MILITARY AFFAIRS

by

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June 2000

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13. ABSTRACT *(maximum 200 words)* Much of the discussion surrounding the Revolution in Military Affairs (RMA) presupposes that modern weapons will be able to locate and strike targets over great distances with a degree of precision that eliminates the need to retain nuclear warheads. The widespread notion that U.S. conventional weapons can replace nuclear weapons for all operational and deterrence purposes is ill-founded. Nuclear weapons will continue to play an indispensable role in U.S. national security policy. Indeed, the primacy of nuclear weapons may actually increase, in spite of the RMA, in three important ways: as a hedge against shortcomings in conventional weaponry; as a means to deter or counter advanced conventional weaponry; and as political-military instruments that, due to more advanced designs, may become more usable. Today, the U.S. armed forces have a commanding advantage in military capability, at least in some circumstances; but it is far from clear that this advantage will be sustained over the long term. Choices influenced by assumptions about the RMA will determine how U.S. forces are armed and prepared to fight for years to come. These choices should take into account the continuing significance of nuclear weapons in international security affairs.

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NUCLEAR WEAPONS AND THE REVOLUTION IN MILITARY AFFAIRS

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ABSTRACT

Much of the discussion surrounding the Revolution in Military Affairs (RMA) presupposes that modern weapons will be able to locate and strike targets over great distances with a degree of precision that eliminates the need to retain nuclear warheads. The widespread notion that U.S. conventional weapons can replace nuclear weapons for all operational and deterrence purposes is ill-founded. Nuclear weapons will continue to play an indispensable role in U.S. national security policy. Indeed, the primacy of nuclear weapons may actually increase, in spite of the RMA, in three important ways: as a hedge against shortcomings in conventional weaponry; as a means to deter or counter advanced conventional weaponry; and as political-military instruments that, due to more advanced designs, may become more usable. Today, the U.S. armed forces have a commanding advantage in military capability, at least in some circumstances; but it is far from clear that this advantage will be sustained over the long term. Choices influenced by assumptions about the RMA will determine how U.S. forces are armed and prepared to fight for years to come. These choices should take into account the continuing significance of nuclear weapons in international security affairs.

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EXECUTIVE SUMMARY

As the United States enters the twenty-first century, technology will play a greater role in how America's armed forces are structured and outfitted for battle. The official consensus among many U.S. government officials, military leaders, scholars, and defense contractors is that the United States is embarked upon a Revolution in Military Affairs (RMA). Much of the discussion surrounding the RMA presupposes that technology will alter the way the United States fights its battles. This notion is linked to the belief that the weapons most characteristic of the new methods of warfare will be able to locate and strike targets over great distances with a degree of precision that eliminates the need to retain nuclear warheads.

Optimism about the possibilities presented by the RMA suggests that many of its supporters believe that non-nuclear technology may offer solutions to all problems in warfare. Due to this belief, earnest attempts have been made to delegitimize nuclear weapons by minimizing their role, their numbers, and their importance, spreading a kind of nuclear stigma. Despite the hypothetical attractions of a world with zero or few nuclear arms, nuclear weapons will continue indefinitely to play an indispensable role in U.S. national security policy—as a hedge against uncertainties, as a means to deter or counter potential aggressors, and as political-military instruments to enable the United States to construct a more stable security environment. Indeed, the primacy of nuclear weapons in strategic relationships may actually increase, in spite of the RMA, in three important ways: as a hedge against shortcomings in conventional weaponry; as a deterrent or operational response to advanced conventional weaponry; and as political-military instruments that, due to more advanced designs, may become more usable.

The widespread notion that U.S. conventional weapons can replace nuclear weapons for all operational and deterrence purposes is ill-founded, because conventional weapons are less robust deterrents to war than their nuclear counterparts and are less capable of forcing an opponent to capitulate. The destructive potential of nuclear weapons may be much greater than that of conventional weapons, depending on their yield, design, mode of delivery, and other variables. Furthermore, nuclear weapons offer unique advantages for attacking certain types of military targets. Finally, the qualitative difference between nuclear and non-nuclear weapons can have desirable political and psychological effects in efforts to deter potential adversaries.

The military gap between the West—symbolized primarily by U.S. military capabilities—and the rest of the world has widened due to the RMA. "Near peer" competitors are unlikely to achieve technological and operational parity with the United States military in the foreseeable future. It is not clear that the principal Soviet successor state, Russia, has the economic capability, political will, resources, and laboratories to exploit the RMA in the medium term. Equally uncertain is China's ability to do so, at least with the scale and sophistication of the U.S. effort. As for the rest of the world, aside from key exceptions (such as Japan, Australia, and Western Europe), most of it is lagging behind in the development of advanced conventional military power. Most countries simply do not have the scientific, technological, and industrial base to produce high-technology weapon systems.

Countries that are unable to exploit or counter the U.S. led RMA by conventional means may consider nuclear weapons a relatively cheap counter to U.S. technological superiority. This notion may be indicative of a growing perception that there is a need

for an RMA deterrent. A nation could influence, dissuade, or counter a government armed with high-technology forces by the mere possession or actual use of an atomic device. At a minimum, a regional power armed with a small, survivable, intermediate-range nuclear capability could impede U.S. force deployments and complicate U.S. efforts to choose an optimal power projection strategy.

Considerable progress has been made in nuclear physics and engineering in the past few years, partly due to the demands of the RMA. Design possibilities that were long considered speculative are now becoming technically feasible. Emerging technology will enable scientists to design nuclear weapons that are better suited for the requirements of RMA warfare. Nuclear weapons may be improved in ways akin to conventional weapons, resulting in devices that can be delivered with greater accuracy over greater ranges in shorter response times. The engineering of future nuclear weapons may make extensive use of advances in high-performance computing and modeling, nanotechnology, and miniaturization techniques.

Having the initial competitive advantage in a period of military revolution—even if the advantage is considerable—is no guarantee of continued dominance, or even competitiveness. Technology eventually diffuses, and this will present potential adversaries with the means to circumvent or counter advances in U.S. high-technology conventional weaponry. Today, the United States armed forces have a commanding advantage in military capability in limited regional contingencies, but in a period of great geopolitical and military-technical change and uncertainty, it is far from clear that this advantage will be sustained over the long term.

Before the United States shifts its strategic deterrent from nuclear to conventional weapons, there must be a careful, serious debate about the consequences of marginalizing nuclear weapons. A nuclear force that is not backed by the perceived ability and willingness to maintain and if necessary, reconstitute itself will increasingly be seen as hollow. This holds important implications for the overall capacity of the United States to shape the international security setting in the years ahead and to provide for the nation's defense in a changing world.

I. INTRODUCTION

> To envision and describe accurately the features and dimensions of the landscape of future battle is a nearly impossible task. The record of America's ability to predict the nature of the next war (not to mention its causes, location, time, adversary or adversaries, and allies) has been uniformly dismal....But the myopia of the past in no way lessens the need to prepare. Quite the contrary. Preparations of the most certain possible are required for a most uncertain future.[1]

Much of the discussion surrounding the revolution in military affairs (RMA) presupposes that technology will alter the way the United States fights its battles. Some RMA enthusiasts argue that, whereas in times past styles of warfare were characterized by attrition or maneuver, today warfare is predicated on the acquisition and denial of information as the key to victory. This notion is linked to the belief that the weapons most characteristic of the new style in warfare will be able to locate and strike targets over great distances with a degree of precision that obviates any practical need to retain or employ nuclear warheads.[2]

These conclusions about the realities of the future strategic environment, however, may be premature. This thesis examines the implications of the RMA for nuclear weapons from several perspectives. Is the nuclear age going to be replaced, or perhaps overlaid, by the information age with its own distinct way of war? What does the RMA mean for the future significance of nuclear weapons? Because so many nuclear

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[1] Charles E. Heller and William A. Stofft, *America's First Battles, 1776-1965* (Lawrence, University Press of Kansas, 1986), xiii. Quoted in Lester W. Grau, "Bashing the Laser Range Finder With a Rock," *Military Review* (May-June 1997): 1. [Journal on-line]; available from http://call.army.mil/call/fmso/fmsopubs/issues/techy.htm.

[2] See Andrew F. Krepinevich Jr., "The Military Revolution: Restructuring Defense for the 21st Century," prepared testimony presented to the Senate Armed Services Subcommittee on Acquisition and Technology, 5 May 1995, 3.

weapons exist in the hands of an increasing number of states and their technical performance characteristics are being improved, it is imperative to understand their limitations and potential utility.

A. METHODOLOGY

This thesis explores the utility of nuclear weapons as the United States struggles to formulate a national security posture that capitalizes on the RMA, yet provides a robust deterrent in an uncertain world. This thesis explores three speculative notions: first, that weapons emerging from the RMA will render nuclear weapons obsolete; second, that the threat of Western conventional force superiority based on the RMA will lead some countries to seek nuclear weapons as a means of "trumping" advances in conventional weaponry; and third, that the RMA will increase the operational utility of nuclear weapons. A critical analysis of selected case studies and a qualitative survey of the relevant scholarly literature provide a basis to explore and analyze the three propositions.

B. WHY UNDERSTANDING THE RMA IS IMPORTANT

At the end of the 1990-1991 Gulf War, and again following the cessation of bombing in the former Yugoslavia in Operation Allied Force in 1999, many U.S. government officials, military leaders, and defense contractors pointed to the effects of high-technology weaponry as being instrumental in the victories over Saddam Hussein and Slobodan Milosevic.

Today, the RMA has become one of the most prominent elements of conventional wisdom at the U.S. Department of Defense. In 1997 the National Defense Panel concluded that the RMA "will have an indelible influence on new strategies, operational

concepts, and tactics that our military employs. If we do not lead the technological revolution we will be vulnerable to it."[3] The panel further recommended spending between $5 billion and $10 billion annually to implement the RMA doctrine.[4] In his 1998 report to the President and Congress, Defense Secretary William Cohen declared that the United States would "prepare now for an uncertain future by exploiting the Revolution in Military Affairs to transform U.S. forces for the future."[5] Ken Silverstein points out that by 1999 the Pentagon had spent almost $60 billion to acquire thirty-three different types of guided munitions and it wanted to spend another $16.6 billion by 2005 to double its inventory, to more than 300,000 weapons.[6]

Clearly, from a fiscal and strategic standpoint, America's stake in the RMA is enormous. It appears that the RMA will influence America's military posture for the foreseeable future. The ability of the United States to shape the international security environment and respond to a full spectrum of crisis situations with appropriately sized, positioned, and mobile forces will be directly affected by appropriation and procurement decisions based on present and future RMA capabilities. In other words, choices influenced by assumptions about the RMA will determine how U.S. forces are armed and how they fight for years to come.

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[3] Philip A. Odeen, Chairman. "Transforming Defense: National Security in the 21st Century," *Report of the National Defense Panel* (Washington, DC: United States Government Printing Office, 1997), 8.

[4] Ibid. 59.

[5] William S. Cohen, *Annual Report to the President and the Congress* (Washington, DC: United States Government, 1998), 14.

[6] Ken Silverstein, "Buck Rogers Rides Again," *The Nation* 269, no. 13 (25 October 1999): 4 [journal on-line] available from http://proquest.umi.com/pqdweb?TS=942184...1&Fmt=3&Sid=1&Idx=1&Deli=1&RQT=309&Dtp=1

C. THESIS OUTLINE

Chapter II of the thesis describes and defines the RMA and the current movement to marginalize nuclear weapons in favor of high technology conventional ordnance. It examines the proposition that U.S. conventional weapons could replace nuclear weapons for all operational and deterrence purposes. The limitations of conventional weaponry are explored, as well as the ability of nuclear weapons to compensate for these limitations in some circumstances.

Chapter III examines the possibility that Western conventional force superiority may lead some states to seek a nuclear capability as the means of "trumping" highly capable, "high-technology" conventional forces. North Korean, Libyan, and Iranian policymakers have expressed this view of the utility of nuclear forces.[7] In addition, Russian leaders have recently reaffirmed their commitment to nuclear weapons as a hedge against the decline of their conventional military capability. Small nuclear arsenals hold out the prospect of not only countering conventional capabilities but also according "sanctuary" status to a homeland or at least some portion of its strategic targets.[8] China's Major General Wu Jianguo points out that in both the Korean War and the Gulf War, nuclear threats were made to restrict the enemy's use of a portion of its nonnuclear forces.[9]

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[7] Keith B. Payne, *The Case Against Nuclear Abolition and for Nuclear Deterrence* (Fairfax, VA: National Institute for Public Policy, 1997), 32.

[8] Andrew F. Krepinevich and Steven M. Kosiak, "Smarter Bombs, Fewer Nukes," *The Bulletin of the Atomic Scientists* 54, no. 6 (November-December 1998): [journal on-line]; available from http://www.bullatomsci.org/issues/1998/nd98/nd98kosiak.html; Internet; accessed 9 November 1999.

[9] Wu Jianguo, "Nuclear Shadows on High-Tech Warfare." *China Military Science*, no. 4, (Winter 1995), [journal on-line]; available from http://www.ndu.edu/inss/books/chinview/chainpt3.html; Internet; accessed 8 November 1999.

Chapter IV discusses the prospect that the RMA may also give rise to a more usable nuclear capability. Advances in nuclear weaponry are not focused on the issue of yield. Instead, the focus is on attacking deeply buried or hardened targets, the technology of adjustable yield, and the enhanced ability to penetrate ballistic missile defenses. Advances in research and development may yield nuclear weapons that are smaller, mission-focused, and highly accurate, and that cause less collateral damage. These nuclear explosives may include earth-penetrating weapons, shock wave weapons, anti-missile weapons, and air-to-ground or ground-to-ground tactical weapons—all of which might add to the flexibility of nuclear use in actual operations.

Chapter V provides a synthesis of the main points of the preceding chapters. It discusses the implications of the RMA with respect to nuclear weapons and U.S. security and suggests that the primacy of nuclear weapons in international security affairs may actually *increase* in spite of the RMA. Implications for the U.S. nuclear arsenal also are discussed, including recommendations for future U.S. nuclear policy.

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II. WEAPONS OF PRECISE DESTRUCTION OR MASS DESTRUCTION?

A. ORIGINS OF THE DEBATE

The most enduring images of Operation Desert Storm are the video records of bombs entering bunker doors and ventilation shafts and cruise missiles flying above the streets of Baghdad on their self-guided missions. These weapons (among others) enabled 795,000 coalition troops to defeat a defending Iraqi army, numbering in the hundreds of thousands, in less than six weeks while suffering only 240 casualties.[10] Stephen Biddle points out that "this loss rate of fewer than one fatality per 3,000 soldiers was less than one tenth of the Israelis' loss rate in either the 1967 Six-Day War or the Bekaa Valley campaign in 1982, less than one twentieth of the Germans' in their blitzkriegs against Poland or France in 1939-40, and about one one-thousandth of the U.S. Marines' in the invasion of Tarawa in 1943."[11] The unanticipated low loss rates made the Gulf War a seminal event for defense planning in the 1990s in that new doctrines, weapons, organizations, and casualty levels are now judged against this 1991 benchmark.[12]

One of the most often repeated "lessons learned" of Desert Storm is that technology has revolutionized the conduct of war.[13] Before 1991, most planners

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[10] Of the coalition troops, 540,000 (and 148 of the fatalities) were Americans. The exact count of Iraqi troops and equipment in Kuwait is unknown, but the lowest current estimates are of multiple hundreds of thousands of troops, multiple thousands of armored vehicles, and at least tens of thousands of artillery pieces. See Lawrence Freedman and Efraim Karsh, *The Gulf Conflict, 1990-1991: Diplomacy and War in the New World Order* (Princeton, NJ: Princeton University Press, 1991), 409.

[11] Stephen Biddle, "Victory Misunderstood: What the Gulf War Tells Us about the Future of Conflict," *International Security* 21, No. 2 (Fall 1996): 142.

[12] Ibid. 142-3.

[13] James Blackwell, Michael J. Mazarr, and Don M. Snider, *The Gulf War: Military Lessons Learned* (Washington, DC: The Center for Strategic and International Studies, 1991), chapter III.

expected future land wars to resemble updated mid-century armored breakthrough battles with air and missile forces playing a supporting role by reducing a combatant's ability to push tanks forward at the point of attack. Today, this traditional concept has almost disappeared, replaced by the official consensus that the United States is embarked upon a "revolution in military affairs."[14] Andrew Marshall, who heads the Department of Defense's Office of Net Assessment and is charged with keeping an eye on the long view, underscored this observation before the Senate Armed Services Committee in 1995 when he stated, "Long-range precision strike weapons coupled to very effective sensors and command and control systems will come to dominate much of warfare."[15]

Long before Desert Storm, however, the perceived capabilities of long-range, conventional precision weapons were being explored. For example, the Commission on Integrated Long-Term Strategy concluded in 1988 that "the precision associated with the new technologies will enable us to use conventional weapons for many of the missions once assigned to nuclear weapons," and that, "as accuracy improves, the nuclear yield

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[14] The professional literature includes noteworthy critiques of the RMA thesis—for instance, A. J. Bacevich, "Preserving the Well-Bred Horse," *The National Interest*, no. 37 (Fall 1994); A. J. Bacevich, "Tradition Abandoned: America's Military in a New Era," *The National Interest*, no. 48 (Summer 1997); Carl H. Builder, "Looking in All the Wrong Places? The Real Revolution in Military Affairs Is Staring Us in the Face," *Armed Forces Journal International*, May 1995; Charles J. Dunlap Jr., "How We Lost the High-Tech War of 2007," *The Weekly Standard*, 29 January 1996; Chris J. Krisinger, "War and Anti-War: Caveat Emptor," *Strategic Review*, vol. 24 (Spring 1996); David Silverberg, "Tofflermania," *Armed Forces Journal International*, June 1995; Williamson Murrary, "Clausewitz Out, Computer In: Military Culture and Technological Hubris," *The National Interest*, no. 48 (Summer 1997).

[15] Andrew W. Marshall, Director, Net Assessment, Office of the Secretary of Defense, statement given before the United States Senate, Senate Armed Services Committee, Subcommittee on Acquisition and Technology, 5 May 1995, 1.

needed to destroy hardened military targets also drops dramatically, to the point where conventional warheads could do the job."[16]

The ability to harness new technologies has enhanced the war fighting capability of the U.S. military. The larger trend has been toward wedding emerging technology to conventional munitions so that the weapons can be guided to an exact location.[17] Andrew Krepinevich points out that:

> During 1943, the U.S. Eighth Air Force struck roughly 50 German strategic targets. In 1991, during the Persian Gulf War, coalition air forces struck over three times as many targets on the first day of the war. This is a three-order-of-magnitude increase in conventional strategic strike capability.
>
> In addition, PGMs made up barely 7 percent of the conventional munitions used in bombing attacks during the [Gulf] war. According to the Gulf War Air Power Survey conducted after the war, aircraft using PGMs were demonstrably 13 times more effective than aircraft using dumb bombs.[18]

Modern precision weapons are indeed impressive. Examples in the U.S. inventory include video- and laser-guided gravity bombs, cruise missiles, guided artillery projectiles, and radar-seeking "anti-radiation" missiles. These precision-guided munitions (PGMs) can potentially destroy any locatable target. PGMs continue to advance along three lines: weapons that require continuous operator guidance (such as fiber-optic-guided missiles and laser-guided bombs); signature-guided weapons (such as

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[16] Fred C. Iklé and Albert Wohlsetter, co-chairmen, *Discriminate Deterrence*, memorandum for the Secretary of Defense and the Assistant to the President for National Security Affairs, (Washington, D.C.: U.S. Government Printing Office, 1988) 8, quoted in Robert G. Spulak, Jr., "Strategic Sufficiency and Long-Range Precision Weapons," *Strategic Review* 22, no. 3 (Summer 1994): 31.

[17] Martin Libicki, "Emerging Military Instruments," in *Strategic Assessment 1996: Elements of U.S. Power*, ed. Hans A. Binnendijk (Washington, DC: National Defense University Press, 1996), 188.

[18] Andrew F. Krepinevich, "Forging A Path to a Post-Nuclear Military," *Issues in Science and Technology* 13, No. 3 (Spring 1997): 81

those guided by infrared, radar reflection, or acoustic homing); and location-directed weapons (those that aim for a specific pre-programmed point).

Technology has a special appeal to Americans, who seem to have an abiding faith in its power. Proponents of the RMA maintain that long-range strike capability can allow U.S. military forces to target and destroy enemy platforms while operating beyond the range of enemy sensors. They further argue that technology is a force multiplier and that it can save lives—always an important consideration, especially in a democracy.[19] Optimism about the possibilities presented by the RMA suggests that many of its supporters believe that technology may be the solution to the problems of warfare. An unbending belief in the ability of technology to shape a conflict exclusively, however, will overlook other basic elements of warfare. [20]

The future roles and strategic significance of nuclear weapons are uncertain. There is, however, reason to doubt the widespread notion that U.S. conventional weapons can replace nuclear weapons for all operational and deterrence purposes. Conventional weapons are less robust deterrents to war than their nuclear counterparts and in some cases cannot force an opponent to capitulate. The destructive potential of nuclear weapons may be much greater than conventional weapons, depending on their yield, design, mode of delivery, and other variables. Furthermore, nuclear weapons remain uniquely suited for attacking certain types of military targets. Finally, there remains a

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[19] Alex Roland, *The Technological Fix: Weapons and the Cost of War* (Carlisle Barracks, PA: Strategic Studies Institute, 1995), 2.

[20] Colin Gray has provided an important point for consideration: "The ideas of the RMA are popular because they conform to American concepts of war, but they often lead us to ignore basic issues regarding the nature of warfare or encourage the notion that we can alter or control a conflict exclusively through the application of advanced technology and military power." Colin S. Gray, "Nuclear Weapons and the Revolution in Military Affairs," in *The Absolute Weapon Revisited*, T.V. Paul, Richard J. Harknett, and James J. Wirtz, eds., (Ann Arbor: The University of Michigan Press, 1998), 101.

qualitative difference between nuclear and non-nuclear weapons that can have desirable political and psychological effects in efforts to deter potential adversaries.[21]

B. CALLS TO MARGINALIZE OR ABOLISH NUCLEAR WEAPONS

The end of the Cold War and the accompanying major reductions in the U.S. and Russian nuclear arsenals revived interest in marginalizing nuclear weapons in the United States and other nations. Earnest attempts have been made to delegitimize nuclear weapons by minimizing their role, their numbers, and their importance.

In November 1995, the Canberra Commission was created by the Australian government of Prime Minister Paul Keating, with the mandate to "develop ideas and proposals for a concrete and realistic program to achieve a world totally free of nuclear weapons," and "to address the related problem of maintaining stability and security during the transitional period and after the ultimate goal is accomplished."[22] In July 1996, the International Court of Justice also issued an advisory position stating that "the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict."[23]

In 1999, Paul Nitze, a former arms control negotiator and ambassador-at-large in the Reagan administration, summed up the prevailing view among a number of nuclear abolitionists when he stated, "The fact is, I see no compelling reason why we should not

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[21] Payne, 30.

[22] A published version of the entire report is available on-line at http://www.dfat.gov.au/dfat/cc/cchome.html.

[23] The court also ruled unanimously that, "There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control." The abolitionists believe that this advisory opinion supports their view that nuclear weapons are not a legitimate political or military instrument. Keith B. Payne, *The Case Against Nuclear Abolition and For Nuclear Deterrence* (Fairfax, VA: National Institute for Public Policy, 1997), 11. For a range of views on the ruling, see *Bulletin of the Atomic Scientists* (September/October 1996): 39-47.

unilaterally get rid of our nuclear weapons. . . . In view of the fact that we can achieve our objectives with conventional weapons, there is no purpose to be gained through the use of our nuclear arsenal."[24] Nitze's comments reflect the conventional wisdom found in abolitionist circles today—that technology, leveraged through advanced conventional armaments, is the means to exploit changes in the international security environment and marginalize nuclear weapons.

Retired U.S. Navy Admiral Stansfield Turner leads another group with an interest in minimizing the role of nuclear weapons. He argues that the United States is now in a position to reshape its nuclear arsenal. Turner contends that the United States should create a strategic escrow of nuclear weapons, initially consisting of approximately 1,000 warheads but transitioning towards less than 200. He further argues that these remaining warheads should be separated from their delivery vehicles, thereby reducing the possibility of an accidental or inadvertent launch. The 1996 *Statement on Nuclear Weapons by International Generals and Admirals* is consistent with Turner's stance toward reducing nuclear stockpiles. The statement argues, "Present and planned stockpiles of nuclear weapons are exceedingly large and should now be greatly cut back." It further contends that, "The United States and Russia should—without any reduction in their military security—carry forward the reduction process already launched by START, they should cut down to 1000 to 1500 warheads each and possibly lower."[25]

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[24] Paul H. Nitze, "A Threat Mostly to Ourselves," The *New York Times*, 28 October 1999, 25(A).

[25] The Statement continues, "The other three nuclear states and the three threshold states should be drawn into the reduction process as still deeper reductions are negotiated down to the level of hundreds. There is nothing incompatible between defense by individual countries of their territorial integrity and progress toward nuclear abolition." *Statement on Nuclear Weapons by International Generals and Admirals*, 5 December 1996. [Statement on-line]; available from http://www.stimson.org/zeronuke/generals/internat.htm.

Many of those in favor of marginalizing nuclear weapons believe that the post-Cold War security environment places nuclear disarmament at the forefront of the international agenda.[26] According to Keith Payne, the ideology that underpins the arguments of the nuclear disarmament advocates may be summarized as follows:

> The overriding problem is not one of how to prevent a resumption of great power competition, but how to adapt to the fundamentally transformative forces of global interdependence. From this perspective, the traditional, Westphalian structure of international politics—dominated by the relationship among nation-states and by the balance of military power—is relatively less important. . . . Rather than familiar "threats" to the sovereignty and independence of states—military coercion and attack by other nations—peoples and individuals now face functional "dangers" to their collective and singular well-being. Such dangers include the proliferation of weapons of mass destruction, terrorism, ethnic and tribal conflicts, global climate change, and the asymmetrical effects of a globalized economy.[27]

Given these dangerous trends, so the abolitionist argument goes, the existence of nuclear weapons does not serve in any way to increase international security. Rather, according to this view, nuclear weapons "greatly exacerbate the possibility of conflict, and gravely increase the environmental and political damage that conflicts could cause," by holding out the promise "that individuals, groups, or nations can resist the imperatives of

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[26] For a representative sample of these points of view see Kathleen Wong, "Nuclear Arms Decried: Former CIA Director Calls Treaties 'Baloney,'" *Monterey County Herald*, 2 November 1999, 1(B); William Odom, *America's Military Revolution* (Washington, DC: American University Press, 1993), chapter 4; Janne E. Nolan, *An Elusive Consensus: Nuclear Weapons and American Security After the Cold War* (Washington, DC: Brookings Institute Press, 1999), 37; Henry Sokoloski, *Fighting Proliferation: New Concerns for the Nineties* (Maxwell Air Force Base, AL: Air University Press, 1996), chapter 4; Andrew F. Krepinevich and Steven M. Kosiak, "Smarter Bombs, Fewer Nukes," *The Bulletin of Atomic Scientists* 54, no. 6 (November/December 1998) [journal on-line] available from http://www.bullatomsci.org/issues/1998/nd98/nd98kosiak.html; Krepinevich, *Forging A Path to a Post-Nuclear Military*; Gray, *Nuclear Weapons and the Revolution in Military Affairs*, 100; Canberra Commission on the Elimination of Nuclear Weapons, "The Nuclear Weapon Debate (Part One)," in *Report of the Canberra Commission on the Elimination of Nuclear Weapons* (Canberra, Australia: Commonwealth of Australia, 1996) [report on-line]; available from http://www.dfat.gov.au/dfat/cc/cc_report1.html.

[27] Payne, 7.

transnational cooperation in the traditional state-centered pursuit of security."[28] An underlying source of motivation among abolitionists is the belief that U.S. possession of nuclear weapons gives credibility to and legitimizes the possibility of nuclear-based security for other nations.

C. THE MOVE TO STIGMATIZE NUCLEAR WEAPONS

Arguments to stigmatize nuclear weapons depend on a credible case that nuclear weapons have no plausible utility. For those who seek to marginalize the role of nuclear weapons, the only real "military" role of nuclear weapons is to deter the use of other nuclear weapons—a function that is obviously not needed if nuclear weapons are eliminated as a result of their efforts. The Canberra Commission, for example, contends that nuclear weapons are too destructive and indiscriminate to secure discrete objectives in the battlefield. The Canberra Commission holds that this destructive force undermines the deterrent capability of U.S. nuclear forces, and that the sheer destructiveness of nuclear retaliation imposes a taboo against their use, which therefore makes nuclear deterrence a hollow threat. Krepinevich and Kosiak argue that "potential adversaries would see the U.S. strategic deterrent as more credible if it included forces capable of conducting effective non-nuclear strategic strike operations."[29] They posit that a shift toward non-nuclear strategic strike forces would offer U.S. political leaders greater flexibility in responding to a threat, thereby enhancing deterrence. They also believe that "since a non-nuclear strike would be far more discriminating, it would not cause anything like the horrific level of casualties that would almost certainly result from a 'limited'

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[28] Payne, 8.

[29] Krepinevich and Kosiak, 7.

nuclear war. It might also reduce significantly the prospects of triggering an armed response from a nuclear-armed adversary."[30]

Paul Nitze has made a similar argument. He argues that the credibility of a deterrent is proportional to the credibility of its use, and that the threat of nuclear use—especially in regional conflicts—is implausible, while the threat to use advanced conventional weapons can be made with great confidence in their military effectiveness. He reasons that the United States should attempt to convert "its principal strategic deterrent from nuclear weapons to a more credible deterrence based at least in part upon 'smart' conventional weapons. . . . They are safer, cause less collateral damage and pose less threat of escalation. They thus offer far greater flexibility in a variety of situations where use of any sort of nuclear weapon would be politically or militarily impractical."[31]

There also seems to be increasing support within elements of the U.S. military for an explicit strategy to de-emphasize nuclear forces in favor of more robust investment in advanced conventional weapons. A recently issued report by the National Defense Panel appointed by Congress to comment on the Pentagon's Quadrennial Defense Review, for example, offered this conclusion: "Advancing military technologies that merge the capabilities of information systems with precision guided weaponry and real-time targeting and other new weapon systems may provide a supplement or alternative to the nuclear arsenals of the Cold War."[32]

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[30] Ibid.

[31] Paul H. Nitze, "Is It Time To Junk Our Nukes? The New World Order Makes Them Obsolete," *Washington Post*, 16 January 1994, quoted in Payne, 18.

[32] National Defense Panel, *Transforming Defense: National Security in the 21st Century* (December, 1997), 51.

The problem with creating a nuclear stigma is that the nuclear genie is out of the bottle. Nuclear weapons cannot be disinvented. Proposals that prescribe a movement towards reducing nuclear danger often rely on the good intentions of other nuclear-armed states, including "rogue" states. In this environment, emotional appeals for unilateral nuclear disarmament are less persuasive than a policy of quid-pro-quo. [33]

D. THE REALISM OF NUCLEAR WEAPONS

In the initial euphoria of the post-Cold War world, wishful thinking was widespread. For example, Leslie Gelb, President of the Council on Foreign Relations, wrote in 1994, "For a long time to come, Russia will be a second-tier country with virtually useless nuclear arms."[34] According to Barry Blechman and Cathleen Fisher, "If all the world were modernist, nuclear weapons would have absolutely no purpose and could already be safely eliminated."[35] The image created of a world with zero or a few

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[33] Robert Spulak provides an insightful response to those who argue the necessity of stigmatizing nuclear weapons. "Since we absolutely cannot achieve the goal of abolishing both nuclear weapons *and* the knowledge of how to construct them, policies and actions that appear to move in that direction will always fail the test of plausibility. But since these policies and actions would be undertaken in the name of 'reducing nuclear danger,' they acquire a respectability that they have not earned through critical examination. This is the reason it is necessary to reject the emotional appeal reflected in Les Aspin's assertion in 1992 that, in the new era, 'the burden of proof is shifting toward those who want to maintain' policies supporting U.S. nuclear weapons and away from those who advocate 'four prescriptions to the left . . . a comprehensive test ban, an end to production of fissile material . . . removal of forward based tactical weapons, and renunciation of first use.' An assumption that the formulation of U.S security policy is based *a priori* toward a given set of policy recommendations is exactly the problem with nuclear stigma." Robert G. Spulak, "The Case in Favor of US Nuclear Weapons," *Parameters* (Spring 1997), [journal on-line]; available from http://carlisle-www.army.mil/usawc/Parameters/97spring/spulak.htm. Emphasis in original. Spulak is responding to a short paper prepared in 1992 by the then House of Representatives Armed Services Committee Chairman, Representative Les Aspin (D-WI), "From Deterrence to Denuking: A New Nuclear Policy for the 1990s." In it, Aspin stated provocatively "if we now had the opportunity to ban all nuclear weapons, we would." See Les Aspin, "From Deterrence to Denuking," January 21, 1992 draft, p. 9. reprinted in U.S Congress, House of Representatives, Committee on Armed Services, Defense Policy Panel. *Shaping Nuclear Policy for the 1990s: A Compendium of Views*, 102nd Congress, 2nd Session, (Washington. DC: U.S. Government Printing Office, December 1992).

[34] Leslie H. Gelb, "Quelling the Teacup Wars," *Foreign Affairs* 73 (November-December 1994): 2-6

[35] Barry M. Blechman and Cathleen Fisher, "Phase Out The Bomb," *Foreign Policy* 97 (Winter 1994): 83-4.

nuclear weapons appears attractive. But such a world appears unattainable for quite some time. In point of fact, it appears that the primacy of nuclear weapons has in some ways actually *increased* in the new international security environment.

The 1997 Presidential Decision Directive (PDD-60) examined the role of nuclear weapons in the context of a changed security environment. While changes were instituted in the targets assigned to the U.S. strategic arsenal, the most important revision concerns the use of nuclear weapons as a deterrent or response to the use of chemical or biological weapons.[36] Similarly, nuclear weapons appear to be playing a growing role in Russian strategic plans, both in a declaratory role and to compensate for a collapsing conventional force structure.[37] In 1992-1993, and again in 1999-2000, the Russians unveiled military doctrines that declared their willingness to use tactical nuclear weapons first, even against opponents not possessing them.[38] Russia's military doctrine has placed increasing reliance on nuclear forces to offset the rapid decline in its conventional forces. Russian nuclear forces are thus the last jewel in a tarnished superpower crown of military capability.[39]

The abolitionists' perception of a world positioned to rid itself of nuclear armaments is incongruent with the policies of the Clinton administration and the

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[36] Gwendolyn M. Hall, John T. Capello, and Stephen R. Lambert, *A Post-Cold War Nuclear Strategy Model*, (U.S. Air Force Academy, CO: Institute for National Security Studies, 1998), 3. [occasional paper on-line]; available from http://www.usafa.af.mil/inss/ocp20.htm.

[37] The development of the SS-X-27 ICBM, continuing investment in the overall nuclear infrastructure, and the retention of 10,000 to 15,000 tactical nuclear weapons all reflect Russia's ongoing emphasis on nuclear forces within its security strategy. See Janne Nolan (Chair) "Arms Control in Light of Evolving Defense Requirements," in *Arms Control and the Revolution in Military Affairs: Summary of the Seventh Annual International Conference on Controlling Arms* (Washington, DC: United States Department of Defense, 1998), 43.

[38] For a more thorough discussion of the Russian military doctrine see Chapter II.

[39] Krepinevich and Kosiak, *Smarter Bombs, Fewer Nukes*, 3.

Department of Defense. In 1995, President Clinton stated, "As part of our national security strategy the United States must and will retain strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces. In this regard, I consider maintenance of a safe and reliable nuclear stockpile to be a supreme national interest of the United States."[40] Secretary of Defense William Cohen noted in a 1998 survey of the international security environment that "of particular concern are the spread of nuclear, biological, and chemical weapons,"[41] and that "nuclear weapons remain important as one of a range of responses available to deal with threats or use of NBC weapons against U.S. interests. They serve as a hedge against the uncertain futures of potentially hostile nuclear powers and as a means of upholding U.S. security commitments to allies."[42]

Robert Joseph and Ronald Lehman offer perhaps the most definitive observation on the permanence of nuclear weapons: "While advanced conventional forces contribute to deterrence, they are not a substitute for nuclear weapons. . . . Nuclear weapons remain the 'ultimate deterrent' . . . Whether we like it or not, nuclear weapons will be part of the global security setting. . . . They cannot be disinvented."[43] Since a world purged of nuclear weapons is improbable in the foreseeable future, the expectation of such a world should not be used as any kind of guidance for the difficult choices to be made in U.S.

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[40] Clinton quoted in Robert Joseph and Ronald Lehman, *U.S. Nuclear Policy in the 21st Century*, (Washington, DC: National Defense University Press, 1998), 17 [executive report on-line]; available from http://www.ndu.edu/inss/ccp/nucpolicy/nucpolicy.html. Joseph and Lehman are quoting a 1995 statement by President Clinton concerning the safety, reliability, and performance of the nuclear weapons stockpile in the absence of underground nuclear testing.

[41] Cohen, 2.

[42] Ibid, 6.

[43] Joseph and Lehman, 4-10.

nuclear weapons policy. The abolitionists have made a common error: they attribute to nuclear weapons the properties that in fact derive from the political situation in which they are fielded.[44]

E. PROBLEMS WITH CONVENTIONAL DETERRENCE

As with all forms of military power, U.S. conventional and nuclear deterrent options entail certain risks and disadvantages. The use of conventional or nuclear weapons can never guarantee achievement of intended political effects. In an imperfect world, however, the best available solutions for protecting U.S. security interests involve a mix of conventional and nuclear instruments, each sub-optimal in some ways yet capable of hedging against possible shortcomings in the other.

The confidence that accompanied the stabilizing role played by nuclear weapons during the Cold War cannot be readily transferred to a strategy that relies solely on conventional deterrent threats. Any deliberations on increasing the deterrent role of conventional weapons must recognize that conventional precision weaponry may not provide the same level of deterrence credibility and reliability as nuclear arms. The United States is obliged to provide a suitable backup to the possible shortcomings of conventional weaponry.

In some circumstances, conventional deterrent threats may be ineffective for one or more reasons, including the following:

- Conventional operations can be lengthy and incremental.
- Conventional weapons are contestable and may not be capable of deterring nuclear, biological, or chemical threats.

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[44] Richard Perle, statement given before the United States Senate, Committee on Governmental Affairs, Subcommittee on International Security, Proliferation, and Federal Services. 12 February 1997, 4.

- Conventional weapons may not convey the same guarantees of regional commitment to U.S. allies as nuclear weapons.
- Operations conducted with conventional munitions (like those with nuclear weapons) are susceptible to "the fog of war."
- Conventional weaponry may not be "strategically sufficient."
- Conventional precision weapons may not be effective against certain "niche targets" in the way that nuclear weapons may be.
- It is doubtful whether conventional weapons provide the same psychological impact as nuclear weapons.

1. The Duration of Conventional Operations

The time required to amass forces and inflict damage on a potential opponent by conventional means may hamper attempts at deterrence, at least in some circumstances. The Persian Gulf War of 1990-91 may be illustrative of this point. According to Richard Harknett,

> Within days of the attack [Iraq's invasion of Kuwait in August 1990], the United States, through diplomatic channels and military deployments, did make it clear that a further attack on Saudi Arabian oil fields would be met with retaliation. The actual conventional capabilities to support this deterrence strategy, however, were not in the region on 2 August and would take months to deploy. Whether Saddam Hussein planned a follow-on offensive is important and will likely never be known. What will be drawn as a lesson by future prospective challengers to U.S. interests will be either to seek immediate accommodation after the initial use of force to secure objectives or, if that is not an option, to prevent the United States uninhibited access into the region to build up its forces. . . . It cannot be overlooked that it took six months of militarily *unopposed* buildup to assemble the overwhelming force that was used in Operation Desert Storm.[45]

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[45] Richard J. Harknett, "The Logic of Conventional Deterrence and the End of the Cold War," *Security Studies* 4, no. 1 (Autumn 1994): 105. Emphasis in original.

Harknett contends that conventional weaponry can inflict damage on a massive scale, but only over extended periods of contact and combat. In other words, conventional weaponry produces a single, episodic effect for one moment in time; the area and degree of damage are finite.[46] James Wirtz argues that because "it would take months or even years for the destruction wreaked by conventional weapons to reach cataclysmic levels. . . . conventional weapons are inherently inferior when it comes to engaging in the 'Diplomacy of Violence'."[47] This is not to imply that the United States would be incapable of amassing its power effectively. It would be imprudent to assume, however, that in future contingencies the United States would be afforded an opportunity to buildup forces similar to that in the Gulf War. Thus, the inherent limitations in amassing conventional forces could embolden a prospective challenger's risk calculus and thus make for a weaker form of deterrence than one based on nuclear weapons.

2. The Incremental Nature of Conventional Deterrence

An adequate deterrent, let alone an enduring condition of stable deterrence, cannot be calculated with precision. Deterrent effectiveness is not a quality that can be purchased discretely and reliably by incremental amounts. It must command respect across the spectrum of conflict. "Conventional deterrence is hampered by the nature of the weapons upon which it is based," according to Harknett.[48] He points out that these weapons may be insufficient as deterrents because their successful use depends on the calculus of skill shown in their application, on the capabilities leveraged, and the counter-

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[46] Ibid. 91-2.

[47] James J. Wirtz. "Strategic Conventional Deterrence: Lessons from the Maritime Strategy." *Security Studies* 3. no. 1 (Autumn 1993): 120.

[48] Harknett. "The Logic of Conventional Deterrence and the End of the Cold War." 88.

capabilities employed by an opponent. Because the destructiveness of conventional weapons is more limited than that feasible with nuclear weapons, their use requires continual calibration according to the challenge imposed by an adversary. As Gray has noted, in an assertion applicable to both nuclear and conventional force posture, "An adequate deterrent at 0900 hours may not be adequate by 1600 hours."[49]

3. Contestable Costs

Richard Harknett suggests that deterrence rests on two factors: the sufficiency of political will to respond militarily, and the possession of a capability that can inflict the threatened level of retaliation.[50] In Harknett's words,

> What is clearly distinctive about conventional and nuclear weapons is how contestable the former is compared to the latter. Measured on a scale of contestability—the degree to which technical, tactical, or operational effects can impact the actual destruction to be borne in combat—the destructive potential of nuclear weapons tends to be highly resilient. At a [comparatively] low level of possession, nuclear weapons can maintain a relatively incontestable level of military force. Counter-weapons, counter-tactics, and general friction can degrade nuclear destruction only on the margins.[51]

Nuclear weapons, though finite in their potential, possess what Colin Gray calls "reliability of effect." Gray uses this term to describe the confidence that the level of destruction threatened (if that level falls within the nuclear power's capabilities) can be reached if nuclear weapons are used.[52]

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[49] Colin Gray, "Deterrence Resurrected: Revisiting Some Fundamentals," *Parameters* (Summer 1991): 2. [journal on-line] available from http://carlisle -www.army.mil/usawc/Parameters/1991/gray1.html.

[50] Richard J. Harknett. "The Logic of Conventional Deterrence and the End of the Cold War," 89.

[51] Richard Harknett, "State Preferences, Systemic Constraints, and the Absolute Weapon," in *The Absolute Weapon Revisited*, T.V. Paul, Richard J. Harknett, and James J. Wirtz, eds., (Ann Arbor: The University of Michigan Press, 1998). 53.

[52] Ibid. 61. Also see footnote 54. 70.

Questions of nuclear deterrence invariably focus on the political will necessary to employ nuclear weapons. Questions of conventional deterrence invariably focus on the capability of the weapons employed. In the mind of a potential challenger, conventional weapons hold out the prospect of technical, tactical, or organizational solution, and it is this prospect that makes them less effective deterrents to war.[53]

Possession of superior or at least equal armaments is not sufficient to furnish a battlefield advantage. Conventional cost infliction is highly dependent on the operational art and skill employed by the opposing sides.[54] Harknett points out that "conventional weapons capability has tended to encourage and at times facilitate the creation of counter-capabilities and tactics," and therefore, "it implies that the costs threatened do not necessarily reflect the level of costs that will be inflicted if the deterrent fails and retaliatory forces are used."[55] Contestability presents the challenger with the perception that the level of costs presented by a deterrer is open to manipulation, such that it is possible to adapt to, and therefore, contest conventional costs even while under attack.

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[53] Richard J. Harknett, "The Logic of Conventional Deterrence and the End of the Cold War," 89.

[54] At the outbreak of the Franco-Prussian War of 1870, France possessed the *mitrailleuse*, a gun capable of firing 150 rounds a minute at a range of 2,000 yards. Its destructive potential in battle was degraded by the fact that few French soldiers knew how to use it and little discussion of deployment tactics had preceded its introduction. 'It was used at extreme range; sighted in the open and in battery; and fired inaccurately and wastefully,' and . . . although in possession of modern weaponry, [at the outbreak of the Gulf War], the Iraqi Air Force proved no match for ... American pilots. Ibid, 96.

[55] Ibid, 92.

Germany's ability during the Second World War to adapt to the Allied strategic bombing campaign is an example of how the effects of conventional weapons can be contested.[56]

States relying on a strategy of conventional deterrence will tend to have an intense focus on the relative balance of capabilities because that is where the prospect of testing a response is revealed. Deterrence relies on communicating unambiguously the retaliatory costs of a potential challenger's actions. The challenge of conventional deterrence is communicating clear and credible signals about capabilities without undermining those capabilities.[57]

The belief that conventional deterrence presents more readily contestable costs underscores its disparity with its nuclear counterpart. This implies that the logic governing nuclear and conventional deterrence is different. Recognition of this distinction raises fundamental questions regarding the effectiveness of conventional deterrence.

4. Deterring Biological and Chemical Attack

Arguments that conventional weapons can deter adversaries across the spectrum of conflict ignore the evidence that nuclear retaliatory threats deterred the Iraqis from using chemical weapons during the Gulf War. Tariq Aziz, Iraqi Foreign Minister at the time of the Gulf War, has stated that Iraq was deterred from using its weapons of mass destruction during the war because Saddam Hussein interpreted Washington's various

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[56] "By decentralizing its industrial base, finding appropriate substitutes for lost resources and converting its total economy to a war footing . . . [Germany's] initial adaptation to the Allied conventional onslaught was so successful that as the tonnage of bombs dropped on Germany increased so did the volume of German war production." Ibid.

[57] Ibid. 106.

threats of grievous retaliation as meaning *nuclear* retaliation.[58] A senior Iraqi defector, General Wafic Al Sammarai, former head of Iraqi military intelligence, has corroborated Aziz's explanation.[59] Apparently, Iraqi leaders believed they could withstand the pressures of conventional war, but not *nuclear* war:

> When Secretary of State James Baker told Iraqi Foreign Minister Tariq Aziz of the 'overwhelming' conventional power that would be 'brought to bear' against Iraq, Aziz responded, 'Mr. Secretary, Iraq is a very ancient nation. We have lived for 6,000 years. I have no doubts that you are a very powerful nation. I have no doubts that you have a very strong military machine and you will inflict on us heavy losses. But Iraq will survive and this leadership will decide the future of Iraq.' In contrast, implicit U.S. *nuclear* threats appear to have had a very desirable deterrent effect.[60]

Nuclear deterrence appears to have been essential in the Gulf War, a conflict in which deterrent threats based on conventional weapons seem to have failed to deter a highly risk-acceptant aggressor.

Many states have promised in international conventions to refrain from acquiring or employing chemical weapons (CW) and biological weapons (BW). The United States has foresworn the use of biological and chemical agents. However, not all states have imposed the same constraints on themselves, and it is plausible that in the future some states may attempt to exploit their CBW capabilities. What are the options for deterrence

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[58] R. Jeffrey Smith, "U.N. Says Iraqis Prepared Germ Weapons," *Washington Post*, 26 August 1995, 1(A).

[59] General Sammarai has stated, "Some of the Scud missiles were loaded with chemical warheads, but they were not used. They were kept hidden throughout the war. We didn't use them because the other side had a deterrent force. I do not think Saddam was capable of taking a decision to use chemical weapons or biological weapons, or any type of weapons against the allied troops, because the warning was quite severe, and quite effective. The allied troops were certain to use nuclear arms and the price will be too dear and too high." Statement by General Wafic Al Sammarai, *Frontline*, "The Gulf War, Part I," no. 1407, 9 January 1996, transcript, 12. Quoted in Payne, 30.

[60] Statements by James Baker and Tariq Aziz, *Frontline*, "The Gulf War, Part I," no. 1407, 9 January 1996, transcript, 9. Quoted in Payne, 31; emphasis in original.

if the United States cannot respond in kind to a chemical or biological threat? Defense alone, even with anti-missile and conventional counterforce weapons, cannot ensure the safety of American forces and U.S. citizens. Deterrence is crucial.[61] While it is easy to assert that conventional weapons would provide a suitable deterrent, there is no evidence to demonstrate that this would be the case in all contingencies. If an enemy is already receiving the full brunt of U.S. conventional strikes when it opts to threaten biological or chemical attack, the threat of further conventional reprisals will probably be ineffective. In point of fact, the experience of the Gulf War suggests that, at least in some circumstances, the only credible deterrent to a chemical or biological threat is that of nuclear retaliation.

The argument put forth by abolitionists that nuclear deterrence should be considered "inappropriate" for deterring chemical and biological threats because nuclear weapons are "disproportional" to such threats is unsound from a strategic viewpoint. As Payne has pointed out, "effective deterrence may frequently require disproportional threats: there is no reason that deterrence threats must be proportional to the threat they are seeking to prevent."[62] In this regard, NATO appears to have been well served by its classic deterrence policy of "flexible response," which was arguably disproportional in that it held out the prospect of NATO nuclear escalation in response to a Soviet conventional attack westward.[63]

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[61] The committee formed to explore nuclear policy in the 21st century concluded that "U.S. nuclear forces . . . provide the clearest and most visible statement of the national will to deter chemical and biological attacks." Joseph and Lehman, 9.

[62] Payne, 31-2.

[63] Ibid.

5. The Dilemma of Extended Deterrence

In light of growing concerns about regional nuclear, biological, and chemical threats, U.S. allies do not believe that conventional weapons can guarantee their security in the same way that nuclear deterrence can. Doubts about the reliability of U.S. security commitments could lead some allies to develop a nuclear deterrent, further undermining nonproliferation efforts. The greater the willingness, however, of the United States to protect potentially embattled friends and allies with U.S. nuclear assurances, the less likely they are to proceed decisively towards (or beyond) nuclear-threshold status.[64] Colin Gray offers a useful distinction regarding the strategic significance of America's nuclear umbrella:

> The United States cannot promise credibly to wage nuclear war on behalf of, say, Taiwan, South Korea, or Japan. But it is all but self-evident that the United States would employ whatever weapons were necessary to protect its own forces deployed in defense of those countries. It would be difficult to exaggerate the strategic significance of the reassurance that such U.S. support can provide.[65]

It appears that America's role as a guardian of international order requires the United States to display some measure of nuclear capability to deter, counter, or retaliate against potential "rogues" who might pursue NBC statecraft in regions where the United States has vital interests.

6. The Psychological Aspect of Nuclear Deterrence

There is a qualitative difference between nuclear and non-nuclear weapons that can have a desirable political and psychological effect on potential adversaries. In some cases, the fearsomeness of nuclear weapons, if appreciated by the challenger, may bolster

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[64] Colin Gray, *The Second Nuclear Age* (Boulder, CO: Lynne Rienner Publishers, 1999), 135.

[65] Ibid. 134.

deterrence. Highly valued assets may be placed at risk immediately and undeniably by nuclear weapons in a way that cannot be matched or overcome by conventional means.[66] Nuclear weapons remain the gold standard by which deterrence is judged.

F. THE SHORTCOMINGS OF RMA WEAPONRY

1. Deception and Dispersion

Precision guided munitions, while formidable, are nevertheless subject to shortcomings. They cannot match the "reliability of effect" advantage guaranteed by nuclear weapons. Due to their limited yield, PGMs are often unable to inflict quick, massive damage across a broad area. An adversary can limit the effects of these weapons, as was the case in Operation Allied Force. Following that campaign, the Department of Defense claimed that NATO forces had destroyed 122 tanks, 250 armored personnel carriers and some 450 artillery pieces in the Alliance's 78-day operation.[67] Ken Silverstein points out, however, that Pentagon officials quietly conceded that the true numbers were far lower.[68] Tim Butcher and Patrick Bishop reported in July 1999 that a private, preliminary review by NATO experts of the bombing campaign against Yugoslavia concluded that "only a handful of tanks, guns and armoured personnel carriers were damaged."[69] Further examination revealed that the withdrawal of Milosevic's forces was accomplished over a road and bridge network that supposedly had

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[66] Payne, 30-1.

[67] Silverstein, 2-4.

[68] Ibid.

[69] Tim Butcher and Patrick Bishop, "NATO Admits Air Campaign Failed," *Electronic Telegraph*, 22 July 1999, 1. [on-line] available from http://www.telegraph.co.uk/et?ac=002400408746017 3&rtmo=wQAAoeMb&atmo=99999999&pg=/et/99/7/22wkos22.html

been shattered by the bombing campaign.[70] Stand-off precision-strike warfare can be frustrated by foes that disperse or harden their forces or engage in deception. By doing so, a foe may be able to ride-out a U.S. standoff attack, emerge with most of its forces intact, and undercut the effectiveness of U.S. precision weaponry. This is especially likely when political considerations (for instance, fear of collateral damage) constrain the employment of certain types of conventional munitions.

2. Sensor Limitation

Although computerized systems will become more sophisticated, nothing on the technological horizon is likely to provide the "God's-eye-view" to force commanders so fervently espoused by proponents of the RMA. Michael O'Hanlon of the Brookings Institution asserts, "All sensors have limitations, and to a large extent they are limitations imposed by the immutable laws of physics. Visible-light and infrared detectors cannot see through heavy clouds. Radar tends to have mediocre resolution. None of these sensors can deeply penetrate metal, water, concrete, or most soils."[71] In addition, the sensors employed by today's conventional forces cannot determine the location of certain targets of great strategic and political significance, such as command posts and mobile weapon platforms.

The increasing dependence of conventional weaponry on sensor performance raises questions about the notion of entrusting United States deterrence and war fighting missions solely to conventional means and their associated systems. Nuclear weapons may provide a means in some circumstances of compensating for the shortcomings in the

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[70] Silverstein. 2.

[71] Quoted in Ibid.

information architecture and the high degrees of synergy needed to conduct a successful precision strike.

3. Friction

The history of warfare has shown that even if a target is identified and targeted, there is no guarantee it will be destroyed.[72] For instance, the delivery vehicle or its payload may malfunction. Clausewitz's assertion regarding the prominence of friction in warfare has not been displaced by the prospects of the RMA. The General Accounting Office concluded after the Gulf War that "no matter what the weather, day or night, delivery of precision air to ground munitions was impaired and sometimes made impossible by clouds, haze, humidity, smoke and dust."[73] In 1999, Serbian forces used a 1964 Russian missile to shoot down an F-117, an aircraft that is meant to be virtually invisible to enemy radar.

New technology itself creates its own distinct types of friction. Barry Watts points out that "technological innovation in the means of combat introduces novelty into warfare, and the indirect effects and second-order consequences of novelty are never predictable with any high degree of certainty."[74] Friction will continue to be central to future warfare regardless of the technological changes in the means of combat. Nuclear weapons are an "anti-friction" arsenal, in that (at least in some delivery modes, such as

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[72] Of war, Clausewitz noted, "No other human activity is so continuously bound up with chance." Carl von Clausewitz, *On War* trans and ed., Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 85.

[73] Silverstein, 3.

[74] Barry D. Watts, *Clausewitzian Friction and Future War* (Washington, DC: National Defense University Press, 1996), chapter 2. [McNair paper no. 52 on-line] available from http://www.ndu.edu/inss/macnair/mcnair52/m52cl.html.

ICBMs and SLBMs) they engender a feeling of certitude with respect to their probable effectiveness that has yet to be eclipsed by any conventional weapon.

The more the U.S. military embraces the RMA, the greater the potential for subtle manipulation of America's "situational awareness" by a sophisticated adversary, or the prospect of confusion with an overabundance of information. Conventional precision munitions dependent on this information architecture are only as effective as the information gleaned from it. Nuclear weapons may provide the means to circumvent degradation in the "system of systems," Admiral William A. Owen's term for fusing sensors; command, control, computer applications and intelligence processing (C4I); and precision weaponry to create "dominant battlespace knowledge"—that is, "awareness and understanding of what, where, when, and why of military significance in any arena in which we may be engaged."[75]

4. Problems of Strategic Sufficiency

A strategic weapon is designed to attack the sources of a country's political, economic, or military power. Spulak contends that "A stockpile of weapons is strategically sufficient if it can, by itself, be used to destroy the sources of the enemy's power," and that, "if long-range precision non-nuclear weapons are strategic in the same sense as nuclear weapons, then they must also be strategically sufficient."[76] In 1972, a White House memorandum defined strategic sufficiency in simpler terms as the forces

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[75] See "A Report on the JROC and the Revolution in Military Affairs," *Marine Corps Gazette*, 16 August 1995. For a similar view, see Joseph S. Nye, Jr. and William A. Owens, "America's Information Edge," *Foreign Affairs* (March/April 1996): 20-36.

[76] Robert G. Spulak, Jr., "Strategic Sufficiency and Long-Range Precision Weapons," *Strategic Review* 22, (Summer 1994): 32.

necessary "to ensure that the United States would emerge from nuclear war in discernibly better shape than the Soviet Union."[77]

The strategic sufficiency argument, as applied to long-range precision weapons, is based on the notion that the precise application of non-nuclear weapons against critical targets would force an adversary to capitulate. Supporters of this proposition see all countries as systems comprised of many interlinking nodes, and these nodes—individuals, physical systems, groups, or perhaps even symbols—are interdependent. Careful analysis of the linkages in this system supposedly can uncover a relatively small number of critical nodes whose destruction or disruption would bring about the physical or psychological collapse of the entire system. For example, in 1988 the Commission on Integrated Long-Term Strategy declared, "fewer weapons are needed to attack military targets, and collateral damage to civil society can be held to very low levels or totally avoided."[78] What follows from this is the belief that war can be waged without widespread, indiscriminate destruction.

Conventional precision weapons are not a panacea for all facets of military conflict or the changing international security environment; greater reliance on these weapons without an accompanying recognition of their shortcomings may jeopardize a

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[77] Gregg Herken, *Counsels of War* (New York: Knopf, 1985), 266. Quoted in Jervis, "The Political Effects of Nuclear Weapons," *International Security* 13, (Fall 1988): 85.

[78] Iklé and Wohlsetter, 36. Quoted in Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 32.

coherent synthesis of U.S. strategic capabilities.[79] While it is both desirable and admirable for military planners to work toward a vision of warfare that mitigates the human cost of armed conflict, the rhetoric accompanying these efforts may lead the United States to expect easy victories and military success without suffering, leading to involvement in conflicts that are much more costly and protracted than anticipated.

The degree to which bombardment can destroy strategically significant targets depends upon the total number of strategic targets, knowledge of the target locations, the number of known targets engaged, the accuracy of the bombardment, the effectiveness of the weapon against each target, and the timeliness of repair.[80]

Perhaps the most important challenge is determining if there really are a small number of critical nodes, or if the number of targets necessary for military victory or successful coercion is likely to be very large. History seems to indicate that an increase in the destructive capability of military forces is accompanied by greater dispersal of an opponent's forces, thus increasing the number of likely targets. Ancient armies had a density of about one man per square meter whereas modern armies have densities of less than one man per 30,000 square meters.[81] The unsuccessful hunt for Scud missiles during the Gulf War serves as a warning about the difficulty of finding weapons

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[79] In 1994 Paul Nitze underscored this point when he stated, "It is now vitally important that we understand both the effectiveness and limitations of strategic conventional weapons. Unfortunately, much of the postwar popular evaluation of our weapons is based on perceptions drawn from media coverage. . . . the professional discussion has been superficial, often little more than speculation about the levels of nuclear weapons required in a post-Cold War strategic environment. Paul H. Nitze, "The Front-Line Duty of Conventional Arms," *Washington Post National Weekly Edition*, January 24-30, 1994, 23. Quoted in Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 33.

[80] Ibid, 34.

[81] Trevor N. Dupuy, *Understanding War* (New York: Paragon House, 1987), 84.

dispersed in an enemy's own territory.[82] Dispersion and deception are formidable strategies in war. In a prolonged conflict, or in preparation for one, nonmilitary facilities also may be scattered for protection.[83]

Dispersion strategies suggest that even a relatively small country can attempt to hide thousands (if not tens of thousands) of strategically important targets. It is reasonable to conclude that in a protracted conflict there may be more potential or suspected strategic targets than expensive conventional ordnance available to destroy them. If this is the case, nuclear weapons may present a viable option to solving problems created by the dispersion of critical assets.

The number of targets designated as strategically important reveals an important paradox concerning long-range precision weapons. If the number of targets in a country is relatively few, they may (with the exception of large fixed facilities) be mobile or hidden. Such countermeasures increase the dependence of precision weaponry on absolute location and construction data, which decreases the effectiveness of precision weaponry. If there are too many strategic targets to hide, long-range precision weapons

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[82] In this case the United States was looking for relatively large weapon systems hidden by Iraq. See David Blair, "How to Defeat the United States: The Operational Military Effects of the Proliferation of Weapons of Precise Destruction," in *Fighting Proliferation: New Concerns for the Nineties*, ed. Henry Sokoloski (Maxwell Air Force Base, AL: Air University Press, 1996), 89.

[83] During the Vietnam War, for example, United States' aerial bombardment of fuel facilities led the North Vietnamese to disperse their oil reserves. They placed storage tanks near major highways and 55-gallon drums along roads, in cities, towns, and rice paddies. Lines of communication were also dispersed. The reason the United States could not interdict the Ho Chi Minh trail was that it was not a single trail but a complex interwoven system of many roads and trails. Bridges that were destroyed were replaced by dispersed systems of fords, pontoons, and underwater bridges. The electrical power plants destroyed in the spring of 1967 were replaced by more than 2,000 portable generators. Quoted in Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 35.

may not be strategically sufficient, either due to the lack of enduring effects of an attack or because of the potential difficulty of allocating a weapon to each target.[84]

Compounding this problem is the fact that, even if conventional precision ordnance reaches a strategic target, there is no guarantee that the damage inflicted will be significant or enduring. Even if attacking forces used ballistic missiles with good 1980s-level accuracy (fifty-meter circular error of probability [CEP]) and optimized runway-cratering munitions, they would still need 15 to 48 missiles to close a single air base, and well-equipped engineers could return the base to an operational status in one day.[85] The tendency of an attacker to overestimate the time and effort required for repairs may lead to miscalculating the "net" effect of a conventional attack.[86] A few examples help illustrate this point:

> The United States Strategic Bombing Survey (USSBS) conducted after the Second World War concluded that industries, railroads, etc., could be quickly rebuilt after intense bombing. The USSBS studied, for example, attacks on the German ball-bearing industry. Paul Nitze relates that 'not one end item of German war production had been delayed a single day by virtue of attacks on the ball-bearing industry. The buildings of the ball-bearing plants had been blown into rubble, not once, but time after time. . . . While the cost to the Germans to restore ball-bearing production was high, involving the dispersal of factories and even the building of underground plants, they were able to offset the damage within the time they had to repair their losses.'[87]
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> On August 17, 1943, RAF Bomber Command launched a massive strike against the missile research facility at Peenemunde. Five hundred ninety six bombers dropped 77,530 bombs, killing 120-170 members of the regular German staff and 500-600 foreign workers. Historians estimate

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[84] Ibid.

[85] Blair, 87.

[86] The word "repair" also means accommodation to the loss of that which has been destroyed.

[87] Paul H. Nitze, *From Hiroshima to Glasnost* (New York: Grove Weidenfeld, 1989), 32. Quoted in Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 37.

> that the raid delayed the German weapon program for no more than two months.[88]
>
> The North Vietnamese had a 500,000-man repair force that repaired bridges, railroads, and roads. The Kep rail yard was frequently operational the day after being destroyed. Bridge spans that were dropped were replaced by floating spans that were kept hidden during the day and emplaced at night.[89]

These examples suggest that a limited bombardment with long-range precision weapons will leave open the opportunity to repair strategic facilities. The opportunity for repair following a strategic nuclear attack is unlikely.[90] In this respect, it appears that although long-range precision weapons may become effective tactical weapons, due to their operational insufficiencies, they cannot be considered strategic in the same sense that nuclear weapons are strategic.

Nuclear weapons cannot simply be substituted for conventional weapons whenever a PGM fails to find its mark or achieve a desired level of destruction. There are tremendous political and psychological inhibitions associated with the use of nuclear weapons, especially in the United States and other Western societies. The challenge faced by planners is to integrate nuclear weapons into the strategic capability of the United States in a manner that provides a hedge against the shortcomings of conventional weaponry, without lowering the threshold for nuclear use.

5. Niche Weaponry

It is a common belief that the RMA has allowed nuclear weapons to be surpassed by precisely targeted conventional weaponry. Gray, however, points out that, while "it is

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[88] Terry White, *Swords of Lightning* (London: Brassey's, 1992), 205. Drawn from Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 37.

[89] Spulak, "Strategic Sufficiency and Long-Range Precision Weapons," 37.

[90] Ibid.

true that accuracy is more important than energy yield in consequence for lethal effect . . . it does not mean that CEP is everything."[91] Although some nuclear weapons, due to their destructive power, can tolerate some degree of target inaccuracy, it appears that they are also ideally suited for applying their unmatched destructive effects against targets that are super-hardened, or otherwise difficult to destroy with any degree of certainty.

Deep underground basing was practiced by Germany and Britain in World War II. It was a hallmark of Soviet and Chinese military construction during the Cold War, and is a feature of Russian, Chinese, Iraqi, North Korean, and Libyan weapons of mass destruction (WMD) facilities today. Gray argues that the most reliable option available for destroying or sealing off super-hard underground targets is a nuclear device.[92]

Destroying biological and chemical weapons and stockpiled agents is a military requirement of growing strategic concern for which nuclear weapons may be suited, at least from operational and technical perspectives. The problems of targeting super-hardened WMD facilities are not confined to the penetration of the physical barriers but also pertain to the reliable elimination of agents that can be lethal in very small doses. Nuclear weapons offer a solution to the shortfalls of conventional weaponry in addressing this problem. According to Gray,

> VX nerve gas and many other chemical, toxin, and even biological agents (which, of course, tend to be fragile as living organisms) are extremely difficult to destroy definitively, as opposed merely to disperse, except by means of the extraordinary heat generated by nuclear explosives.[93]

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[91] Gray, *The Second Nuclear Age*, 135-7.

[92] Ibid.

[93] Ibid.

Given the greater influence exercised by hostile regional powers, it is likely that at least some of them will seek to protect their most vital strategic assets (WMD, delivery vehicles, C^3I systems, political leaders, and key staff) by means of super-hardening or positional uncertainty. Given the vulnerability of U.S. and Allied forces and homelands to assault by NBC weapons, U.S. military options should include a nuclear capability to destroy such weapons, before they are used against civilian or battlefield targets.

G. SUMMARY

Euphoria surrounding Western triumphs in the Cold War coupled with America's conventional military excellence has led some to question the role of America's nuclear arsenal. Some proponents of the RMA have argued that technology can now be leveraged to eliminate the need for nuclear weapons. U.S. conventional military excellence, real enough though it is, however, does not always translate into guaranteed defense or deterrence (extended or otherwise). The effects of conventional weapons are not strategically sufficient to allow their uncontested use. The time required to amass forces and inflict damage on a potential opponent by conventional means hinders attempts at deterrence or compellence. The technological advances of the RMA will invariably bring about negative indirect effects and second-order consequences that are yet unknown. Conventional precision weapons, because they rely on the "system of systems" information architecture, may be susceptible to subtle manipulation and information overload that preclude the "reliability of effect" that nuclear weapons seem to assure. Finally, conventional weapons lack the explosive yield and incendiary effects essential for destruction of some hardened targets and some WMD facilities.

The advantages created by the RMA will not continue in perpetuity. Having the advantage in a period of military revolution is no guarantee that the advantage will endure, or that it will translate into increased military effectiveness in all contingencies. Since the Napoleonic era, military organizations have had to exploit changes in technology quickly to derive an advantage before their major competitors copy or offset the advantage.[94] Moreover, there is no guarantee that the United States will maintain the qualitative conventional edge derived from the RMA, either because of budgetary constraints caused by competing national priorities or because other states will surpass the United States in key technologies, or adopt effective asymmetrical strategies.[95] For the foreseeable future, nuclear weapons will remain the ultimate deterrent and a hedge against the failure of conventional forces in battle.[96]

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[94] Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest*, (Fall 1994): 37.

[95] Joseph and Lehman, 10. For a similar view that highlights concern over future funding of the RMA see Libicki, "Emerging Military Instruments," 191.

[96] With this in mind, the policy logic described by Thucydides as motivating Athens to maintain a very large fleet is worth revisiting. "The trireme fleet was kept in service in 'peacetime' from the time of Themistocles to the beginning of the Peloponnesian War; its commanders were political appointees rather than specialists; and the political dimension of naval power was well understood. In particular, it was realized that the size of the fleet (200 boats) reflected the level of Alliance resources and the scope of Athenian ambitions, rather than a response to the scale of perceived enemy threats. Athenians would not have thought it wise to reduce the size of their fleet merely because the Persian/Phoenician or Corinthian threat waned. Their deployment strategy was not responsive, but rather intended to provide the means needed for a positive affirmation of Athenian political goals. When war came, however, this 'political' fleet fought, and by all accounts, it fought well." Edward N. Luttwak, *The Political Uses of Sea Power* (Baltimore: Johns Hopkins University Press, 1974) 71-2. Quoted in Gray, *The Second Nuclear Age*, 121-2.

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III. ASYMMETRIC RESPONSES

A. CONTOURS OF FUTURE WAR

What future warfare will look like depends where, under what circumstances, and for what purposes a country commits armed forces to combat. Lester Grau contends that the Russian General Staff's vision of future warfare "anticipates dynamic, high-tempo, high-intensity land-air operations encompassing vast areas and extending into outer space. Precision-guided munitions (PGMs), which approach the effectiveness of tactical nuclear weapons but avoid most collateral damage, would be employed from [the] war's outset."[97] This view of future war puts a premium on maintaining large stocks of expensive, constantly-upgraded PGMs. The Russians may aspire to fulfill this vision, but as Operation Desert Storm in 1991 and Operation Allied Force in 1999 demonstrated, only the United States and a few European nations are currently able to conduct this type of war on a theater level.

The current revolution in military affairs (RMA) have led America's armed forces to concentrate on wedding emerging technologies to conventional munitions, often with impressive results. As Grau points out,

> One of the enduring lessons from "Desert Storm" is that a nation does not want to stand up against the precision-guided munitions and cruise missiles of the United States unless it has its own large supply of precision-guided munitions and cruise missiles, or, at the very least, an effective air defense or a limited target set of marginal value. At present, the countries that have a large supply of high-tech weaponry are few and unlikely to go to war with the United States in the near future.[98]

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[97] Grau, 2.

[98] Ibid.

Grau's assertion does not mean that the United States has entered a period of guaranteed peace or that nations without a large supply of high technology weaponry will avoid conflict with the United States. The United States has global commitments and interests, and may come into conflict with other nations. These nations may choose to challenge the United States by blunting its technological edge.

In some instances, a nuclear device could represent a counter to U.S. technological superiority. A nation could influence, dissuade, or counter high technology forces by the mere possession or actual use of these atomic devices.

B. U.S. CAPABILITY

The military gap between the West—symbolized primarily by U.S. military capabilities—and the rest of the world has widened due to the RMA. David Blair argues that the U.S. military has two great advantages over all other militaries in the world: money and organizational capability.[99] These factors have enabled the United States to exploit the RMA in a manner that is not likely to be equaled or eclipsed by competitors in the near future. The United States spends eight to ten times as much on the military as its nearest competitor, and the U.S. defense budget is higher than the entire gross national products of many "rogue states" that Americans see as their most likely opponents.[100] Though less quantifiable, the organizational capability of the U.S. military must seem equally imposing to any state thinking of challenging the United States. In 1996, David Blair underscored this point:

> That [organizational] capability allows the U.S. to operate and maintain air and naval forces that even European countries can only palely imitate. Further, it allows the U.S. to provide logistics support for large forces

[99] Blair, 76.

[100] Ibid

> around the world and to carry out large, complicated, joint-force operations that no one else can think of matching. Other U.S. advantages in technology, training, strategic and operational thought, and alliance support flow from advantages in money and organizational capability. Thus, even after reductions in military spending that followed the cold war, U.S. military capability certainly seems sufficient, at least at first glance, to justify bestowing the title of 'sole superpower' on the United States.[101]

Similarly, in 1998 Ahmed Hashim argued, "Today, no other nation even approximates America's combination of technological prowess, economic vitality, military strength, [and] internal stability."[102] Thus, for the near term, the United States may be the nation most capable of exploiting technology and making the necessary organizational and doctrinal changes to benefit from the current RMA.

C. THE CAPABILITIES OF COMPETITORS

The ability of "near peer" competitors to achieve technological and operational parity with the U.S. military is uncertain. Russia does not have the economic capability, political will, resources and laboratories to exploit the RMA. The Russian armed forces are preoccupied by implementation of basic reforms, including cutting down the inflated conventional force structure and possibly creating a professional force to better reflect the country's relatively small economic base and military budget.[103]

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[101] Ibid. 76-7.

[102] Ahmed S. Hashim. "The Revolution in Military Affairs Outside the West," *Journal of International Affairs* 51. no. 2 (Spring 1998): 4 [journal on-line] available from http://proquest.umi.com/pqdweb?TS=950063...&Fmt=3&Sid=1&Idx=36&Deli=1&RQT=309&Dtp=1

[103] Ibid. 5.

Equally uncertain is China's ability to implement the RMA. Hashim points out that China must overcome considerable obstacles to field an RMA-type military:

> While numerically impressive the, the PLA remains an immobile and antiquated behemoth. Its command, control and communications are still relatively rudimentary; it lacks precision-guided munitions and has a very backward electronic warfare capability. In short, it is not in a position to leap into the future; rather, it is incrementally moving from the past into [Western standards of] the late 1970s in terms of the quality of its weapons. It is not clear that the PLA high command fully understands the culture of high-technology warfare, symbolized by the strongly held belief in the value of a capital-intensive approach to war and in the decentralization of command and control; or if PLA leaders are even comfortable with that culture. In fact, the believers in the RMA in China are probably still a minority.[104]

As for the rest of the world, aside from key exceptions (such as Japan, Australia, and Western Europe), most of it is lagging behind in the development of advanced conventional military power. Many countries have been importers of weapons, not producers of advanced armaments. They simply do not have the scientific, technological, and industrial base to produce high-technology weapon systems. In addition, military units in developing countries have shown a marked inability to wage conventional war effectively, and this may hamper their efforts to benefit from the RMA.[105]

These disadvantages affect the ability of some of America's potential adversaries to exploit or counter the U.S.-led RMA. Due to the absence of the technical prowess,

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[104] Ibid. 6.

[105] Eliot Cohen. "Distant Battles: War in the Third World," *International Security* 16, no. 4 (Spring 1986): 143-171. Cohen discusses how battles in the Third World have been characterized by the domination of land warfare and a systematic inability to use the other branches of the military, namely air and naval power, effectively. There are several reasons why this is so. Some countries had well-developed ground forces but embryonic air and naval forces when they gained independence from colonial powers in the 1950s and 1960s. Others did develop large air and naval forces (e.g., Latin America and Arab countries), but there never arose a culture of interservice cooperation or coordination. Often jealous of one another and fighting for a bigger share of the defense budget, the services in many countries exist as autonomous fiefdoms headed by service chiefs more interested in competing in national politics or defending their turf than in working with the other services.

organizational flexibility and decentralized system of command and control necessary to compete with the United States in high-technology conventional warfare, it is entirely plausible that a country might seek an asymmetrical response to the widening gap between its conventional capabilities and those of the United States. This quest for an asymmetrical response could result in the acquisition or use of nuclear weapons to deter U.S. intervention in a regional conflict or to make U.S. involvement as costly as possible.

D. ASYMMETRIC RESPONSES

The relative optimism expressed in the early 1990s about the post-cold war era seems to have been overshadowed by a sense of urgency about new or more complicated threats to U.S. national security, including asymmetric threats.[106] U.S. conventional dominance has motivated its potential foes to seek effective asymmetric forms of warfare (e.g., political, NBC, irregular) to offset U.S. conventional superiority.[107] The search for

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[106] In 1998, Peter Wilson, of the RAND Corporation, defined asymmetry as "the prospect of an opponent designing a strategy that fundamentally alters the terrain on which a conflict is fought." Such a strategy would likely include the use of weapons in ways unforeseen by the United States. Ibid.

[107] In 1997, Secretary of Defense William Cohen stated, "As the new millennium approaches, the United States faces a heightened prospect that regional aggressors, third-rate armies, terrorist cells, and even religious cults will wield disproportionate power by using ... nuclear, biological, or chemical weapons against our troops in the field and our people at home.... Indeed, a paradox of the new strategic environment is that American military superiority actually *increases* the threat ... by creating incentives for adversaries to challenge us asymmetrically." Office of the Secretary of Defense, *Proliferation: Threat and Response* (Washington, DC: Government Printing Office, 1997), iii.

a suitable counter, or deterrent, to one state's military superiority, is not unique to the current RMA but has been a hallmark of military history.[108]

The ability to counter America's RMA is not limited to technologically sophisticated countries. As Donald E. Ryan has cautioned, "Even technologically backward societies have a nasty habit of devising strategies to offset [America's] high-tech superiority."[109] The key to developing a strategy to blunt U.S. technology is to create a military based on weapons that are relatively cheap to field and maintain but nevertheless threaten the ability of the U.S. to project power.[110]

For potential adversaries, the attractiveness of weapons of mass destruction, especially nuclear weapons, may increase if United States development of an RMA-based military force centered around precision-guided munitions continues on its current

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[108] An example of this occurred in 1962, when the Soviet political military leadership decided to shift the global geo-strategic correlation of forces and provide Cuba with a credible defense against an invasion by the United States. With limited air- and sealift assets, the Soviet military decided to deploy an expeditionary force that would rely heavily on the new revolution in military affairs nuclear weapons and long-range missiles. Operation *Anadyr* called for deployment of ballistic missiles—the SS4 MRBM and the SS5 IRBM—to rapidly upgrade the Soviet transoceanic range nuclear arsenal in order to buy time for the delayed SS7 ICBM program. A second feature—undetected by U.S. intelligence for some 30 years—was the deployment of tactical nuclear weapons for use by the relatively small Soviet expeditionary force as high-firepower, anti-invasion weapons. Recent revelations indicate that the Soviet political-military leadership designed *Anadyr* as an asymmetric response to the clear military nonnuclear superiority of the United States in the Caribbean region. Peter Wilson, "Asymmetric Threats," in Hans Binnendijk and David C. Gompert, eds., *Strategic Assessment 1998* (Washington, DC: U.S. Government Printing Office, 1998), 1. [report on-line] available from http://www.ndu.edu/inss/sa98/sa98ch11.html; Internet; accessed 09 February 2000.

[109] Quoted in Dunlop, 22.

[110] David Blair has provided an important point for consideration regarding the likelihood of an opponent's use of asymmetric means. "Supposed you were a military planner for a country that might eventually want to challenge U.S. superiority. How would you develop a competitive strategy? You would not seek to build an air force or blue-water navy. Maintaining a fleet of modern fighter aircraft is beyond the finances and organizational capabilities of most countries. Even China, Russia, Japan, or a major Western European country can hardly think of building an air force with sufficient size, organizational capability, or technology to challenge the U.S. Air Force. Similarly, no other country could hope to deploy a navy in a way comparable to the U.S. Navy. The U.S. advantage on the ground is less dramatic, but no other nation can match the integrated combined-arms capability of the U.S. Army and Marine Corps." Blair, 89.

trajectory. Less developed countries also may view the acquisition of a substantial conventional strategic strike capability as well beyond their means. But, they may consider nuclear weapons as a relatively cheap counter to non-nuclear strategic strike operations.[111]

A future regional opponent could threaten U.S. and allied forces with a dramatic form of military escalation. Colin Gray asserts, "There are undeniable old-fashioned virtues to nuclear arms," in that "such arms are the ultimate in swift brutality, they are reliable in their destructive effect (if their delivery is tactically practical, that is), and they are universally comprehended and feared."[112] Whether or not it is actually used, the Russian, Chinese, or North Korean nuclear capability, as well as the growing nuclear threat presented by other regional actors, could have profound implications for the United States and its coalition partners, and could severely limit their ability to operate in the digitized battlespace during a conflict. A single nuclear warhead, detonated above the battlespace, could have devastating consequences for the RMA technologies deployed by the United States. Such systems, including precision-guided munitions and their associated sensors, could be rendered impotent by the effects of an electromagnetic pulse.[113]

Even without operational use, the mere presence of a nuclear capability would act as a "strategic shadow" and could weaken the commitment of key allies to any future

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[111] Krepinevich and Kosiak, 8.

[112] Gray, *The Second Nuclear Age*, 165.

[113] Robert L. Pfaltzgraff, Jr., and Richard H. Shultz, Jr., "Future Actors in a Changing Security Environment," in Robert L. Pfaltzgraff, Jr., and Richard H. Shultz, Jr., eds., *War in the Information Age: New Challenges for U.S. Security* (Washington, DC: Brassey's, 1997) 16-7. For another view on this, see Peter Wilson, "Asymmetric Threats," in Hans Binnendijk and David C. Gompert, eds., *Strategic Assessment 1998*.

U.S.-led military response to regional aggression.[114] This assessment is similar to that suggested by Robert Harkavy in his theory of "triangular" deterrence. In some instances, when a state is threatened by a nation which it cannot strike against due to distance or technological incapacity, it may attempt to deter its adversary by threatening to strike a third nation within its range, or attempt to compel it to change its behavior with an actual attack.[115]

It appears that—at least in some circumstances—no matter how competent U.S. multilayered protection, information architecture, and precision-guided weaponry are, nuclear-armed forces, even if small and unsophisticated, could neutralize or severely disrupt the employment of state-of-the-art conventional arms.

E. STRATEGIC SANCTUARY

Threats to use nuclear weapons, particularly in strategic strikes, will continue to exert a dampening effect on military operations. The loss of life and property associated with nuclear reprisal following a precision conventional attack would most likely result in any nuclear-armed state being accorded the status of a strategic sanctuary.[116] Had the Iraqis possessed nuclear weapons during the Gulf War, it is probable that the course of that conflict would have been dramatically affected.

Similarly, Krepinevich and Kosiak argue that "there is danger that the development of an effective non-nuclear strategic strike capability by the United States—

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[114] Wilson, 2.

[115] Robert E. Harkavy, "Triangular or Indirect Deterrence/Compellence: Something New in Deterrence Theory?" *Comparative Strategy* 17, no. 1 (January-March 1998): 66.

[116] See Michael G. Vickers, "The Revolution in Military Affairs and Military Capabilities," in Robert L. Pfaltzgraff, Jr., and Richard H. Shultz, Jr., eds., *War in the Information Age: New Challenges for U.S. Security* (Washington, DC: Brassey's, 1997) 43.

because it would appear much more usable than a nuclear strike capability—would increase the incentives for potential adversaries to acquire at least a small nuclear arsenal, so that they too will have their homeland, or at least some portion of strategic targets within it, accorded 'sanctuary' status."[117] At a minimum, a regional power armed with a small, survivable, intermediate-range nuclear capability could impede U.S. force deployments and complicate efforts to choose an optimal employment strategy. Certain aspects of conventional power projection, such as target selection and sea control, might be compromised as well. U.S. operational planners might have to select different sets of targets for conventional long-range strikes. U.S. forces might have to achieve forced entry against stiff opposition due to threats of nuclear reprisals. Such constraints could undercut America's reliance on PGMs.

F. VIEWS OF KEY FOREIGN POWERS

1. Russia

Today, one of the biggest threats to U.S. security interests is not based on Russia's strength, but on Russia's weakness. In 1998 Peter Wilson highlighted the problems facing Russia:

> Much of Russia's industry is shattered. Its military sits at the edge of crisis. Birthrates have fallen below death rates. Technology-savvy people are emigrating. The central government has problems with organized crime and fissiparous tendencies in the perimeter (e.g., Siberia, the Caucasus). Russians still aspire toward great power status, but in a bleak economy individuals are consumed by survival.[118]

Russia's loss of empire, its degraded conventional military capabilities, its humiliations in Afghanistan and Chechnya, its eroding warning systems, and its increased reliance on

[117] Krepinevich and Kosiak, 8.

[118] Wilson, 4.

nuclear forces all add up to a potential threat to the United States different from the one posed by the Soviet Union. Russians are steadfast in their desire to be accorded superpower status, even though they now lack many superpower capabilities. Moscow desperately wants to be recognized as a fulcrum power; lacking such recognition, and compounded with feelings of its own irrelevance, Russia's reaction could lead to irrational behavior and unintended consequences.

The successful employment of PGMs in the Gulf War and the Kosovo conflict by the United States forced Russia to confront the growing disparity between its conventional forces and those of the United States, a power perceived by many Russians as their likely adversary. Nikolay Poroskov, a Russian military commentator, recently summed up Russian conventional wisdom:

> While we were living as captives of the disarmament myth, the world continued to arm itself at a new technological level, while preparing for the wars of the third millennium. The United States is capable of employing up to 3,000 precision-guided munitions with non-nuclear warheads in a single strike and thereby achiev[ing] [its] strategic goals.[119]

The realization that Russian conventional forces are incapable of countering Western high-technology conventional weapons has led Russia to adopt a military doctrine that allows for an asymmetric response to overwhelming conventional superiority. The doctrine reinforces the belief that nuclear weapons are the most reliable and best-controlled component of the Russian Armed Forces, that relatively small expenditures are

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[119] Nikolay Poroskov, "The Case for the Nuclear Cudgel: Every Other State in the World is Obliged to Study Our Draft Military Doctrine," *Moscow Vek*, (04 February 2000): 1, FBIS. ID: CEP20000210000315.

required for their maintenance and modernization, and that both of these factors are especially important as Russia reforms its general-purpose forces.[120]

a. Russian Military Capability

In recent years, the combat readiness of the armed forces, with few exceptions, has continued to deteriorate. The war in Chechnya has provided an indication of Russian military capabilities and readiness, revealing an impoverished and antiquated force that has been poorly manned, inadequately trained, ill-equipped, and badly led.[121] Despite several partial breakthroughs recently in the reform process, Russia's armed forces continue to be in a state of deep crisis. Walter Parchomenko underscores the dire situation in the Russian military:

> Russia faces daunting problems in virtually every aspect of its armed forces. Too often, Russian soldiers are homeless, unpaid, hungry, humiliated, brutalized, and angry. Moreover, the poor state of Russia's conventional forces necessarily means a greater reliance on strategic nuclear forces in their military strategy and, consequently, a much lower threshold for resort to nuclear weapons.[122]

The low level of operational and combat readiness of Russian forces witnessed in Chechnya continues to drop primarily due to lack of funding, and it appears that few resources are available to improve the Russian's situation. The total 1999 defense budget

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[120] V. Baranovskiy, "On the Role of Military Factors in Post-Soviet Russia," Moscow *Mirovaya Ekonomika I Mezhdunarodnaya Otnosheniya* (01 November 1999): 4-5, FBIS, ID: CEP20000112000011.

[121] Ibid, 3.

[122] Ibid,1.

was only about $4 billion, providing six times less than the minimally needed funding for adequate combat training.[123]

Recurring financial shortfalls have wreaked havoc on the ability of the Russian military to provide rations and logistic support to garrisons in many regions of Russia.[124] Russian defense experts have stressed that:

> The re-equipping of the army and navy with modern weapons and military equipment has virtually stopped; the annual flying time of Russian pilots continues to drop and is now 15-20 hours *annually* compared to 150-180 hours in many NATO countries; more than 40 percent of Russian helicopters are unserviceable; much of the armor fleet is made up of obsolete models of tanks and armored personnel carriers; the provision of clothing, gear, and rations is at a very low level.[125]

Inadequate funding has resulted in a Russian military stripped of its former conventional capability and incapable of redeploying troops or conducting strategic operations.[126] In the spring of 1997, Russian Defense Minister Marshall Igor Sergeyev admitted that, apart from the Strategic Missile Forces and the Airborne Forces, "there were virtually no units

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[123] Walter Parchomenko, "The State of Russia's Armed Forces and Military Reform," *Parameters* (Winter 1999-2000): 6. [journal on-line] available from http://carlisle-www.army.mil/usawc/Parameters/99winter/parchome.htm; Internet; accessed 10 February 2000.

[124] In testimony to the Duma Defense Committee in October 1998, Colonel General Aleksandr Kosovan, Deputy Defense Minister and chief of the Construction and Billeting of Troops Directorate, stated that chronic nonpayment of debts by the military had interrupted deliveries of bread and vegetables to garrisons in many regions of Russia; that only two million of 600 million rubles (0.3 percent) allocated for military medicine in the 1998 defense budget had been received; and that only 17 percent of the required stocks of fuel had been delivered, thus restricting pilot flying time to only 8-10 percent of the required norm, and permitting virtually no navy combat training. Ibid, 2.

[125] Parchomenko, 4. Emphasis in original.

[126] Ibid, 3.

which were combat ready."[127] Under such conditions, Russian leaders may conclude that increased reliance on the deterrent effects of nuclear weapons will provide the best avenue for Russian security.

b. Russian Military Doctrine

As a result of almost a decade's "pause" in equipping Russia's Armed Forces, they are noticeably falling behind Western military establishments. This gap in capability has led many Russian military and government officials to question the ability of Russian forces to fight and win against an opponent armed with high technology conventional weapons. In response, a revised 1993 Russian military doctrine eliminated the 1982 Soviet pledge of "no first use" of nuclear weapons, implicitly because of the virtually "nuclear effects" demonstrated by the U.S. conventional arsenal in the 1991 Gulf War.[128] Moreover, in 1998, Defense Minister Sergeyev outlined a new direction for Russian security in response to continuing growth in Western conventional force superiority and the virtual collapse of Russia's conventional forces. Under these new guidelines direct threats to the sovereignty and territorial integrity of the Russian state would be met with all available means, up to and including nuclear weapons.[129]

This declaratory policy was followed in the fall of 1999 with a new draft military doctrine that introduced two important innovations. First, it allowed for the use

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[127] Sergeyev quoted in Vladislav Putilin, "Optimize the Strength of the Armed Forces," *Military News Bulletin* VII, no. 6 (8 April 1998): 2. Drawn from Jacob W. Kipp, "Russian Military Reform: Status and Prospects (Views of a Western Military Historian)," Foreign Military Studies Office. Based on a paper presented at: Seminar on Russian Security Prospects (9-11 June 1998) Department of Strategic and Defence Studies Finnish National Defence College, Sveaborg, Finland. [Article on-line] available from: http://call.army.mil/call/fmso/fmsopubs/issues/rusrform.htm, 6.

[128] James R. FitzSimonds, "The Changing Military Threat," Paper prepared for *Beyond the Technological Frontiers of Force XXI Conference*, 24 September 1996, OSD Net Assessment, 5.

[129] Moscow *RIA Military News Bulletin* (November 1998): 5. FBIS, ID: FTS19990128000061. Quoted in Parchomenko, 7-8.

of nuclear weapons in response to other weapons of mass destruction, such as chemical weapons.[130] Second, it allowed nuclear weapons to be used against any country or coalition—not necessarily one that includes a nuclear state—if the situation is critical to Russian national security. The draft military doctrine states, "The Russian Federation retains for itself the right to use nuclear weapons in response to the use of nuclear and other kinds of weapons of mass destruction against it and its allies, and in response to wide-scale aggression using conventional weapons in situations critical to the national security of the Russian Federation and its allies."[131] These new provisions hint that the Russians recognize that asymmetrical means may be necessary to buttress conventional armed forces that are incapable of providing an adequate defense against high technology conventional weaponry.[132]

According to Viktor Yesin, chief of the Security Council Military and Organizational Development Directorate, "however Russia may revive economically, it will never be able to oppose an organization like NATO with conventional weapons."[133] Russian Defense Minister Sergeyev also has declared that "at this moment, the overall situation is such, that in the coming years, Russia will not be able to support military-strategic and military-technical parity with the leading powers of the West on a

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[130] The policy is similar to one adopted earlier by the United States. In December 1997, Robert Bell, the senior director for defense policy at the U.S. National Security Council (NSC), stated that "If any nation uses weapons of mass destruction against the United States, it may 'forfeit' its protection from U.S. nuclear attack..." Quoted in David S. Yost, *The US and Nuclear Deterrence in Europe* (New York: Oxford University Press, 1999), 30.

[131] "Text of Written Version of Russian Ministry of Defence Draft Military Doctrine," *Krasnaya Zvezda*, Moscow (9 October 1999), 3-4.

[132] Nikolai Sokov, "Overview: An Assessment of the Draft Russian Military Doctrine," *CNS Reports* (October 1999): 2. [Report on-line] available from http://cns.miis.edu/pubs/reports/sokov.htm. Accessed 10 January 2000.

[133] Moscow *Nezavisimaya Gazeta* (05 February 2000): 1. FBIS, ID: FTS20000207000361.

'symmetrical' basis, especially in the area of non-nuclear armaments....In this regard, overall priority for the coming decade is being given to completing the development and launching of limited production of the most important models of strategic nuclear and non-nuclear armaments...."[134] In other words, nuclear deterrence has now become the backbone of Russia's defenses and nuclear weapons are seen as a hedge against Western conventional weapons superiority.

This proposition was tested in the summer of 1999 during the "Zapad-99" maneuvers, which simulated a NATO attack on Kaliningrad Oblast, a small enclave of Russian territory between Poland and Lithuania.[135] According to Dr. Nikolai Sokov, a senior research associate at the Center for Nonproliferation Studies, "Russian conventional forces were unable to hold for more than three days, and to avoid defeat Russia selectively used nuclear weapons to demonstrate that it took the situation seriously and was not afraid of escalation."[136] The Russian government's choice of such a scenario for the exercise constitutes a serious development and underscores its commitment to nuclear options when confronted with overwhelming high-technology conventional weaponry.

According to Pavel Felgengauer, the suggestion for Russia (and the rest of the world) is that "the threshold for future nuclear hostilities has now necessarily dropped

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[134] Moscow *Krasnaya Zvezda* (09 December 1999): 5-6, FBIS, ID: CEP19991208000053.

[135] Sokov, 2.

[136] Ibid.

to the lowest possible level."[137] This point is highlighted by the recent comments by Victor Sokirko in the Russian media:

> If there is reason to do so we can drop the big one not only in a world war but even in a conventional war when all other means of repulsing aggression have been exhausted.... Given that the conventional forces are already insufficient we will not be slow in using our nuclear weapons.[138]

Thus, it seems that Russia has forfeited all confidence in its conventional capability. As a result, Russian military and economic weakness may encourage reliance on prompt launch doctrines for nuclear retaliation and emphasis on nuclear first use in situations where its conventional forces are incapable of responding to high technology conventional weaponry.

2. China

The RMA has become one of the biggest challenges to China's military modernization. In a December 1999 article for the Institute of Southeast Asian Studies, You Ji contends that the People's Liberation Army (PLA) will have few capabilities to deal with the type of warfare associated with high technology conventional weaponry, nor will it be able to achieve breakthroughs in the military technology necessary to apply the RMA to its own defense modernization.[139] Ji concludes, "It is likely that China may be left further behind as [the] RMA helps the United States to achieve a qualitative leap

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[137] Quoted in Parchomenko, 8.

[138] Moscow *Moskovskiy Komsomolets* (27 January 2000): 2, FBIS, ID: FTS20000127000926.

[139] You Ji, "The Revolution in Military Affairs and the Evolution of China's Strategic Thinking," *Contemporary Southeast Asia* 21, no. 3 (December 1999): 1. [journal on-line] available from http://proquest.umi.com/pqdweb?TS=950063...1&Fmt=3&Sid=1&Idx=5&Deli=1&RQT=309&Dtp=1. Accessed 08 February 2000.

in its power projection capabilities in the new century."[140] If Ji is correct, China may seek an asymmetrical response, such as nuclear weapons, to offset the advantages conferred on a military force structured around PGMs and other RMA capabilities.

a. Chinese Shortcomings

Despite its great numbers of military personnel, China's military is beset with obstacles that may prevent it from achieving parity in its conventional capabilities with its presumed rivals. According to Peter Wilson, "China has a long way to go: its rocket forces have mixed performance records, its air force and navy are unimpressive, and no army can get half its budget from running businesses without putting its warrior orientation in question."[141]

Similarly, China's technical community seems to be incapable of developing and fielding RMA technology and weaponry. It appears that China has attained world standards only in limited technical areas, such as in its space program.[142] Ahmed Hashim judges that "the Chinese scientific and technological (S&T) infrastructure is considerably behind that of the West."[143] In many respects this may be one reason why China feels vulnerable to U.S. RMA-type capabilities.

In response to this vulnerability the Chinese Military Commission (CMC) has ordered the PLA to improve its research on the RMA. An important undertaking has been to use computer simulation systems to replicate high technology operations of the major powers in their recent limited wars. Of particular concern is a Chinese research

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[140] Ibid.

[141] Wilson, 4.

[142] Ji, 9.

[143] Hashim, 6.

project that is studying how to employ asymmetric warfare against an overwhelmingly powerful enemy.[144] This study could alter the Chinese view of nuclear weapons and influence Beijing's decisions about how to address conventional weaponry shortcomings.

b. Chinese Asymmetry

The Chinese seem to recognize the obstacles to countering high technology conventional munitions. Shen Kuiguan, a professor at the Air Force Command Institute in Beijing, has written that:

> Modern high-tech war is a fierce competition using high-tech weaponry under nuclear or deterrent conditions. In such a war, it will be difficult for the side that is at a disadvantage in technology and military strength to defeat the opponent, because the high quality combat capacity of high-tech weaponry widens the disparities between the two sides.[145]

The Chinese further understand the utility an asymmetric response may present in providing a hedge against high technology weaponry. In 1995, Major General Wu Jianguo underscored this point in a paper published in *China Military Science*:

> When countries possessing nuclear weapons and high-tech conventional weapons are involved in a war in which the conflict is intensifying, the possible use of nuclear weapons cannot be ruled out. Nuclear weapons, therefore, are still a trump card in the hands of nuclear nations.[146]

What merits attention is the intensity with which the Chinese have undertaken to further their understanding of nuclear weapons in a high technology conventional environment and the conclusions they have drawn. Of specific concern is the Chinese position regarding the role nuclear weapons appear to have played in shaping

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[144] Ibid. 10.

[145] Senior Colonel Shen Kuiguan, "Dialectics of Defeating the Superior With the Inferior," *Chinese Views of Future War, Part Three: Modernizing For Local Defense Modernization in Historical Perspective*, 53. [book on-line] available from http://www.ndu.edu/inss/books/chinview/chinapt3.html. Accessed 08 November 1999.

[146] Jianguo. 14.

decisions during the Gulf War. Chinese military officials clearly believe that, owing to their psychological impact, nuclear weapons provided an effective deterrent and counter to the use of certain non-nuclear weapons in that conflict. (Apparently the Chinese were referring to chemical and biological weapons.) The Chinese maintain that this lesson should not be forgotten.[147]

3. North Korea

a. Early Impressions

The United States exposed a newly formed North Korea to the asymmetric qualities of nuclear weapons. North Korea's weakness as a non-nuclear state was revealed when the United States implied that it would use nuclear weapons to deter North Korean and Chinese aggression during the Korean War. It is reported that Kim Il Sung began showing an interest in nuclear weapons during Harry Truman's Presidency.[148]

During President Eisenhower's administration North Korea also was shown the potential benefits of a nuclear capability. Eisenhower's tenure was characterized by two phrases that defined America's outlook regarding nuclear weapons

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[147] General Jianguo indicates the threat to use nuclear weapons in a conventional war would confer significant psychological advantages and would "enable a military force to hold a dominant position, which would enhance troop morale and frighten the enemy on the one hand, and restrict the enemy's use of some conventional means on the other, thus changing the direction of the war. These past events should not be forgotten." Quoted in Ibid, 15-6.

[148] Thomas H. Henriksen and Jongryn Mo, eds., *North Korea After Kim Il Sung: Continuity or Change?* (Stanford: Stanford University Press, 1997), 68.

until the late 1950s: "New Look" and "massive retaliation."[149] Eisenhower's refusal to turn the United States into an "armed camp" by matching Chinese and Russian armies "man for man, gun for gun, and tank for tank at any particular time and place" served as the foundation for the New Look defense doctrine.[150] Eisenhower saw the doctrine as first "a reallocation of resources among the five categories of forces, and second, the placing of greater emphasis than formerly on the deterrent and destructive power of improved nuclear weapons."[151] This position was coupled with Eisenhower's belief that nuclear weapons should be treated merely as part of the American military arsenal, available for use like any other weapon.[152] From this, the North Korean government learned that not only did nuclear weapons provide a significant regional deterrent, but that they also served as an inexpensive substitute for conventional parity with a potential adversary.

c. Democratic Republic of North Korea's (DPRK) Reaction to the NATO Bombing of Yugoslavia

NATO's bombing of Yugoslavia in the 1999 Kosovo conflict apparently made a deep impact on the thinking of the North Korean authorities about their professed

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[149] In a passage in his speech on 12 January 1954 to the Council of Foreign Relations in New York, Secretary of State John Foster Dulles, emphasizing the importance of "massive retaliatory power," stated that the "way to deter aggression is for the free community to be willing to and able to respond vigorously at places and with means of its own choosing." Dulles did not use the term "massive retaliation" in his speech, nor did he concentrate solely on nuclear weapons. Nevertheless, this speech has come to be remembered as the enunciation of the American "massive retaliation" strategy. For a complete discussion of this point see Saki Dockrill, *Eisenhower's New Look National Security Policy, 1953-61* (New York: St. Martin's Press, 1996).

[150] Eisenhower quoted by John Foster Dulles, "A Policy of Boldness," *Life* (May 1952), 148-9. Quoted in Dockrill, 52.

[151] Dwight D. Eisenhower, *The White House Years: Mandate for Change 1953-1956* (Garden City, New York: Doubleday & Company, 1963), 451.

[152] This became part of U.S. national security policy in that NSC 5602/1 of 15 March 1956 stipulated: "It is the policy of the United States to integrate nuclear weapons. Nuclear weapons will be used in general war and in military operations short of general war as authorized by the President." Quoted in Dockrill, 69.

need for an asymmetric counter to high technology weaponry. The Center For Nonproliferation Studies reports that NATO's bombing "'completely and irreversibly' convinced Pyongyang that it is dealing with 'a new Hitler' who is 'determined to conquer the entire world through intimidation, pressure, and aggression,' ... [and] that given the slightest opportunity, the United States will attack the DPRK 'like a vulture.'"[153] To deter this perceived threat of U.S. aggression, it is likely that North Korea will speed up its missile development, presumably to mate delivery vehicles to its nascent nuclear capability. Pyongyang views such development as a matter of national survival that must proceed unfettered by the United States.[154] North Korean officials have hinted that their intention is to acquire such a significant deterrent force that Washington "will not dare to think about attacking the DPRK."[155] In light of North Korea's previous attempts to develop nuclear weapons, any deterrent force it fields would probably include some type of nuclear capability to offset U.S. high-technology conventional weapons.

d. North Korean Conventional Shortcomings

The fact that the North Korean military has been weakened by dismal economic conditions may be an indication that the DPRK would consider the efficacy of nuclear weapons in hedging against Western PGMs. North Korean conventional forces are suffering from a shortage of fuel, spare parts, ammunition, and repair facilities.[156] Additionally, the DPRK government has been forced to cut its military expenditures due

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[153] Center For Nonproliferation Studies. *The DPRK Report*, no. 17 (March-April 1999): 1. [report on-line] available from http://cns.miis.edu/pubs/dprkrprt/99marapr.htm. Accessed 21 February 2000.

[154] Ibid.

[155] Ibid.

[156] Center For Nonproliferation Studies, *The DPRK Report*, no. 20 (September-October 1999): 2. [report on-line] available from http://cns.miis.edu/pubs/dprkrprt/99sepoct.htm. Accessed 21 February 2000.

to lack of funds: the 1999 defense budget was 2 percent lower than in the previous year.[157] Another revealing indication of North Korean insecurity and intent is the finding that the relative proportions within the military budget have changed, so that a comparatively larger amount is now being spent on missiles and other "high impact" arms that may have an asymmetrical effect against conventional weapons.[158] Presumably this is because, dollar for dollar, the relative effectiveness of "high impact" arms in response to the precision-guided munitions of an adversary is much greater than that of conventional weapons.

G. SUMMARY

Rapidly evolving technologies, coupled to conventional munitions, will result in a profound change in the character of warfare in the coming decades. However, not all states will have the capability to exploit the RMA to the same degree as the United States. A lesson gleaned from the Gulf War by America's potential adversaries has been that nuclear weapons are a necessity for fighting the United States. This belief may be indicative of a growing attitude about the need for RMA "deterrence."[159] Because of this, an adversary may try to neutralize or diminish any advantage in RMA-led conventional war-fighting capabilities through asymmetric means. Unable to replicate

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[157] Center For Nonproliferation Studies, *The DPRK Report*, no. 21 (November-December 1999): 2. [report on-line] available from http://cns.miis.edu/pubs/dprkrprt/99novdec.htm. Accessed 21 February 2000.

[158] Ibid.

[159] James R. FitzSimonds, "The Coming Military Revolution: Opportunities and Risks," *Parameters* (Summer 1995): 34.

U.S. high-technology forces, an opponent may attempt to counter them with nuclear weapons. Furthermore, the effects of conventional strategic strike operations, leveraged by PGMs, may, at some level of perceived capability, bring forth the type of asymmetrical warfare that the United States is explicitly seeking to avoid.[160]

[160] Ibid.

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IV. TECHNOLOGY AND NUCLEAR ARMS

The pace of technological innovation and scientific achievement associated with the current RMA shows no signs of slackening and has had a revolutionary impact on how states view future warfare. In the case of nuclear weapons, many different types—some of which are based on physical processes that differ from those used in current fission and thermonuclear weapons—are being studied and could someday be developed. These potential devices are based on atomic or nuclear processes that are not restricted by the Comprehensive Test Ban Treaty (CTBT).[161] Their development utilizes many recent advances in fundamental or applied research and technology, and sophisticated computer simulation techniques that could allow deployment after limited, or, in some cases, no field testing. Examples of such weapons include pure-fusion bombs; anti-matter bombs; laser-triggered bombs; thermonuclear shaped-charges; and new explosives based on nuclear isomers, superheavy elements, and metallic hydrogen.[162]

The exploitation of technology may endow future nuclear weapons with significant military advantages such as reduced size and weight, focused blast, reduced collateral damage, and minimal or no residual radiation. These advances may make possible a more efficient use of their nuclear yield and could lead to a greater willingness to make these devices available for use. A nuclear device capable of producing well-focused blast effects with minimum residual radioactivity and collateral damage would

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[161] The CTBT was adopted by the general assembly of the United Nations with the intended purpose of putting an end to the explosive testing of nuclear weapons. However, since laboratory testing is not covered by the CTBT, the development of nuclear weapons could continue using a number of techniques, including computer simulation and modeling, which today can effectively replace field-testing.

[162] Andre Gsponer and Jean-Pierre Hurni, *Fourth Generation Nuclear Weapons* (Darmstadt University of Technology, Germany: International Network of Engineers and Scientists Against Proliferation (INESAP), 1999) 79.

make an ideal weapon for targeting deeply buried or hardened targets. Furthermore, the enhancement of the electromagnetic pulse (EMP) effects of nuclear weapons could greatly diminish the reliance of a state on high-technology electronic weaponry, thus leveling the RMA battlefield.

While existing high-yield thermonuclear weapons will likely remain the principal component of strategic arsenals for quite some time, future nuclear weapons may consist of highly miniaturized explosives with yields in the one-ton to one-kiloton range—within the gap that, according to Andre Gsponer and Jean-Pierre Hurni, members of the Independent Scientific Research Institute, "separates conventional from nuclear weapons."[163] Freeman Dyson recognized this gap as far back as 1960:

> Below a certain explosive yield on the order of a kiloton, nuclear weapons are grossly inefficient and extravagant. However, for military purposes other than wholesale annihilation, a kiloton is already an unreasonably big bang. There is a clear and acute need for an explosive which would fill the gap between a ton and a kiloton of TNT with a cost which is proportional to the yield instead of being independent of it.[164]

Due to their potentially "low yield," and enhanced effects, the nuclear weapons most likely to be developed in the future may not be considered weapons of mass destruction in the same manner that existing nuclear devices are. Such a fundamental shift in the operational capabilities of nuclear weapons would confer significant military and political advantages to those states armed with these new devices.

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[163] Ibid. 81-2.

[164] Freeman Dyson. "The Future Development of Nuclear Weapons." *Foreign Affairs* 38. (April 1960): 458.

A. NUCLEAR WEAPONS RESEARCH

Emerging technology will support development of future nuclear weapons and will enable scientists to design weapons suited for a battlefield shaped by the RMA.

1. Inertial Confinement Fusion

Today, the most significant modern laboratory tool available to weapons designers is Inertial Confinement Fusion (ICF). This simulation technology enables thermonuclear fusion explosions—with yields equivalent to a few kilograms of TNT—to be performed in the laboratory. Inertial fusion energy (IFE, i.e., energy derived from an inertial confinement fusion reactor) is produced when a sequence of tiny fuel pellets containing deuterium and tritium is projected towards the center of a reaction chamber in which high-power laser or particle beam pulses strike each pellet, compressing and heating its fuel, and releasing thermonuclear energy.[165]

From a military perspective, success with IFE will make possible the development of radically new types of nuclear weapons. This is because IFE could provide a continuous salvo of contained nuclear explosions with yields, dependent on the firing rate, in the range of a few 100 kilograms to a few tons of TNT equivalent.[166] The military significance of these yields derives from the fact that, while the amount of conventional high explosives carried by typical delivery systems is limited (generally on the order of 120 kilograms to 2,000 kilograms), an ICF pellet weighs only a fraction of a gram. ICF-based military explosives could revolutionize warfare. When combined with precision guidance, earth and concrete penetration, and other existing techniques, small and lightweight ICF-based warheads could destroy virtually all targets, and render

[165] Gsponer and Hurni, 58.

[166] Ibid. 59.

existing types of high-yield nuclear weapons obsolete for most military application. To make such warhead designs feasible, the huge laser or particle beam driver necessary for compression will have to be replaced by some sufficiently miniaturized device.[167] Advances in anti-matter and super laser technology, however, may someday surmount this obstacle.

2. Fusion

The search for fusion power is another major area of ongoing research that could potentially increase the effectiveness of nuclear weapons. Atomic energy is generated from the decay of atoms, but this only releases a small proportion of the energy locked in a nuclear structure.[168] The sun, however, is able to burn for millions of years by fusing light atoms into heavier ones and then releasing greater amounts of fusion energy. To generate the necessary conditions for fusion, a concentration of very high energy particles must be achieved. The difficulty in fusing atoms together is that very high temperatures are necessary to trigger the process. To date, sufficient concentrations of these energy levels have only been achieved in the middle of a nuclear explosion and only then by using a fission weapon to provide detonation.[169]

Timothy Gardner has provided a useful distinction between fission and fusion weapons:

> The destructive power of nuclear weapons depends on the combination of a number of different effects. Typically the energy released by a fission type explosion is made up of 50 per cent blast, 35 per cent thermal radiation, 5 per cent prompt radiation, and 10 per cent residual radiation.

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[167] Ibid.

[168] Timothy Garden, *The Technology Trap* (McLean, Virginia: Brassey's International Defense Publishers, 1989), 45.

[169] Ibid, 63.

> If a pure fusion weapon were possible then the proportions might be 20 per cent blast and thermal [radiation], with the [remaining] 80 percent of energy being released as prompt radiation, and very little residual radiation.[170]

The advantage of a weapon that provides a lethal dose of prompt radiation, leaves less residual radiation, and has a more precise blast effect, is that its use would probably appear more credible to an enemy. Such a capability could furnish significant advantages in deterrence and operations in regional conflicts in which the use of short-range weapons is often necessary and in which it is imperative to limit risks for friendly forces

3. Antimatter

Matter-antimatter interaction produces more energy per unit mass than any other means of energy production. Moreover, when antimatter is brought into the proximity of matter, annihilation starts by itself, without the need of a critical mass, as in fission, and without the ignition energy needed in fusion.[171] In short, it could be an ideal nuclear trigger, provided that methods to produce and manipulate sufficient quantities of antimatter can be found.

It may be possible to build a hydrogen or neutron bomb in which the plutonium primary is replaced by one microgram of antihydrogen.[172] The result would be a "clean" bomb—a weapon practically free of radioactive fallout because of the absence of fissile materials. Such a device could be desirable in situations where political or environmental constraints might otherwise prevent the use of a nuclear weapon. Although advances in

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[170] Ibid. 64.

[171] Gsponer and Hurni. 91.

[172] Ibid.

technology indicate that military use of antimatter may well be feasible, further research is needed to produce enough antiprotons to use in military testing.[173]

Great strides have been made toward producing enough antiprotons to study the feasibility of an antimatter weapon. In 1985 the RAND Corporation carried out a study for the U.S. Air Force "examining the possibilities for exploiting the high energy release from matter-antimatter annihilation."[174] The report concluded that it was technologically feasible to develop the amounts of antiprotons necessary for military applications.[175] In the time since the report was first published antimatter has been captured in an electromagnetic trap and stored for further experiments.

Researchers have discovered that a relatively small number of antiprotons are sufficient to initiate a chain reaction in a highly compressed pellet of plutonium or uranium.[176] They have also determined that antiprotons can be easily directed and focused onto a very small target. These discoveries open the prospect of making low-weight fission explosives with yields in the sub-kiloton range.[177] Another important

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[173] Ibid.

[174] B.W. Augenstein, *Concepts, Problems, and Opportunities For Use of Annihilation Energy* (Santa Monica, CA: RAND Corporation, 1985), 61. Quoted in Gsponer and Hurni, 93.

[175] Additionally, the report identified four main categories of antimatter applications: propulsion (fuel for ultra-fast anti-missile rockets), power generators (light and ultra-compact generators for military platforms in orbit), directed energy weapons (antihydrogen beams or pumped lasers relying on very-short-duration energy release) and classified additional special weapons (various bombs triggered by antimatter). Gsponer and Hurni, 94.

[176] Ibid. 96.

[177] Ibid.

potential application of antimatter to nuclear weapons development could be its use as a trigger for ICF pellets.[178] The result would be a miniature thermonuclear explosive that could be made small and lightweight enough to serve as a weapon.

The crucial advantage of antimatter in the design of future nuclear weapons is that it delivers a very large pulse of energy by simple contact with ordinary matter; there is no need for a big laser or any other bulky device to trigger a reaction. Conceivably, anti-matter could one day allow nuclear weapons to be made small enough to place on Unmanned Aerial Vehicles (UAVs), drones, or miniaturized robotic devices. Similarly, a nuclear device could hypothetically be made small enough to place inside precision-guided munitions. Such a capability could increase the effectiveness of these weapons and enhance an engagement strategy based on precision-strike warfare. Andre Gsponer and Jean-Pierre Hurni contend that "antimatter research is possibly the most important and vigorous of the fourth-generation nuclear weapons research and development programs."[179] The reason for this is that matter-antimatter annihilation does not pose any fundamental research problem. In other words, its military use is now mostly a question of technological development, and the answer will evolve with the pace of the current RMA.

4. Electromagnetic Pulse

Within the area of nuclear weapons development, one of the most productive areas for research is generating electromagnetic energy for offensive purposes. This seems especially true given the RMA-generated momentum towards an electronic

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[178] Ibid.

[179] Ibid. 100.

battlefield. As dependence on electrical and electronic systems increases, vulnerability to adversary-induced failures of these systems also increases.

The electromagnetic pulse (EMP) associated with a nuclear explosion is already a cause of considerable concern, and great expenditure is incurred in taking protective measures to reduce EMP vulnerability.[180] It is conceivable that a weapon could be designed to produce much more of its energy as a narrower band of electromagnetic radiation. If the wavelength is selected so that propagation in the atmosphere is unimpeded, then protection against the EMP effect becomes much more difficult.[181]

The United States has placed considerable emphasis on understanding the EMP potential of nuclear weapons. In 1997, the Defense Special Weapons Agency's projects included adjusting EMP data for nuclear weapons to allow war planners to assess the damage that would be inflicted by the EMP effect of nuclear weapons.[182] This data will support the development of models for using EMP to knock out selected targets.

Advances in technology may eventually yield nuclear weapons that are specifically designed to maximize electromagnetic radiation and minimize the blast effects of a nuclear detonation. If even a relatively small proportion of a nuclear explosion could be channeled into microwave radiation, the resulting EMP effect could wreak havoc on computer systems, microprocessor control systems, power sources,

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[180] This effect is greatest in exo-atmospheric or high altitude explosions. There are two different EMP generators. The plasma passing through the earth's magnetic field causes a broadband surge of electromagnetic radiation. In addition. the ionizing of the atmosphere by gamma and x-rays produces a current from the flow of electrons. which in turn produces electromagnetic radiation.

[181] Garden. 67.

[182] Hans Kristensen, "Targets of Opportunity," *The Bulletin of the Atomic Scientists* 53, (September/October 1997): 10. [journal on-line] available from http://www.bullatomsci.org/issues/1997/so97kristensen.html. Accessed 16 November 1999.

communications systems and all things electrical. This would have considerable implications for command and control arrangements.

5. Nuclear Isomers

The military interest of isomers is three-fold: first, they may provide a route to the development of gamma-ray lasers; second, they may prove useful as fuels, explosives and weapons; and third, certain fissile isomers are expected to have electro- and laser-induced fission threshold energies somewhat less than those characteristic of ordinary fissile materials.[183]

Nuclear isomers have available energies close to those released by nuclear reactions, but their advantage is that they might not produce radioactivity. Major advances in nuclear weapon design could be made if an isomer's enormous potential of nuclear energy storage could be tapped without the attendant penalty of radioactive by-products. Even if the practical energy density achieved is several orders less than that of fission or fusion, it would still be orders of magnitude greater than anything ever attainable with chemical technology.[184] Such a development could lead to weapons with a significant explosive potential without the accompanying penalty of residual radiation.

B. COMPUTING AND MODELING NUCLEAR WEAPONS EFFECTS

Advances in computing hardware and software have had a tremendous impact on the development and performance of high-technology conventional weaponry. Nuclear weapons research and development also have benefited from improvements in high-performance computing. These developments could ultimately aid a potential proliferant

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[183] Gsponer and Hurni. 94.

[184] Ibid. 102.

in developing a nuclear capability or could facilitate an established nuclear power's development of a new generation of nuclear weapons.

The recent achievement of the one-trillion math-operations per second computing milestone has ushered in a new era in which high-fidelity three-dimensional simulation will enable scientists to model the complex physics involved in nuclear weapon performance. Art Hale, a technical manager at Sandia National Laboratory, believes this ability "opens the door to dramatically more realistic three-dimensional simulations, which will profoundly change the way we use simulation in science and engineering."[185] Such an accomplishment is noteworthy because it could make possible the development of new nuclear weapons during a time when the Comprehensive Test Ban Treaty is stimulating a shift from test-centered nuclear weapons development programs to computational-centered programs.[186] Despite the absence of explosive testing, vastly enlarged laboratory and computing capabilities could hypothetically create new opportunities for designing extremely safe and robust new nuclear weapons, whether based on old or new principles. Some scientists and engineers specializing in nuclear weapons design tasks, however, question the prudence of relying on weapons designs that have not been proven in explosive tests.

At one time, computers were considered to be restricted technology that limited the ability of nations to develop weapons. Carey Sublette, a staff member of the

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[185] Hale quoted in Sandia National Laboratories Press Release, "Sandia Putting Expertise in Advanced Software Applications into Teraflops Supercomputer," (16 December 1996). [Press Release on-line]: available from http://www.sandia.gov/search97cgi/s97_cgi?action=View&VdkVgwKey=http%3A%2F%2Fwww%2Esandia%2Egov%2Fmedi.

[186] Ibid.

Federation of American Scientists, points out that conventional wisdom no longer holds this to be true:

> The computational effort required for the neutronic and hydrodynamic computations used in fission weapons is actually quite modest, easily within the capability of any commercial PC [personal computer] available today. Even with thermonuclear weapons design, computational requirements are not that extreme. The initial design effort on most weapons in the U.S. arsenal was completed before the first Cray 1 went on line in 1976. A high-end workstation is comparable or superior to the best computers available when most current U.S. warheads were developed. Even the lowest performance office computers now on the market are orders of magnitude faster than the computers that were used to design the first hydrogen bombs.[187]

Raw computational power alone is not sufficient in the development of nuclear weapons. Sophisticated computer codes are required to permit the reduction or elimination of the need to conduct explosive weapon tests to develop or prove a design. The lack of proven codes substantially constrains the usefulness of computer technology. It is possible, however, that a clandestine weapon developer could gain access to or develop such codes.

The advantages of exploiting advances in computational power are not limited solely to the design and testing of a nuclear warhead but also are important in the development of the delivery vehicles for these warheads. A proliferator can achieve an understanding of the most efficient and cost-effective way to extend the range of a missile by using finite element, structural, and fluid dynamic computer routines and automated codes to predict missile performance and aerodynamic properties.[188] The

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[187] Carey Sublette, "Engineering and Design of Nuclear Weapons," (20 February 1999), 11. [Article on-line]; available from http://www.fas.org/nuke/hew/nwfaq/nfaq4.html; Accessed 13 April 2000.

[188] Defense Threat Reduction Agency, *Militarily Critical Technologies: Means of Delivery Technology* (Washington, DC: Department of Defense, 1999), II-1-9.

Defense Threat Reduction Agency assigns equal importance to a proliferant's computing capabilities and its hardware (e.g., laboratory facilities, measurement systems, and fiber-optic equipment) when analyzing its potential development of a nuclear capability.[189] Since computer routines reduce the number of engineers needed to modify missiles and design warheads, they are particularly significant in reducing both unit and system costs, which may increase the likelihood of proliferation.

In the absence of nuclear explosive testing, computer simulation and modeling appear to be the only means by which states can verify how nuclear weapons will affect their own forces and those of their opponents in a nuclear environment. Furthermore, it appears that further advances in a nation's nuclear capability will be closely linked to its ability to exploit advances in computer technology, both in hardware and software. Capabilities to conduct nuclear weapons simulations and to execute survivability and hardening programs have both offensive and defensive aspects, and will be desirable not only to states that possess nuclear weapons, but to those with plans to build them as well.

C. BURIED TARGETS

With the advent of precision non-nuclear attack, a new game of hide-and-seek has developed between the United States and its potential adversaries. Responding to the lessons of the Persian Gulf War, would-be opponents have been seeking military refuge deep underground, digging into mountains and tunneling under landscapes. This trend represents a significant military and technical challenge to the ability of the United States to employ its power effectively in times of conflict. Advances in technology and nuclear

[189] Ibid.

weapons design could make possible the production of nuclear devices well-suited for attacking deeply buried targets.

Part of the problem in attacking deeply buried targets is generating a shock wave at a depth that will cause significant damage. The destruction of hardened underground structures is much more efficient if the explosion occurs underground. Surface bursts and airbursts do not transmit energy efficiently to the ground, giving a moderate-sized explosion a relatively small radius of effectiveness. An underground explosion, even a relatively shallow one, converts nearly all of its energy into a ground shock wave. The degree of damage inflicted in attacking a buried target increases exponentially with the depth of warhead detonation.[190]

Designing a weapon that can penetrate deeply into the ground is a significant problem. The basic requirement is to embed a nuclear explosive device inside a long, narrow casing that is massive and strong enough to punch through concrete, rocks, and soil. The nuclear device must be rugged enough to withstand the shock of impact. The current U.S. ground-penetrating warhead is the recently developed B61-11 bomb. It was reportedly designed by repackaging a B61-7 thermonuclear warhead (which was inherently shock resistant) in a heavy, high-strength steel bomb body with a special nose. The B61-11's depth of penetration is shallow (approximately six meters).[191]

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[190] For further discussion on the difficulty of attacking deeply buried targets see Michael E. Ruane, "Bunkers Can Thwart U.S. Bombs," *The Salt Lake Tribune*, 28 October 1996. [article on-line] available from http://www.sltrib.com/96/OCT/28twr/0010282.htm. Accessed 09 April 2000; Andrew Koch, "Dual Delivery is Key to Buried Targets," *Jane's Defense Weekly*, 8 March 2000; Greg Mello, "New Bomb, No Mission," *Bulletin of the Atomic Scientists* 53 (May-June 1997): 28-32. [article on-line] available from http//www.bullatomsci.org/issues1997/mj97/mj97mello.html.

[191] Sublette, 8.

The U.S. Department of Defense is developing a concept to enable its existing stockpile of conventional penetrating munitions to hit buried or hardened targets. According to Jay Davis, director of the Defense Threat Reduction Agency, the program, called "Consecutive Miracles," was designed as follows: "the first bomb tears a hole and the second bomb will go right into it and penetrates further."[192] The intent is for the first weapon to prepare a shaft, and for the second bomb to enter this shaft and do more damage further down.

This concept also could be applied to nuclear bombs, assuming that technology could someday resolve the issues of fratricide that would arise. A small-yield nuclear device could follow a conventional or nuclear penetrating warhead. The ensuing detonation would increase the probability of destroying the target to a greater extent than is feasible with conventional munitions. Moreover, the development of such technology would afford a greater measure of confidence regarding the complete destruction of buried chemical or biological agents. Advances in targeting and delivery technology might someday allow a "ring" of low-yield nuclear weapons to be delivered to a target, so that warhead detonation would occur simultaneously, thereby inserting as much cumulative blast energy into the ground as possible. Obviously such a scenario presents tremendous technical problems involving targeting, timing, guidance, and the coordination of blast effects; but given the current pace of advances in weaponry, the solutions should eventually be obtainable. A strategy that relies on delivering warheads

[192] Koch, 1.

underground to destroy buried targets would benefit from technology that would allow the effects of a nuclear warhead to be directed or shaped.[193]

Given the problem of neutralizing buried targets, it is obvious that an asymmetry of nuclear effects would be advantageous. A nuclear weapon designed to destroy buried WMD or command and control facilities would be improved if the nuclear effects could be channeled forward in a cylinder with dimensions related to the accuracy of delivery.[194] A battlefield nuclear weapon could be made more useful and usable if all its effects could be concentrated in the enemy's direction without danger to friendly forces. With advances in nuclear weapons design and technology, it may become possible to pursue the development of asymmetries in nuclear effects along the lines of the shaped charges of conventional explosives.

D. NANOTECHNOLOGIES

The engineering of future nuclear weapons will make extensive use of nanotechnologies and of various miniaturization techniques that are being developed because of the current RMA and in particular because of Inertial Confinement Fusion (ICF) diagnostic devices and ICF target construction.[195] Gsponer and Hurni point out that nanotechnology is crucial to nuclear weapons development in two respects:

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[193] Garden, 65. Garden points out the need to explore this hypothesis: "All nuclear weapons have similar effects. The balance of damage caused by heat, blast, and radiation can be altered by changing the yield or by altering the height of the detonation between a ground burst and a height at which the fireball no longer touches the ground. Yet in every case the energy is radiated out as an expanding sphere until it meets resistance. A bullet is highly directional. Anti-tank shells have shaped charges to penetrate in the direction which will give most lethality to a tank. Mines are arranged to fire their charges up into the vulnerable parts of vehicles. Yet nuclear weapons remain ... equally destructive in all directions. This suggests that energy is wasted and collateral damage is more difficult to control."

[194] Ibid.

[195] Gsponer and Hurni, 130.

> It will enable the fabrication of very small mechanical assemblies (such as sub-millimeter-size microtraps for proton storage); and the production of very fine grain super-plastic materials will enable the fabrication of very small components with highly predictable behaviors under stress (as a result of their well characterized metallurgical properties).[196]

These engineering and miniaturization techniques could lead to the development of mass production techniques similar to those employed in microcomputer manufacturing today.

The continued exploitation of RMA technologies by the United States could yield advances in nuclear weapons design and manufacturing processes that could facilitate coupling U.S. nuclear capabilities to the RMA technologies of precision guidance and advanced command and control architectures. Ultimately, this process could yield nuclear weapons that are cheaper, smaller, and better suited for the requirements of RMA warfare.

E. SUMMARY

Throughout history, there are many examples of the critical role that technology has played in military capabilities. The potential military applications arising from current technological discoveries will be of key interest to the defense establishment. Technology may enable nuclear weapons to be improved in ways akin to conventional weapons, resulting in devices that could be delivered with greater accuracy over greater ranges in shorter response times. The technologies to accomplish these results are all non-nuclear.[197] What nuclear physics and engineering can provide are weapons optimized for particular targets, with improvements in ease of production, cost, and maintenance. Considerable progress has been made in nuclear physics in the past few

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[196] Ibid. 131.

[197] Garden. 67.

years, partly due to the demands of the RMA. Design possibilities that were long considered speculative are now becoming technically feasible.[198]

Designing and producing cost-effective and operationally robust nuclear weapons that take advantage of advances in RMA technology, yet also rise to the demands of RMA-based warfare, is a formidable engineering task. It is not, however, out of proportion with what has been achieved in the past decades in several areas of high technology.[199] The nuclear weapons that might be developed could be seen as more readily available for use, due to enhancements and efficiencies in the design of their potential effects. These effects are expected to be more controllable and discriminate, with little or no residual radioactivity.

It is likely that, due to the technological advances of the RMA, most advanced military powers will continue to develop and acquire high-precision conventional weapons. At the same time, however, they will continue to develop the scientific and technological basis for fielding new types of nuclear weapons. There no longer appear to be any insurmountable scientific obstacles to this accomplishment. The danger is that the remaining engineering problems may be overcome before a thorough understanding of the ramifications of these new weapons has been acquired.

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[198] Gsponer and Hurni, 137.

[199] Ibid.

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V. CONCLUSION

Advances in technology are enabling the United States to conduct long-range conventional strike missions with a degree of precision that has led many to question the utility of nuclear weapons. However, those who support the marginalization of nuclear weapons have failed to take into account key developments in the strategic environment, overstated the robustness of conventional alternatives to nuclear weapons, and overlooked the unintended consequences that could arise from reliance on conventional munitions as the sole means of U.S. power projection and deterrence. Indeed, the primacy of nuclear weapons in the international security environment may actually increase, in spite of the RMA, in three important areas: as a hedge against shortcomings in conventional weaponry; as a deterrent and/or asymmetrical operational strategy against advanced conventional weaponry; and as a weapon that, due to more efficient and controlled effects, is more usable.

A. THE INDISPENSABLE ROLE OF NUCLEAR WEAPONS

Nuclear weapons will continue to play an indispensable role in U.S. national security policy—as a hedge against uncertainties, to deter potential aggressors that are more diverse and less predictable than in the past, and to allow the United States to construct a more stable security environment.[200] Recent nuclear tests by India and Pakistan make it clear that nuclear weapons remain part of the security setting. The aggressive pursuit of nuclear, biological, and chemical weapons by states such as Iraq, Iran, and North Korea underscores the need for nuclear deterrence as a central component

[200] Joseph and Lehman. 1.

of U.S. security strategy. U.S. nuclear weapons also serve to protect against an uncertain future with Russia and China, states that continue to value nuclear weapons for reasons of political status and national security. In Russia's case, nuclear weapons help to compensate for what many Russians see as growing conventional inferiority.

B. THE INCREASING PRIMACY OF NUCLEAR WEAPONS

Precision-guided munitions must overcome many barriers before they are truly capable of performing deterrence, strike, and defense missions in the same manner as nuclear weapons.[201] Limitations in the destructive yield of conventional weapons lessen their deterrent effect. Indeed, in some cases, conventional military capabilities may have a minimal impact on an opponent's strategic calculus. Their limitations prevent the uncontested use of conventional weapons, and in some circumstances, may render them strategically insufficient. The interval required to inflict sufficient damage with conventional weapons can be lengthy and may hinder attempts at deterrence and coercion. Because they rely on the "system of systems" information architecture, RMA-based conventional precision weapons may be susceptible to the effects of subtle manipulation and information overload that preclude the "reliability of effect" that nuclear weapons can assure in virtually all circumstances. Conventional weapons lack the explosive yield and incendiary effects that may be essential for the destruction of certain types of military targets, such as deeply buried or hardened targets or WMD facilities. Finally, conventional weapons lack the political and psychological impact necessary to deter potential adversaries.

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[201] Dennis M. Gormley and Thomas G. Mahnken, "Facing Nuclear and Conventional Reality," *Orbis* 44, (Winter 2000): 110.

The attractiveness of nuclear weapons for some foreign powers may increase if America's development of RMA-based capabilities continues. Not all states have the capability to exploit the RMA to the same degree as the United States. Because of this, there is a growing belief among many of them of the need for RMA "deterrence." Such beliefs could lead adversaries to develop asymmetric weapons to neutralize or diminish any U.S. advantage in RMA-led conventional war-fighting capabilities. Unable to replicate U.S. high-technology forces, an opponent might consider nuclear weapons a relatively cheap counter to non-nuclear strategic strike operations. A nation could influence, dissuade, or counter a government armed with high technology forces by the mere possession or actual use of atomic devices.

Advances in technology may one day lead to nuclear weapons with significant military advantages such as reduced size and weight, focused blast, reduced potential for collateral damage, and minimal or no residual radiation effect. It is likely that the design of future nuclear weapons will focus on the development of highly miniaturized explosives with yields in the one-ton to one-kiloton range. Due to their potentially "low yield" and enhanced capabilities, these devices may not be considered weapons of mass destruction in the same manner as existing nuclear devices. Such a fundamental shift regarding the operational capabilities of nuclear weapons will confer significant military and political advantages to states armed with these new devices and could lead to a greater willingness to make nuclear weapons as readily available for use as conventional munitions in certain circumstances.

C. THE UNITED STATES COMPETITIVE ADVANTAGE

Today, the United States military has a commanding advantage in military capability in specific types of contingencies—for instance, a regional war with adequate infrastructure and host nation support in the theater. The 1999 NATO intervention in the Kosovo conflict—Operation Allied Force—revealed, however, that the United States would find it difficult to carry out its declared strategy of being able to wage and win two major theater wars almost simultaneously. In certain areas of capability (e.g., electronic warfare aircraft), United States force deficiencies in facing multiple contingencies became apparent.[202]

In a period of great geopolitical and military-technical change and uncertainty, it is far from clear that U.S. advantages in non-nuclear capabilities will be sustained over the long term. The competitive advantages of a military revolution are short-lived.[203] Military organizations recognize that there are great penalties for failing to maintain their competitive position. As pointed out by Andrew Krepinevich, "In the last two centuries there do not seem to be any prolonged 'monopolies' exercised by a single competitor in periods of military revolution."[204] In other words, having the initial competitive advantage in a period of military revolution—even if the advantage is considerable—is

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[202] Loren B. Thompson, "The Future of Electronic Warfare," *Sea Power* (March 2000). Thompson contends that "Operation Allied Force proved that, at least in the case of electronic-warfare aircraft, the United States did not have the capacity to prosecute two major theater wars simultaneously. In fact, it was not so clear that even one such conflict could be supported over a long period while meeting other global commitments." For a similar viewpoint, see Bryan Bender, "USA Forced to Re-Assess 'Two-War' Strategy," Jane's *Defence Weekly* 31, (28 April 1999).

[203] Andrew F. Krepinevich, "Calvary to Computer: The Pattern of Military Revolutions," *The National Interest* (Fall 1994): 37.

[204] Ibid.

no guarantee of continued dominance, or even competitiveness. Technology eventually diffuses, and this will present potential adversaries with the means to circumvent or counter advances in U.S. high-technology conventional weaponry. The United States cannot afford to make decisions about its defense priorities based on the unproven promises of RMA technology and the subsequent calls to marginalize nuclear weapons.[205]

The United States should anticipate that one or more competitors seeking to exploit technological advances in military potential might soon arise. It is by no means certain that competitors will follow the same path as the United States in developing their military postures for twenty-first century warfare. As Krepinevich has noted,

> Different security requirements and objectives, strategic cultures, geostrategic postures, and economic situations will likely lead different competitors in different directions. While there are those who believe that, given our current advantage, this military revolution will only progress at a pace and direction that the United States decides to give it, history suggests that this is a dangerous delusion.[206]

In light of predictions concerning the potential short-term advantages of the RMA, the appeals to abandon or marginalize U.S. nuclear capabilities are particularly ill-advised.

D. UNITED STATES RESPONSIBILITIES

Before the United States shifts its strategic deterrent from nuclear to conventional weapons, there must be a careful, serious debate about the consequences of marginalizing nuclear weapons. Continued trends in de-emphasizing U.S. nuclear weapons could result

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[205] Murray, 63. Murray offers a pertinent reflection in this regard: "Precisely because we Americans have a long track record of overestimating our technological superiority and underestimating the ability of our opponents to short-circuit our advantages, this is a form of hubris we cannot afford to indulge again."

[206] Krepinevich, 42.

in critical shortfalls in the areas of planning, weapons safety and reliability, command and control, and recruiting and retention of the necessary cadre of nuclear experts.

The decisions and actions that the United States takes concerning its total force posture in the years ahead will influence how both allies and adversaries perceive the credibility of the U.S. deterrent. A nuclear force that is not backed by the perceived ability and willingness to maintain and, when necessary, reconstitute important elements will increasingly be seen as hollow.[207] In turn, this holds important implications for the overall capacity of the United States to shape the security setting in the years ahead and to provide for the nation's defense in a world of change and turbulence.

The challenge policy makers face today is to devise a strategy that incorporates the technological advances of the RMA yet preserves the caution-inducing benefits of nuclear weapons without creating the potential for long-term instabilities. Given the potential for an increased relevance of nuclear weapons in new circumstances, the nation's leaders must take concrete steps to sustain a strong nuclear deterrent.

United States nuclear policy should not foreswear the use of nuclear weapons in response to any nation which uses weapons of mass destruction (including biological and chemical weapons) against the United States and/or U.S. allies and security partners.[208] U.S. officials would not, to be sure, use a nuclear weapon without considering the strategic and political implications, as well as the grave consequences of such an action.

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[207] Joseph and Lehman, 2.

[208] In April 1996, then U.S. Secretary of Defense William Perry outlined what America's response to the use of weapons of mass destruction against the U.S might entail: "If some nation were to ... attack the United States with chemical weapons, then they would have to fear the consequences of a response from any weapon in our inventory ... In every situation that I have seen so far, nuclear weapons would not be required for response. That is, we could make a devastating response without the use of nuclear weapons, but we would not forswear that possibility." Perry quoted in Walter B. Slocombe, statement before the Senate Governmental Affairs Subcommittee on International Security, Proliferation and Federal Services, Hearing on Nuclear Weapons and Deterrence, 12 February 1997, 2, 5. Quoted in Yost, 29-30.

U.S. policy should not require retaliation with nuclear weapons, but it should retain the capability as one of a complete spectrum of possible options.

The U.S. armed services' current fascination with the conventional RMA should not blind them to the responsibility of developing and sustaining a highly trained cadre of nuclear experts. The United States should develop a program to ensure that personnel with key skills in nuclear weapons planning, operations, design, production, and maintenance are retained, and that a suitable successor generation is recruited before these key skills atrophy. In addition, a long-term plan outlining the specific roles and requirements for future U.S. nuclear weapons, delivery systems and infrastructure should be developed, implemented, and reported on to the President and Congress.

Most importantly, and without regard to advances in conventional smart weapons, the United States should retain the triad of bombers, land-based ICBMs and sea-based SLBMs. The triad remains valuable because the synergy of its elements provides flexibility, enhances survivability, and complicates defenses, thereby strengthening deterrence. Diverse basing and penetration modes also provide a hedge against technological breakthroughs (conventional or otherwise) or the discovery of significant material problems with any one system.

The war fighting capabilities that might result from the RMA are certainly promising, but entail significant operational uncertainties. Conventional RMA wisdom

dictates that the role of nuclear weapons will continue to depreciate with advances in technology. If the attitude that nuclear weapons are increasingly out-dated and irrelevant is allowed to prevail, nuclear weapons could re-emerge on the international scene in unexpected and dangerous ways, with profound implications for U.S. national security.[209]

[209] Patrick J. Garrity, "The Depreciation of Nuclear Weapons in International Politics: Possibilities, Limits, Uncertainties," *Journal of Strategic Studies* 14, (December 1991): 501.